



DEPARTMENT OF  
HIGHER EDUCATION &  
WORKFORCE DEVELOPMENT

## New Program Report

**Date Submitted:**

02/12/2024

**Institution**

University of Missouri-Kansas City

**Site Information**

**Implementation Date:**

8/1/2024 12:00:00 AM

**Added Site(s):**

**Selected Site(s):**

University of Missouri-Kansas City, 5100 Rockhill Road, Kansas City, MO, 64110

**CIP Information**

**CIP Code:**

301801

**CIP Description:**

A program with a combined or undifferentiated focus on one or more of the physical and biological sciences.

**CIP Program Title:**

Natural Sciences

**Institution Program Title:**

Natural Sciences

**Degree Level/Type**

**Degree Level:**

Doctoral Degree (Research PhD)

**Degree Type:**

Doctor of Philosophy (PHD)

**Options Added:**

**Collaborative Program:**

N

**Mode of Delivery**

**Current Mode of Delivery**

Classroom

**Student Preparation**

**Special Admissions Procedure or Student Qualifications required:**

Please visit website to learn about the discipline specific application requirements.

**Specific Population Characteristics to be served:**

n/a



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### Faculty Characteristics

Special Requirements for Assignment of Teaching for this Degree/Certificate:

All faculty with teaching responsibilities in the PhD, Natural Sciences program will have a terminal degree, PhD or professional doctoral degree (MD, DDS, PharmD).

Estimate Percentage of Credit Hours that will be assigned to full time faculty:

Full time faculty will teach 100% of coursework/credit hours in the program.

Expectations for professional activities, special student contact, teaching/learning innovation:

Faculty teaching in the program will be expected to engage in professional activities and teaching/learning innovation activities including research, and participation and presentations at professional organizations and societies. Faculty will also be expected to mentor and advise students while enrolled in the program and while engaging in independent research.

### Student Enrollment Projections Year One-Five

Year 1	Full Time: 100	Part Time: 0	
Year 2	Full Time: 123	Part Time: 0	
Year 3	Full Time: 123	Part Time: 0	Number of Graduates: 20
Year 4	Full Time: 123	Part Time: 0	
Year 5	Full Time: 123	Part Time: 0	Number of Graduates: 20

### Percentage Statement:

n/a

### Program Accreditation

Institutional Plans for Accreditation:

Like the current I PhD program, the proposed PhD program in Natural Sciences falls under the purview of the university's institutional accreditation. The university is accredited by the Higher Learning Commission, one of the regional accrediting bodies recognized by the U.S. Department of Education, which ensures that the institution and all its programs, including the proposed PhD program, meet the established standards of academic quality.

### Program Structure

#### Total Credits:

42

#### Residency Requirements:

Ph.D. students must satisfy the doctoral residency requirement by satisfactory completion of at least 18 credits in no more than 24 consecutive months. When satisfying the residency requirement, all Ph.D. students are subject to the following restrictions:

- The doctoral residency requirement must be satisfied no later than the end of the semester in which the student completes his or her comprehensive examinations.
- Students must achieve a cumulative graduate grade-point average of at least 3.0 in all courses counted toward satisfying the residency requirement.

#### General Education Total Credits:

42



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**Major Requirements Total Credits:**

42

**Course(s) Added**

COURSE NUMBER	CREDITS	COURSE TITLE
XXXXX	30	Major Coursework including fundamental and advanced courses along with seminars
XXXXX	12	Dissertation

**Free Elective Credits:**

0

**Internship or other Capstone Experience:**

12 credit hours of dissertation required

**Assurances**

I certify that the program is clearly within the institution's CBHE-approved mission. The proposed new program must be consistent with the institutional mission, as well as the principal planning priorities of the public institution, as set forth in the public institution's approved plan or plan update.

I certify that the program will be offered within the proposing institution's main campus or CBHE-approved off-site location.

I certify that the program will not unnecessarily duplicate an existing program of another Missouri institution in accordance with 6 CSR 10-4.010, subsection (9)(C) Submission of Academic Information, Data and New Programs.

I certify that the program will build upon existing programs and faculty expertise.

I certify that the program can be launched with minimal expense and falls within the institution's current operating budget.

I certify that the institution has conducted research on the feasibility of the proposal and it is likely the program will be successful. Institutions' decision to implement a program shall be based upon demand and/or need for the program in terms of meeting present and future needs of the locale, state, and nation based upon societal needs, and/or student needs.

**Contact Information**

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Kent

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# New Degree Proposal

## FULL PROPOSAL

### Basic Program Information

Sponsoring University: University of Missouri-Kansas City

College or School: School of Graduate Studies

Department: School of Graduate Studies

Proposed Program Title: Natural Sciences, PhD

Degree Level/Type: Doctoral

Emphasis Areas: Biomedical and Health Informatics

Cell Biology and Biophysics

Chemistry

Geosciences

Mathematics

Molecular Biology and Biochemistry

Oral and Craniofacial Sciences

Pharmaceutical Science

Pharmacology

Physics

Program Modality: In-person

If online component: n/a

Program CIP Code<sup>1</sup>: **CIP 30.1801**

Implementation: August 2024

Expected Date of First Graduation: May 2025

Proposal Author(s): The Natural Sciences cluster was developed by the School of Graduate Studies personnel, in close collaboration with faculty disciplinary coordinators in Physics, Chemistry, Math/Statistics, Biology, Earth and Environmental Sciences, Pharmacy, Dentistry, and Medicine.

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<sup>1</sup> A selection of CIP codes can be viewed on the National Center for Education Statistics website: <https://nces.ed.gov/ipeds/cipcode/browse.aspx?y=55>

Name, phone, and email of person primarily responsible for the proposal:

Doctoral Program Director, School of Graduate Studies. Dr. Joseph Parisi, (816) 235-2919,  
[jparisi@umkc.edu](mailto:jparisi@umkc.edu)

Individual(s) Responsible for Success of the Program:

During the transition Professor Parisi, the current Interdisciplinary PhD Program Director, will be responsible in collaboration with the following discipline-specific coordinators. Professor Parisi will continue to direct the I PhD and the Natural Sciences PhD during the transition; a new director will be appointed with expertise in the disciplines reflected in the STEM program.

Dr. Jenifer Allsworth – Biomedical and Health Informatics

Dr. Karen Bame -- Biology

Dr. Xiaobo Chen -- Chemistry

Dr. Fengpeng Sun -- Geosciences

Dr. Liana Sega -- Mathematics

Dr. Mary Walker – Oral and Craniofacial Sciences

Dr. Kun Cheng – Pharmacy

Dr Paul Rulis – Physics

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# Executive Summary

UMKC currently offers a PhD in Interdisciplinary Studies under CIP code 30.0000 (Multi-/Interdisciplinary Studies, Other; Defined as “any instructional program multi/interdisciplinary studies not listed above,” National Center for Education Statistics). As part of a comprehensive strategy to improve academic and research excellence, inclusive of Carnegie R1 classification, UMKC seeks to close the current, catch-all interdisciplinary PhD and create eight (8) discipline-specific and more narrow interdisciplinary PhD programs from the over 20 primary disciplines within it.

This transition will allow for the following: Carnegie credit for degree conferrals across STEM, Social Science, and Humanities disciplines, improved research ranking and reputation as a discovery enterprise, advantage in recruiting high quality students and faculty, and enhanced clarity and validity with students and employers regarding the curricula offered as part of our doctoral degrees.

This proposal focuses on a new **Natural Sciences PhD** that can be delivered with existing courses, faculty, staff, student support services, assistantship funding, and other resources currently allocated to the natural sciences primary discipline within the Interdisciplinary PhD.

The new PhD in Natural Sciences will now align itself with CIP Code 30.1801 (Multidisciplinary - Natural Sciences), earning a STEM and Carnegie eligibility. It will encompass 10 science disciplines carried over from our previous Interdisciplinary PhD Program, including Biomedical & Health Informatics, Cell Biology & Biophysics, Chemistry, Geosciences, Mathematics, Molecular Biology & Biochemistry, Oral & Craniofacial Sciences, Pharmaceutical Science, Pharmacology, and Physics.

The primary advantage of this transition to a PhD in Natural Sciences is that it will enable UMKC to receive doctoral research recognition in the STEM domain, further enhancing our academic and research standing. This strategic change reflects our commitment to providing a dynamic and specialized educational experience while ensuring that current students are supported throughout their academic journey.

## **Curriculum:**

The proposed PhD program in Natural Sciences has been designed to mirror the existing interdisciplinary doctoral program, maintaining academic rigor through a balanced curriculum. This curriculum includes foundational courses, advanced coursework, research seminars, and a comprehensive doctoral dissertation, all drawn from the existing structure and resources of the doctoral program. As with the current interdisciplinary doctoral program, a minimum of 30 classroom credits is required, including fundamental and advanced courses along with seminars. Additionally, a doctoral dissertation necessitates a minimum of 12 research credits.

The curriculum of each participating discipline will not change from current offerings. The program will be administered by the School of Graduate Studies using existing resources. No additional faculty, staff, student support services, or other resources will be needed.

# 1. Introduction

The PhD in Interdisciplinary Studies (30.0000) was launched in 1989. For many years it has provided UMKC students the opportunity to develop as scientists and scholars in their chosen field by combining two or more disciplines of study. The Interdisciplinary PhD at UMKC originally included 26 distinct disciplines, ranging from STEM to social sciences to the humanities. Despite its strength as a highly flexible doctoral degree, it limits our ability to attract highly competitive PhD students who want a narrower disciplinary focus, as well as prospective students who are seeking STEM certified doctoral education. Most recently, we have learned that the current Interdisciplinary PhD program is not recognized by Carnegie in their university classification system—a significant barrier in our progress toward becoming a Carnegie R1 institution.

To address these challenges, we aim to transition the current Interdisciplinary PhD program into eight (8) distinct PhD programs that will be attractive to students (evidenced by historical enrollment data) and that will be recognized by Carnegie. These include **Computer Science, Economics, Education, Engineering (Electrical and Computing; Civil; and Mechanical), Humanities, plus a multidisciplinary PhD in Natural Sciences**. These doctoral research programs were selected after extensive review and discussion with doctoral faculty across the university because they are the strongest historic enrollments, core faculty of active researchers, and greatest potential for ongoing success at UMKC. Together they promise to have a significant impact on our ranking as a research institution, and the workforce in the Kansas City and greater MO area through the research and post-graduate employment outcomes produced by the graduates.

This proposal focuses on the **PhD in Natural Sciences**.

## **Impact:**

The impact of this broad degree transition, including the **PhD in Natural Sciences**, will be the following: Carnegie credit for degree conferrals across STEM, Social Science, and Humanities disciplines, improved research ranking and reputation as a discovery enterprise, advantage in recruiting high quality students and faculty, and enhanced clarity and validity with students and employers regarding the curricula offered as part of our doctoral degrees.

# 2. University Mission & Program Analysis

## **2.A. Alignment with University Mission & Goals**

The change will allow UMKC's STEM specific fields to have a greater impact on UMKC's research goals, grant funding, and Carnegie Rankings.



## **2.B. Duplication & Collaboration within Campus, Across System**

The UM System does not offer another multi-disciplinary structure for a STEM doctoral program in the Natural Sciences.

# **3. Business-Related Criteria & Justification**

## **3.A. Market Analysis**

### *3.A.1. Rationale & Workforce Demand for the Program*

Student demand in STEM fields has been steady over the past five years. According to the U.S. Bureau of Labor Statistics (<https://www.bls.gov/>), overall employment of scientists and mathematicians is projected to grow 5% to 31% from 2021 to 2031, depending on the field. PhD-trained natural scientists and mathematicians are needed for jobs, such as college-level faculty, researchers at National Laboratories, Research Institutes, Biotechnology and Pharmaceutical companies, and as researchers/data analysts for a wide range of not-for-profit, insurance or financial institutions.

Pharmaceutical Sciences and Pharmacology have high demand from employers both in Missouri and nationally. Pharmaceutical Sciences has a predicted growth of approximately 15% by 2027 in Missouri and 24% nationally (Lightcast data). Historically, PhD students in both Pharmaceutical Sciences and Pharmacology from UMKC have been in high demand with those seeking jobs having a 100% employment rate either in industry or in academia after graduation. Within the Kansas City region, major employers include Bayer, Pfizer, Merck, Eurofins, and others (MARC data), while some of our graduates seek employment in regional CROs including KCAS, Xenotech, and others.

UMKC School of Pharmacy is the only public pharmacy school in Missouri and one of only two Pharmacy schools in the state. As such, students graduating from the UMKC School of Pharmacy with a PhD have high demand skills that can be used in pharmaceutical manufacturing, drug discovery, regulatory oversight, and in other areas such as technical writing. Students who have graduated from the program and gone into academia have a strong record of accomplishment, with some bypassing post-docs entirely and landing tenure-track positions both within and outside of the United States. For our PhD program, enrollment in either discipline has averaged about 33 students over the past 3 years.

### **Impact:**

While at UMKC, doctoral students in the sciences and mathematics engage in innovative, basic research. Not only does this further the research mission of UMKC, but it provides publications that support UMKC faculty in obtaining external research funding from local, regional, and

national sources. Many doctoral students have also been employed as GTAs during their studies and receive training in how to be effective teachers.

After graduation, UMKC-trained students are employed locally, regionally, and nationally in academic, public, and private institutions, and local and federal government agencies, contributing to educating the next generation and the economic development of the Kansas City region and beyond.

- UMKC PhD graduates are college faculty, lecturers, and researchers at institutions in the state of Missouri and the Kansas City region, as well as academic institutions throughout the U.S. and foreign countries. Examples include University of Missouri – Columbia, UMKC, Northwest Missouri State, Drury University, Washburn University, Johnson County Community College, Kansas City Kansas Community College, Adams State University, Arizona State University, East Carolina University, Florida Polytechnic University, Rosalind Franklin University of Medicine and Science, University of Florida, University of Kansas, University of Southern California, University of Tennessee-Knoxville, University of Wisconsin-Parkside and Umm Al-Qura University (Saudi Arabia).
- UMKC PhD graduates are hired as research scientists and data analysts at local institutions, and federal and state government agencies, including Catalant Pharma Solutions, KCAS Bioanalytical Services, MRI Global, Immunophotonics, H&R Bloch, Valorem Reply, U.S. Department of Agriculture, Missouri Department of Natural Resources, Foreign Military Studies Office at Fort Leavenworth, Kansas, and Leavenworth County, Kansas.
- UMKC PhD graduates have been hired as research scientists and data analysts across the US, including KBI Biopharma (North Carolina), Bristol Myers Squibb (Massachusetts), and Intermountain Precision Genomics (Utah).

Students in Pharmacy have been instrumental in powering the growth of research at UMKC with many of our faculty having successful extramural grants from the NIH and other groups supporting our students averaging to about \$1.2M funding annually over the past 5 years.

Additionally, our students are well published, having contributed to approximately 40 papers in the 3-year period covering 2020 through 2022, with about 30 posters at national or regional meetings in the same period. Additionally, our students often serve as graduate teaching assistants, which helps keep the PharmD program running smoothly. Students contribute to about 50% of PharmD professional courses.

### *3.A.2. Student Demand for the Program*

Student demand is evidenced by our previous five-year enrollment trends in the 10 primary disciplines within the current interdisciplinary PhD that will comprise the new Natural Sciences PhD. These ten disciplines have varied widely in their frequency of admitting students and total student enrollment, ranging from 1 student/year in oral and cranifacial sciences to 31

students/year in physics. Combined, the five year average of all 10 primary disciplines is 123.6 students/year. Pending approval, we will encourage current interdisciplinary PhD students to switch to the new degree program in Fall 24; those who want to complete their degree within the existing interdisciplinary PhD program will be allowed to do so. Admission to the existing interdisciplinary PhD program will be suspended in Fall 24 and program teach out will begin. This period of transition is reflected in the enrollment projections below.

**Table 1a. Student Enrollment Projections** (anticipated total number of students enrolled in the program during the first five fall semesters following implementation.)

<b>Year:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Full-time</b>	100	123	123	123	123
<b>Part-time</b>	0	0	0	0	0
<b>Total</b>	100	123	123	123	123

**Table 1b. Projected Number of Degrees Awarded**

<b>Year:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
<b># of Degrees Awarded</b>	20	20	20	20	20	20	20	20	20	20

### **3.B. Financial Projections**

Research-based doctoral education (i.e., PhD) differs in key ways from professional doctoral education (e.g., JD, MD, PharmD, DDS, etc.). These differences can be found in the curricular and academic experiences, size of the student cohorts, and relationship of the program to the University mission. As such, there are significant differences in the financial models between research-based and professional doctoral programs. Research-based doctoral programs (e.g., PhD), in contrast to professional doctoral programs (e.g., JD, MD, PharmD, etc.), generally accept a smaller cohort of new students each year and often offer full or partial financial support in the form of tuition waivers and graduate assistantships. PhD students, in turn, make significant contributions to faculty research through their work on research studies (e.g., data collection), dissemination of research findings (e.g., manuscript/monograph writing), and grant writing. PhD students also provide critical support to the educational mission of the University through mentorship and instruction of undergraduate students. In most instances, PhD programs are revenue neutral or have a financial cost that is offset by positive impact on University research productivity and support of undergraduate education.

In the sections that follow, we have estimated the costs and revenues associated with the PhD in Natural Sciences. *Notably, because we are using the same resources, the net revenue and financial impact of the PhD in Natural Sciences is the same as the 10 primary disciplines within the existing interdisciplinary PhD program.*

#### **3.B.1. Additional Resources Needed**

No new resources are needed, inclusive of instructional costs, assistantship funding, marketing, or other university overhead.

### 3.B.2. Revenue

Revenues are generated from tuition (net scholarship) and remain the same as the existing interdisciplinary PhD program.

### 3.B.3. Net Revenue

No new one-time expenses are needed because all resources exist within the current interdisciplinary PhD program. Similarly, recurring expenses are not new, and are estimated based on the current interdisciplinary PhD program. Existing recurring expenses and revenues will shift from the interdisciplinary PhD to the new PhD, with the majority of that shift happening in year 1, as most current students transfer to the new degree program.

Faculty salaries are estimated at .10 FTE (representing 25% of their overall teaching workload) for the current faculty who participate in teaching and mentorship within the interdisciplinary PhD. Notably, many courses are taught as part of master's or professional doctoral programs, thereby inflating the FTE specific to PhD students; this inflation is offset by the variable amount of time spent mentoring dissertations. Staff estimates represent staff support time within the academic units. Institutional overhead includes library and all central campus enrollment management and student support staff. Other includes assistantship stipends and associated tuition remission.

**Table 2. Financial Projections for Proposed Program for Years 1 Through 5.**

	Year 1	Year 2	Year 3	Year 4	Year 5
<b>1. Expenses per year</b>	0	0	0	0	0
<b>A. One-time</b>	0	0	0	0	0
<i>New/Renovated Space</i>	0	0	0	0	0
<i>Equipment</i>	0	0	0	0	0
<i>Library</i>	0	0	0	0	0
<i>Consultants</i>	0	0	0	0	0
<i>Other</i>	0	0	0	0	0
<b>Total one-time</b>	0	0	0	0	0
<b>B. Recurring</b>					
<i>Faculty</i>	663,366	663,366	663,366	663,366	663,366
<i>Staff</i>	5000	5000	5000	5000	5000
<i>Benefits</i>	240,611	240,611	240,611	240,611	240,611
<i>Equipment</i>	0	0	0	0	0
<i>Library</i>	0	0	0	0	0

<i>Institutional Overhead</i>	33,600	41,328	41,328	41,328	41,328
<i>Other</i>	1,925,280	2,139,200	2,139,200	2,139,200	2,139,200
<b>Total recurring</b>	<b>2,867,857</b>	<b>3,089,505</b>	<b>3,089,505</b>	<b>3,089,505</b>	<b>3,089,505</b>
<b>Total expenses (A+B)</b>	<b>2,867,857</b>	<b>3,089,505</b>	<b>3,089,505</b>	<b>3,089,505</b>	<b>3,089,505</b>
<b>2. Revenue per year</b>					
<i>Tuition/Fees</i>	409,920	504,201	504,201	504,201	504,201
<i>Institutional Resources</i>	0	0	0	0	0
<i>State Aid -- CBHE</i>	0	0	0	0	0
<i>State Aid -- Other</i>	0	0	0	0	0
<b>Total revenue</b>	<b>409,920</b>	<b>504,201</b>	<b>504,201</b>	<b>504,201</b>	<b>504,201</b>
<b>3. Net revenue (loss) per year</b>					
	(2,457,937)	(2,585,304)	(2,585,304)	(2,585,304)	(2,585,304)

#### 3.B.4. Academic and Financial Viability

There is no net difference in academic and financial viability between the existing natural science primary disciplines within the interdisciplinary PhD and the new PhD in Natural Sciences. The enrollment projections described above will ensure we achieve a degree conferral threshold consistent with MDHE expectations, as well as advance our Carnegie ranking. There is a financial cost, consistent with doctoral education in general, and funds will be reallocated from the existing PhD program to the new PhD program so that we remain financially net neutral.

### **3.C. Business Plan: Marketing, Student Success, Transition & Exit Strategies**

#### 3.C.1. Marketing Plan

Marketing will be expanded and modified from its current state to highlight that the current Interdisciplinary PhD (26 programs in numerous disciplines) has changed to a more focused STEM degree (10 disciplines) in the Natural Sciences.

#### 3.C.2. Student Success Plan

No additional student support services will be needed to support or retain students in the PhD in Natural Sciences program. Current enrollment, retention and graduation trends for this program are on track with institution and national averages, and the program will continue to provide current levels of faculty and staff resources to support students through graduation.

### *3.C.3. Transition Plan*

The people primarily responsible for the success of the PhD in Natural Sciences are: During the transition Professor Parisi, the current I PhD Program Director, will be responsible in collaboration with the following discipline-specific coordinators. Professor Parisi will continue to direct the I PhD and the Natural Sciences PhD during the transition; a new director will be appointed with expertise in the disciplines reflected in the STEM program.

Dr. Jenifer Allsworth – Biomedical and Health Informatics

Dr. Karen Bame -- Biology

Dr. Xiaobo Chen -- Chemistry

Dr. Fengpeng Sun -- Geosciences

Dr. Liana Sega -- Mathematics

Dr. Mary Walker – Oral and Craniofacial Sciences

Dr. Kun Cheng – Pharmacy

Dr Paul Rulis – Physics

Program leadership is supported by program faculty and the School of Graduate Studies staff.

### *3.C.4. Exit Strategy*

If full-time enrollment in the PhD in Natural Sciences drops below 20 students, the School of Graduate Studies will evaluate a temporary hiatus or program closure, depending on the reason for the low enrollment (e.g., temporary funding challenge, market demand, etc.).

## **4. Institutional Capacity**

No new expenses. Discipline Coordinators will receive the same annual stipend as within the previous program, and the Program Director is a paid position within the School of Graduate Studies. Revenue comes from student enrollment in the various areas. No additional courses, staff, or student support services are necessary to support the program.

## **5. Program Characteristics**

### **5.A. Program Outcomes**

Program Goals

Students in the Ph.D. Program will acquire:

- grounding in the primary and secondary disciplines
- the ability to integrate the principles and theories of the disciplines

- the ability to effectively communicate findings and approaches to solving research problems;
- research skills, such as approaches, methods, ethical principles, and tools to pursue a research line of inquiry;
- the ability to form effective interdisciplinary teams to solve novel research questions

## **5.C. Program Structure**

- 1. Total Credits Required for Graduation: 42**
- 2. Residence requirements, if any:** Ph.D. students must satisfy the doctoral residency requirement by satisfactory completion of at least 18 credits in no more than 24 consecutive months. When satisfying the residency requirement, all Ph.D. students are subject to the following restrictions:
  - The doctoral residency requirement must be satisfied no later than the end of the semester in which the student completes his or her comprehensive examinations.
  - Students must achieve a cumulative graduate grade-point average of at least 3.0 in all courses counted toward satisfying the residency requirement.
- 3. General education**
  - a. Total general education credits: n/a**

Courses (specific course or distribution area and credit hours):

The course requirements for the Natural Sciences interdisciplinary program will remain consistent with those of the previous Interdisciplinary PhD program. No new resources will be required. The coursework requirements encompass:

1. A minimum of 12 credit hours of coursework within the primary area, accompanied by at least 12 dissertation hours. The primary disciplines retain the flexibility to potentially request more than the minimum credit hours.
2. A minimum of 9 credit hours within a secondary discipline area, with the secondary discipline also having the option to specify additional credit hours beyond the minimum.
3. A minimum of 30 classroom credits is required, including fundamental and advanced courses along with seminars.
4. Any primary area discipline can be combined with any secondary area discipline. Coursework available in each discipline (primary and secondary) can be found in section 5.B of this proposal (which follows).

The participating disciplines encompass a range of fields, including:

- Biomedical and Health Informatics
- Cell Biology and Biophysics
- Chemistry
- Geosciences
- Mathematics

- Molecular Biology and Biochemistry
- Oral and Craniofacial Sciences
- Pharmaceutical Science
- Pharmacology
- Physics

Example:

To illustrate, consider the example program of study of a current student (listed below) with Pharmaceutical Science as their primary discipline and Chemistry as their secondary discipline:

**Primary discipline coursework e.g.:**

Pharmaceutical Science (a minimum of 12 credit hours in coursework and 12 dissertation hours). Students select courses from those offered in the discipline:

- Advanced Organic Medicinal Chemistry (3)
- Analytical Methods (3)
- Techniques in Biotechnology (3)
- Protein and Nucleic Acid Drug Delivery (3)
- Special Topics – Foundations of Pharmaceutical Science (3)
- Seminar in Pharmaceutical Science (3)
- Dissertation hours (12)

**Secondary discipline coursework example:**

Chemistry (a minimum of 9 credit hours). Students select courses from those offered by the secondary discipline:

- Synthetic Organic Chemistry (3)
- Selected Topics in Organic Chemistry (3)
- Survey of Organic Chemistry (3)
- Advanced Bio-organic Chemistry (3)
- Survey of Organic Chemistry (3)

<b>Primary discipline coursework in Pharmaceutical Science</b>		
<ul style="list-style-type: none"> <li>• A minimum of 12 credit hours in coursework and 12 dissertation hours</li> <li>• Courses are selected from those offered in the discipline</li> </ul>		
Course Number	Course Title	Credit Hours
Pharm 5521	Advanced Organic Medicinal Chemistry	3
Pharm 5527	Analytical Methods	3
Pharm 5588	Techniques in Biotechnology	3
Pharm 5634	Protein and Nucleic Acid Drug Delivery	3
Pharm 5690A	Special Topics – Foundations of Pharmaceutical Science	3



Pharm 5580A	Seminar in Pharmaceutical Sciences	3
Pharm 5699A	Research and Dissertation	12
<b>Secondary discipline coursework in Chemistry</b>		
<ul style="list-style-type: none"> <li>• A minimum of 9 credit hours in coursework</li> <li>• Courses are selected from those offered in the discipline</li> </ul>		
Chem 5520R	Survey of Organic Chemistry	3
Chem 5522	Synthetic Organic Chemistry	3
Chem 5529	Selected Topics in Organic Chemistry	3
Chem 5567	Advanced Bio-organic Chemistry	3
<b>Total hours toward the degree:</b>		<b>42</b>

**4. Free elective credits**

b. Total free elective credits: n/a

**4. Requirement for thesis, internship or other capstone experience:**  
12 credit hours of dissertation required

**5. Any unique features such as interdepartmental cooperation:**  
n/a

## **5.B. Program Design & Content**

### **Biomedical and Health Informatics**

Course requirements are remaining the same from the previous Interdisciplinary PhD program to the PhD in Natural Sciences.

Core coursework in the Biomedical and Health Informatics Primary discipline will include a minimum of 18 credit hours of courses in the table below: 6 credit hours should be taken from Biostatistics; 6 credit hours should be taken from Research methodology and ethics area and 6 credit hours should be taken from informatics area. Courses taken to meet this requirement may be adjusted to reflect the courses taken in the chosen secondary discipline.

Area	Credit Hours	Available Courses (3 credit hours each)	
Biostatistics	6	<u>MEDB 5501**</u> <u>MEDB 5502**</u> <u>MEDB 5503</u>	Applied Biostatistics I Applied Biostatistics II Biostatistics III: Mixed-Effects Models Quantitative Aspects of Epidemiologic Research

		<u>MEDB 5535</u>	
Research Methodology	3	<u>MEDB 5510</u> <u>MEDB 5511</u> <u>MEDB 5512</u>	Clinical Research Methodology Principles and Applications of Epidemiology Clinical Trials
Research Ethics	3	<u>MEDB 5561</u>	Responsible Conduct of Research
Informatics	6	<u>MEDB 5520</u> <u>MEDB 5521</u> <u>BIOL 5525</u> <u>COMP-SCI 5565</u> <u>COMP-SCI 5590</u>	Introduction to Medical Informatics Clinical Bioinformatics Bioinformatics and Data Analysis Introduction to Statistical Learning Special Topics, Machine Learning

\*\*Required course

## Cell Biology and Biophysics

Course requirements are remaining the same from the previous Interdisciplinary Ph D program to the Ph D in Natural Sciences.

### Primary discipline:

Course Number	Credits	Course Title
LSCBB 5530	3	Cell & Molecular Biology I
LSCBB 5520	3	Cell & Molecular Biology II
LSCBB 5596 or LSCBB 5597	2	Advanced Experimental Cell Biology I or II
2X LSCBB 5612	2 x 1	Seminar in CBB
LSCBB 5690	5-8	Analytical Methods in CBB (research b/f advancing to candidacy)
BIOL 5501	1	Proposal Writing
Electives	3-7	Courses in discipline or related discipline courses

### Secondary Discipline

Course Number	Credits	Course Title
LSCBB 5530	3	Cell & Molecular Biology I
LSCBB 5520	3	Cell & Molecular Biology II
LSCBB 5612	1	Seminar in CBB
Electives	≥ 3	Biology graduate courses for a minimum of 10 total cr. hr.

## Chemistry

Course requirements are remaining the same from the previous Interdisciplinary Ph D program to the Ph D in Natural Sciences.

Students must successfully complete a minimum of fifteen credit hours and a maximum of eighteen credit hours of didactic chemistry graduate coursework, among which one course must be from Group A, one course from Group B, and a minimum of two additional courses (six credit hours) from any graduate chemistry course numbered 5500 to 5589, excluding CHEM 5520R, CHEM 5530, and CHEM 5540R. The remaining required chemistry credit hours may be satisfied with directed studies (CHEM 5590).

### Group A

<u>CHEM 5530</u>	Systematic Physical Chemistry	3
<u>CHEM 5531</u>	Classical Thermodynamics	3
<u>CHEM 5532</u>	Chemical Kinetics	3
<u>CHEM 5533</u>	Quantum Chemistry	3
<u>CHEM 5534</u>	Molecular Spectroscopy	3
<u>CHEM 5535</u>	Statistical Thermodynamics	3

### Group B

<u>CHEM 5520R</u>	Survey Of Organic Chemistry	3
<u>CHEM 5521R</u>	Mechanisms Of Organic Reactions	3
<u>CHEM 5522</u>	Synthetic Organic Chemistry	3

### Other

<u>CHEM 5611</u>	Chemistry Seminar	1
<u>CHEM 5590</u>	Directed Studies	1-3

## Geosciences

Course requirements are remaining the same from the previous Interdisciplinary Ph D program to the Ph D in Natural Sciences.

Course Number	Credits	Course Title
GEOG 5507	4	Advanced Geographic Information Science
GEOG 5544	4	Advanced Spatial Data Analysis
GEOG/GEOLO GY 5597	3	Graduate Seminar in Geosciences
GEOG 5502	4	Environmental Remote Sensing and Digital Image Analysis
GEOG 5506	3	Global Environmental Change
GEOG 5546	3	Global Water & Sustainability

GEOG 5548	4	Satellite Climatology
GEOG 5598	1-3	Special Topics in Geography
GEOG 5598D	1-3	Special Topics in Advanced GIS and Remote Sensing
GEOG 5598F	1-3	Special Topics: Geostatistics and Modeling
GEOG 5690	1-3	Special Research Topics
GEOG 5699R	1-10	Research and Dissertation
GEOLOGY 5516	3	Understanding and Living with Volcanoes
GEOLOGY 5521	3	Advanced Methods for Earth and Environmental Science
GEOLOGY 5598	1-3	Special Topics in Urban Environmental Geology
GEOLOGY 5598E	1-3	Special Topics in Energy and Mineral Resources Ray
GEOLOGY 5598I	1-3	Special Topics In Urban Environmental Geology
GEOLOGY 5690	1-3	Special Research Topics

### Mathematics

Course requirements are remaining the same from the previous Interdisciplinary Ph D program to the Ph D in Natural Sciences.

#### Doctoral coursework, Mathematics:

Course Number	Credits	Course Title
MATH 5519	3	Algebra II
MATH 5523	3	Real Variables II
MATH 5542	3	Advanced Numerical Analysis
STAT 5576 or STAT 5578 or STAT 5588	3	Probability or Advanced Mathematical Statistics or Theory of Linear Model

Satisfy secondary discipline requirements.

The requirements for Mathematics as a secondary discipline are: 9 graduate course hours in MATH or STAT with at least 3.0 average GPA, out of which at most 3 can be undergraduate approved for graduate credit.

#### Doctoral coursework, Statistics:

Course Number	Credits	Course Title
STAT 5576	3	Probability

STAT 5578	3	Advanced Mathematical Statistics
STAT 5588	3	Theory of Linear Model
MATH 5519 or MATH 5523 or MATH 5542	3	Algebra II Real Variables II Advanced Numerical Analysis

Multidisciplinary coursework: Take 9 graduate credit hours in 1-2 discipline(s) other than STAT with at least 3.0 average GPA. At most 3 credit hours can be undergraduate approved for graduate credit. This coursework needs to be approved in advance by the advisor or interim advisor.

### **Molecular Biology and Biochemistry**

Course requirements are remaining the same from the previous Interdisciplinary Ph D program to the Ph D in Natural Sciences.

Primary discipline:

Course Number	Credits	Course Title
LSMBB 5561	4*	Biochemistry I
LSMBB 5562	3	Biochemistry II
LSMBB 5596 or LSMBB 5597	2	Advanced Experimental Molecular Biology I or II
2X LSMBB 5611	2 x 1	Seminar in MBB
LSMBB 5690	5-8	Analytical Methods in MBB (research before advancing to candidacy)
BIOL 5501	1	Proposal Writing
Electives	3-7	Courses in discipline or related discipline courses

Secondary discipline:

Course Number	Credits	Course Title
LSMBB 5561	4*	Biochemistry I
LSMBB 5562	3	Biochemistry II
LSMBB 5611	1	Seminar in MBB
electives	≥ 2-3	Biology graduate courses for a minimum of 10 total cr. hr.

## Oral and Craniofacial Sciences

Course requirements are remaining the same from the previous Interdisciplinary Ph D program to the Ph D in Natural Sciences.

### Primary Discipline Curriculum

Course Number	Credits	Course Title
<b>Required Core Curriculum</b>		
BIO-SCI 5751	1-2	Elements of the Scientific Method
BIO-SCI 5752	1-5	Research Methods in Oral & Craniofacial Sciences
RES-ME 5700	2-3	Introduction to Research Methodology
RES-ME 5704	2-3	Introduction to Biostatistics
<b>Additional courses applicable to the discipline</b>		
BIO-SCI 5710	2	Genetics & Biochemistry of Craniofacial Biology
BIO-SCI 5739	1	Biomaterials for the Dental Specialist
BIO-SCI 5740	2	Oral Pathology
BIO-SCI 5742	2	Biomaterials for the Restorative & General Dentist
BIO-SCI 5759	2	Special Problems in Pharmacology
BIO-SCI 5760	2	Physiology of Oral Mineralized Tissues
BIO-SCI 5790	1-6	Directed Research in Oral & Craniofacial Sciences
BIO-SCI 5802	2	Immunopathology
BIO-SCI 5805	2-3	Molecular Biology of Oral Microflora
MEDB 5561	3	Responsible Conduct of Research

Additional courses as appropriate from related disciplines (I.e., secondary discipline)

### Co-Discipline Curriculum Course Options

Course Number	Credits	Course Title
BIO-SCI 5751	1-2	Elements of the Scientific Method (Required)
BIO-SCI 5752	1-5	Research Methods in Oral & Craniofacial Sciences
RES-ME 5700	2-3	Introduction to Research Methodology
RES-ME 5704	2-3	Introduction to Biostatistics
BIO-SCI 5710	2	Genetics & Biochemistry of Craniofacial Biology
BIO-SCI 5739	1	Biomaterials for the Dental Specialist
BIO-SCI 5742	2	Biomaterials for the Restorative & General Dentist
BIO-SCI 5760	2	Physiology of Oral Mineralized Tissues
MEDB 5561	3	Responsible Conduct of Research

Minimum total: 9 credit hrs.

## Pharmaceutical Science

Course requirements are remaining the same from the previous interdisciplinary program to the Ph D in Natural Sciences.

Primary discipline students must take at least 12 hours; secondary discipline students must take at least 9 hours. Offered courses include:

Course Number	Credits	Course Title
Pharm 5521	3	Advanced Organic Medicinal Chemistry
Pharm 5527	3	Analytical Methods
Pharm 5533	3	Advanced Biopharmaceutics & Pharmacokinetics
Pharm 5588	3	Techniques in Biotechnology
Pharm 5605	3	Foundations of Pharmaceutical Sciences
Pharm 5631	3	Drug Product Design & Regulatory Affairs
Pharm 5632	3	Novel Drug Delivery Systems
Pharm 5634	3	Protein & Nucleic Acid Drug Delivery
Pharm 5501	1	Introduction to Research

## Pharmacology

Course requirements are remaining the same from the previous Interdisciplinary Ph D program to the Ph D in Natural Sciences.

Pharmacology Primary Discipline:

Core Program Requirements Pharmacology as Primary Discipline		
Specific course requirements will be determined by the student in consultation with the research advisor and the supervisory committee.		
Pharmacology Courses (specific courses OR distribution area and credits)		
Pharmacology Requirements		
Course Number	Credits	Course Title
PHARM 5519	2	Pharmacology I
PHARM 5520	4	Pharmacology II
PHARM 5530	4	Pharmacology III
PHARM 5509	3	Toxicology
PHARM 5615	3	Methods In Pharmacology and Toxicology

PHARM 5580C	3	Seminar in Pharmacology/Toxicology
Additional Requirements		
EDUC-R&P 5505	3	Statistical Methods I
Secondary Discipline courses <sup>1</sup>	7-11	
Advanced courses (5500-level or above) <sup>2</sup>	3-7	
Total	45	
<sup>1</sup> 7-11 credit hours in one or a combination secondary discipline, which may include Cell Biology and Biophysics, Chemistry, Molecular Biology and Biochemistry, Oral and Craniofacial Sciences, Pharmaceutical Science or other pertinent areas as approved by the supervisory committee.		
<sup>2</sup> 2-6 credit hours of advanced courses (5500 level or above) Pharmacology or related areas as approved by the supervisory committee.		

**Pharmacology Secondary Discipline:**

Pharmacology Secondary discipline Requirements		
Course Number	Credits	Course Title
PHARM 5519	2	Pharmacology I
PHARM 5520	4	Pharmacology II
PHARM 5580C	1	Seminar in Pharmacology/Toxicology
Plus, sufficient courses constituting the required percentage of their program of study, as approved by the supervisory committee.		

Several courses offered by the Division of Pharmaceutical Sciences may be appropriate electives. Many of these are listed below:

Course Number	Credits	Course Title
5521	3	Advanced Organic Medicinal Chemistry
5527	3	Analytical Methods
5533	3	Advanced Biopharmaceutics & Pharmacokinetics
5588	3	Techniques in Biotechnology
5631	3	Drug Product Design & Regulatory Affairs
5632	3	Novel Drug Delivery Systems
5634	3	Protein & Nucleic Acid Drug Delivery
5690A	3	Foundations of Pharmaceutical Sciences

**Physics**

Course requirements are remaining the same from the previous Interdisciplinary Ph D program to the Ph D in Natural Sciences.



Students must complete 12 dissertation hours and 30 total coursework hours, 15 hours of which are chosen from the following:

- Physics 5510 – Theoretical Mechanics I
- Physics 5520 – Electromagnetic Theory and Applications I
- Physics 5521 – Electromagnetic Theory and Applications II
- Physics 5530 – Quantum Mechanics I
- Physics 5531 – Quantum Mechanics II
- Physics 5540 – Statistical Physics I

### **5.D. Program Goals and Assessment**

All UMKC programs are required to submit an annual summary of program assessment efforts (assessment plans, findings & discussions, and recommendations). The Natural Sciences Ph.D. program will maintain the established assessment protocol currently in place for all Interdisciplinary Ph.D. disciplines. The following outcomes have been identified:

1. Students will demonstrate a thorough degree of knowledge in the discipline.
2. Students will demonstrate an ability to use proper investigation techniques for the discipline.
3. Students will effectively use oral and written forms of communication to convey their ideas.

Applicable student learning outcomes will be assessed at the following program, academic milestones: 1) Comprehensive Exams; 2) Dissertation/Research Proposal; and 3) Dissertation Defense.

At the milestone of Dissertation Defense, program targets for student performance across all Student Learning Outcomes have been set to meet or exceed average ratings of 3.5 for all (100% of) students assessed. For example, one component of students' ability to use proper investigation techniques will be evaluated by the following rubric and rating scale:

Superior (4)	Good (3)	Acceptable (2)	Unacceptable (1)	Cannot Judge
Cutting edge methodology or novel application of existing method	Incremental advance in application of methodology and careful plan for execution of research	Conventional use of methodology and adequate plan for execution of research	Inappropriate use of method; use of method that cannot adequately address research question	Outside area of expertise

## **5.E. Student Preparation**

The minimum criteria for admission to the UMKC graduate school can be found via the UMKC catalog.

### **Biomedical and Health Informatics Discipline-Specific Admissions Requirements**

Please visit the School of Medicine website for information on applying to the Biomedical and Health Informatics primary discipline and co-discipline to learn about the discipline specific application requirements. Your application to the Biomedical and Health Informatics primary discipline is NOT complete until you submit a one-page goal statement explaining your interest in the discipline through the School of Medicine Supplemental Application.

### **Cell Biology and Biophysics Discipline-Specific Admission Requirements**

A cumulative GPA of at least 3.0 (on a 4.0 scale) on all college work for bachelor's degree or post-baccalaureate work. Due to the sequencing of coursework, new students selecting cell biology and biophysics as their primary discipline will normally only be admitted in the fall term.

#### ***Qualifying Requirements for Full Admission***

Minimum of 16 hours of approved graduate coursework at UMKC toward the Ph.D. program with a grade-point average of at least 3.0 on a 4.0 scale. International students must establish English proficiency.

### **Chemistry Discipline-Specific Admission Requirements**

Normally, only applications to full-time academic status will be considered. To qualify for full admission (Note: full admission is unrelated to full-time academic status), applicants are expected to have the equivalent of an American Chemical Society-approved bachelor's degree in chemistry, which includes coursework in general chemistry, analytical chemistry, one year of organic chemistry, inorganic chemistry and one year of physical chemistry requiring calculus and physics as prerequisites. (For example, see UMKC's B.S. program in the Chemistry section in this catalog.) Applicants will be admitted as provisional students with a limited number of undergraduate deficiencies. They will be notified, at the time admission is offered, of any requirements to be met for reclassification as fully admitted. Undergraduate courses included in these requirements must be completed with grades of "C" or higher.

Applicants should take particular note of the physical chemistry requirement.

Applications are only accepted through the online system, and include:

1. Official, confidentially transmitted transcripts.
2. Statement of purpose
3. Three confidentially transmitted letters of recommendation (academic and/or professional).
4. English language proficiency requirement.

### **Geosciences Discipline-Specific Admission Requirements**

Specific admission requirements defined by the faculty in Geosciences follow the guidelines established by the School of Graduate Studies. Typically, a student would be expected to hold an undergraduate or master's degree in environmental sciences, geology, geography or a closely related field. Opportunities within the department range from the physical sciences to the humanities. Because of the wide range of faculty expertise, and in keeping with the general spirit of the entire PhD program, the faculty in Geosciences has deliberately chosen to establish broad guidelines for admission of Ph.D. students. All prospective graduate students must attain a GPA of 3.0 or above, on a 4.0 scale, in all university work prior to admission. Three letters of recommendation from professors as well as a proposal from the prospective student detailing goals and expectations are needed for an evaluation of the application. Students are expected to have an advisor at the time of admission.

Non-native English-speaking applicants seeking Geosciences as a primary discipline must demonstrate proficiency in English. This requirement can be satisfied by obtaining English proficiency certification from UMKC.

**Mathematics Discipline-Specific Admission Requirements**

**For applicants electing mathematics as the primary discipline:** To get full admission, an applicant should have a bachelor's degree or a master's degree in mathematics/statistics (or equivalent) from an accredited college or university. Applicants who do not have a master's degree are expected to provide strong evidence of academic ability and research capability. GRE General scores are required in most cases, but may be waived under extenuating circumstances, provided there are sufficient other indicators of academic ability. Applicants are encouraged to contact the discipline coordinator to inquire whether a waiver can be granted. A student who is admitted to the PhD program while having not completed all of the qualifying/pre-requisite coursework as described below must complete the missing courses with a GPA of 3.0 or better to be deemed qualified to continue in the PhD program.

**Qualifying coursework, Mathematics:**

Course Number	Credits	Course Title
MATH 5509	3	Algebra I
MATH 5513	3	Real Variables I
MATH 5532	3	Numerical Linear Algebra
MATH 5510	3	Complex Variables I
MATH 5521	3	Differential Equations

**Qualifying coursework, Statistics:**

Course Number	Credits	Course Title
STAT 5501	3	Statistical Design of Experiments
STAT 5513	3	Real Variables I
STAT 5537	3	Mathematical Statistics I
STAT 5547	3	Mathematical Statistics II
STAT 5551	3	Applied Statistical Analysis
STAT 5565	3	Regression Analysis

STAT 5572	3	Multivariate Analysis
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**For applicants electing mathematics as a co-discipline:** To get full admission, an applicant should have a bachelor's degree in mathematics/statistics from an accredited college or university, or a bachelor's degree in another subject including evidence of a strong performance in at least three mathematics courses beyond Calculus I, II, and III.

Applicants may get provisional admission if the above conditions are not fully satisfied at the time of application.

**Molecular Biology Discipline-Specific Admission Requirements**

A cumulative GPA of at least 3.0 (on a 4.0 scale) on all college work for bachelor's degree or post-baccalaureate work. Due to the sequencing of coursework, new students selecting molecular biology and biochemistry as their primary discipline will normally only be admitted in the fall term.

**Oral and Craniofacial Sciences Discipline-Specific Admission Requirements**

In addition to the general minimum requirements for admission to Ph.D. study, an applicant must hold either (1) a baccalaureate degree, (2) an M.S degree, or (3) a D.D.S. or equivalent degree. In general, an applicant will be expected to have a minimum cumulative GPA of 3.0 based on a 4.0 scale for previous education programs, including dental school (if applicable).

Applicants must also meet the following minimum GRE requirements:

- Quantitative: 150
- Verbal: 155
- Analytical Writing: 4.0

The TOEFL is required for all international applicants, who must have a score of at least 80. An IELTS score of 6.0 or above may be accepted in place of the TOEFL.

All application materials should be submitted prior to March 1 for students wishing to begin their study in the fall semester; however, applications will be accepted throughout the year. Evaluation criteria include the following:

- Transcripts. Analysis of transcripts from all prior institutions is required.
- Letters of recommendation. Three letters of recommendation are required from current or former teachers who are familiar with the applicant's past achievements and research ability.
- Personal statement from applicant. The applicant must submit a letter describing why he or she is interested in pursuing a Ph.D. study in oral and craniofacial sciences, how the experience of the program may be used by the candidate in the future, and a list of potential research interests.
- Interviews. Interviews are not required; however, interviews are preferred and will be arranged upon the candidate's request. Successful interviews may enhance the candidate's chance of acceptance.

### **Pharmaceutical Science Discipline-Specific Admission Requirements**

Applicants must hold a professional degree in pharmacy (Pharm.D. or B.S.) or a baccalaureate degree in a related field such as chemistry, biology or biomedical engineering with an undergraduate GPA of at least 3.0 on a 4.0 scale. Students who hold a master's degree in an appropriate discipline may be admitted on satisfaction of the general requirements of the School of Graduate Studies. Application deadlines are October 1st for the spring semester and February 1st for the fall semester.

### **Pharmacology Discipline-Specific Admission Requirements**

Due to course sequencing, new students will ordinarily be accepted only in the fall term. Applicants must hold a professional degree in pharmacy (Pharm.D. or B.S.) or a baccalaureate degree in biological, chemical science or health science. In special situations, baccalaureate degrees in other disciplines will be evaluated for possible admission. For graduates of foreign schools, the applicant must have completed a course of study at least the equivalent of a U.S. baccalaureate degree.

Prospective students must have an aggregate minimum grade-point average of 3.0 on a 4.0 scale for all college work taken prior to the bachelor's degree, or an aggregate GPA of at least 3.5 on all post-baccalaureate work to date (minimum of nine hours). For graduates of foreign schools, the applicant must have above-average grades in previous college study. Prospective students must have a minimum aggregate GRE score of 295 for verbal and quantitative and 3.5 out of 6.0 for analytical writing.

For graduates of foreign schools, the applicant must have a minimum score of 550 on written or 213 computer-based or 79 on Internet-based TOEFL exam or alternatively, a minimum score of 6 on the IELTS.

### **Physics Discipline-Specific Admission Requirements**

For admission to the program, an applicant must meet the requirements of the School of Graduate Studies, the International Student Affairs Office (if applicable), and specific Physics and Astronomy admission requirements described below.

The Faculty of Physics and Astronomy does not require general or subject-specific GRE scores as part of the Ph.D. application.

The graduate studies committee of the Faculty of Physics and Astronomy will review applications and make admission recommendations to the School of Graduate Studies. The basic criterion for admission is the likelihood that an applicant will be successful in the Ph.D. program, particularly in the research component of the program. All applicants must satisfy the graduate studies committee that they meet this criterion through evidence such as transcripts, letters of recommendation, statements of purpose, performance on a written Ph.D. qualifying examination, etc. Furthermore, a member of the doctoral faculty must be willing to accept the applicant as a research student.

## **5.F. Faculty and Administration**

The people primarily responsible for the success of the PhD in Natural Sciences are: Professor Parisi, the current I PhD Program Director, Dr. Jenifer Allsworth – Biomedical and Health Informatics, Dr. Karen Bame – Biology, Dr. Xiaobo Chen – Chemistry, Dr. Fengpeng Sun – Geosciences, Dr. Liana Segal – Mathematics, Dr. Mary Walker – Oral and Craniofacial Sciences, Dr. Kun Cheng – Pharmacy, and Dr Paul Rulis – Physics.

All faculty with teaching responsibilities in the PhD, Natural Sciences program will have a terminal degree, PhD or professional doctoral degree (MD, DDS, PharmD). Full time faculty will teach 100% of coursework/credit hours in the program. Faculty teaching in the program will be expected to engage in professional activities and teaching/learning innovation activities including research, and participation and presentations at professional organizations and societies. Faculty will also be expected to mentor and advise students while enrolled in the program and while engaging in independent research.

## **5.G. Alumni and Employer Survey**

The UMKC Alumni Affairs Office, and External Relations team engage with UMKC alumni and the community through several opportunities designed to maintain connections, gather feedback, provide engagement opportunities, and create an environment of continuous improvement.

Graduating students are surveyed through an exit survey at the point of graduation and followed up with at 6-months post degree conferral if the student was still seeking employment at graduation or did not respond to the initial survey request. Alumni affairs and external relations provides opportunities for alumni to participate in student research competitions such as the Three Minute Thesis. Alumni are also engaged through on campus events, opportunities to serve on boards, volunteer, and nominate and receive alumni awards.

## **5.H. Program Accreditation**

Like the current I PhD program, the proposed PhD program in Natural Sciences falls under the purview of the university's institutional accreditation. The university is accredited by the Higher Learning Commission, one of the regional accrediting bodies recognized by the U.S. Department of Education, which ensures that the institution and all its programs, including the proposed PhD program, meet the established standards of academic quality.

## 6. Appendices

- Letters of Support
  - Ian M. Colrain; President and CEO, MRIGlobal
  - Kevin Truman; Dean, School of Science and Engineering- UMKC
  - Mary Anne Jackson; Dean, School of Medicine- UMKC
  - Russel Melchert; Dean, School of Pharmacy- UMKC
  - Steven Hass; Dean, School of Dentistry- UMKC
  - IPhD Executive Committee- UMKC
  - David Borrok; Vice-Provost and Dean, College of Engineering and Computing- Missouri S&T
  - Jennifer Lundgren; Provost and Executive Vice Chancellor- UMKC
  - Stephen John Dilkes; Associate Dean, School of Graduate Studies- UMKC

**Letters of Support for  
the PhD Program in  
Natural Sciences**





The science you expect.  
The people you know.

Ian M. Colrain, PhD  
President & Chief Executive Officer  
icolrain@mriglobal.org

To: University of Missouri Board of Curators

MRIGlobal is an independent not for profit research institute in its 80<sup>th</sup> year, headquartered in Kansas City adjacent to UMKC. Our mission is “to improve the lives of people through innovative scientific and engineering research”, and we provide advanced biology, chemistry and engineering services to the US federal government and multiple national and international companies. We are constantly looking to hire Ph.D. level scientists in Kansas City and our other locations.

I am in full support of the re-categorizing UMKC’s current iPhD to regular Ph.D.s in Engineering, Computer Science, and the Natural Sciences disciplines—namely Physics, Chemistry, Mathematics and Statistics, Biology, and Earth and Environmental Science. This change will offer multifaceted benefits to your students and to industry.

Ph.D. is standard designation for those completing such an intensive course of graduate study in a specialized area in their chosen field. Employers that hire Ph.D.’s value the degree program and what it represents. When looking for interns, post-doctoral fellows or new hires, the current iPhD designation likely is a hindrance for the student. Funding agencies might also be confused as to what an iPhD program represents. I have reviewed hundreds of NIH grant applications over the past two decades and admit that I would be puzzled by such a degree title, assuming it reflected a less prestigious degree. In the highly challenged current funding environment, it is likely leaving UMKC graduates at a disadvantage when applying for competitive grant mechanisms.

MRIGlobal serves clients from around the world. The current iPhD program designation would be a challenge to explain or categorize to international collaborators or partners. A shift to the more universally understood Ph.D. label will make it clear that students are earning Ph.D.s when they complete their program and that they would be able to add the value to the customer, usually associated with attainment of that degree.

Sincerely,

A handwritten signature in black ink, appearing to read "I. Colrain".

Ian M. Colrain Ph.D

President and CEO, MRIGlobal.

Professorial Fellow, School of Psychological Sciences, The University of Melbourne, Australia.

Professor of Internal Medicine (Volunteer), KU Medical Center, The University of Kansas.



**School of Science and Engineering**

Office of the Dean

September 29, 2023

To: University of Missouri Board of Curators

Re: Support and Commitment to the SSE's iPhD to Ph.D. Transition

As Dean of the School of Science and Engineering I am writing to express my full commitment to transitioning our interdisciplinary Ph.D. (iPhD) degrees to Ph.D. for the School of Science and Engineering (SSE)'s Computer Science, Engineering, and Natural Sciences programs.

I want to emphasize that this transition primarily consists of code and title changes that do not necessitate allocating new resources. We intend to name programs with industry and academic standards, ensuring that we are appropriately recognized for the exceptional work already underway at our school, and improve our faculty and student recruitment and retention.

By transitioning to standard and well-known Ph.D. designations, we strategically position UMKC to enhance its research status especially through Carnegie ranking: historically, under the iPhD moniker, our related activities have not been correctly recognized given that we could not use the right CIP codes. Further, our international students have struggled to justify this unconventional naming to their host countries and institutions. This no-cost move is essential to rectify these issues, ensuring that our institution receives the recognition it deserves for its outstanding contributions to STEM research in our state and beyond.

In conclusion, I would like to reiterate the dedication of my team and myself to this transition. We believe these changes will strengthen our institution's reputation and bolster our research and enrollment, making us an even more effective member of the UM system. We look forward to accomplishing this positive shift together.

Sincerely,

A handwritten signature in black ink, appearing to read 'Kevin Z. Truman'.

Kevin Z. Truman, Ph.D., F.ASCE  
Dean, School of Science and Engineering

**UNIVERSITY OF MISSOURI-KANSAS CITY**

Flarsheim Hall, Room 534 | 5110 Rockhill Road | Kansas City, MO 64110  
☎: 816-235-1285 | [sse.umkc.edu](http://sse.umkc.edu)



**School of Medicine**  
Department of Biomedical and Health Informatics

Wednesday, September 27, 2023

**RE: Natural Sciences CIP code for Doctoral Degree**

To: The University of Missouri Board of Curators

I am writing to express my wholehearted endorsement and unwavering support for the proposed transition of our IPhD to a PhD program in Natural Sciences. The changes being considered, specifically the Department of Education's Classification of Instructional Program (CIP) code and title modifications, are a crucial step forward in our continuous pursuit of academic excellence.

First and foremost, it is essential to emphasize that these proposed changes do not necessitate any additional resources. Our current CIP code classification lacks recognition within the DOE's CIP taxonomy system. The proposed transition is a straightforward alteration of the CIP code and program title. This strategic shift is a testament to our institution's ability to adapt and evolve within our existing framework, maximizing the resources at our disposal while staying committed to our academic mission, educational quality, and commitment to our student's career opportunities.

The transition we are embarking upon holds immense potential to significantly enhance our university's research status and engage more students who are interested in the STEM sciences. By clarifying our existing and ongoing contributions to recognized STEM research designations by the Department of Homeland Security, which were not fully acknowledged for technical reasons under the previous IPhD program, we can expect a substantial improvement in our standing within the academic community and toward Carnegie designated R1 status. This recognition is not only a testament to our dedication to scientific inquiry but also an acknowledgment of the quality and impact of our research endeavors. Several further benefits include enhanced funding opportunities, increased grant allocations, and improved Carnegie classification for the university. The adjustments proposed will ensure that we receive due credit for the exceptional research conducted within our specialized areas, which are not adequately acknowledged under our existing CIP code and IPhD structure. Such recognition is vital for advancing our research reputation, as well as for attracting top-tier faculty and students. It is also clear that we are not generating any concerns with the Deans of other programs within the UM system regarding competition or duplication of any of their existing PhD programs.



**School of Medicine**  
Department of Biomedical and Health Informatics

In conclusion, I believe that the modifications of our program to the Natural Sciences PhD program are warranted and are an essential step in our journey to academic excellence. I am confident that these changes will benefit our institution and contribute significantly to the advancement of STEM research and education. I stand ready to lend my full support and commitment to ensure the successful implementation of these modifications.

Thank you for considering my endorsement and support for this important initiative. I look forward to witnessing the positive impact these changes will have on our academic community, research success at UMKC, and the field of Natural Sciences as a whole.

Sincerely,

*Mary Anne Jackson, MD, FAAP, FIDSA, FPIDS*

*Dean, School of Medicine, UMKC*



**School of Pharmacy**  
Dean's Office

September 26, 2023

RE: Letter of Support for the PhD in Natural Sciences Program

To the University of Missouri Board of Curators-

I enthusiastically support the new Doctor of Philosophy (PhD) program in Natural Sciences and happy that our interdisciplinary tracks in Pharmacology & Toxicology and Pharmaceutical Sciences will be able to join the program.

The School of Pharmacy, in conjunction with and offered through the School of Graduate Studies, has a long and prosperous history of offering two tracks within the Interdisciplinary PhD program at UMKC. On average, across both tracks we have approximately 30-35 PhD students in any given year and graduate anywhere from 5-10 students each year. The majority of the graduates of our tracks go on to research careers in pharmaceutical industry, yet a good portion go on to post-doctoral fellowships in academia (several over the past few years in such prestigious institutions as Stanford, Cambridge, MIT, and other significant universities), and yet others go directly into academia in schools or colleges of pharmacy. I cannot remember a time in my 13 years at UMKC where a PhD graduate from one of our tracks was unable to find placement. Importantly, our graduates compete so well for positions because they graduate typically with 4-10 publications in high impact journals contributing significantly to the knowledge within their areas of research and often leading to their coauthorship and development of disclosures of intellectual property. Of course, the reason our PhD graduates have been so successful is that they are led by an outstanding faculty whose research has been supported by grants from the National Institutes of Health, the National Science Foundation, Department of Defense, private foundations, and various contracts with pharmaceutical companies.

The UMKC School of Pharmacy is known nationally and internationally not just for our outstanding and award-winning clinical doctor of pharmacy (PharmD) program, but also for the high quality research of our faculty and graduates of our PhD tracks. Joining the Natural Sciences program will only help the success of our tracks as they exist now. The reason for this is that getting credit for these STEM doctoral graduates will only help the prestige of our great university, particularly through enhancing funding opportunities, increasing grant allocations, and improving our Carnegie classification. Increasing the prestige of our university will no doubt increase the recognition of our already strong faculty and that in turn will assist them in their pursuit of fruitful research collaborations, grant applications, and continual recruitment of the best and brightest PhD students from around the world.

All of this comes only at the price of a simple change in name of the program and in US Department of Education assigned CIP code to ensure the university receives due credit for the hard work of our students, staff, and faculty. As you know, we will not need any additional resources to support our PhD students with this change. We will continue to support their work (research supplies, stipends, tuition

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**University of Missouri-Kansas City**

waivers, etc) as we always have, with significant extramural research support, a limited number of teaching assistantships, and philanthropic support through endowed scholarships.

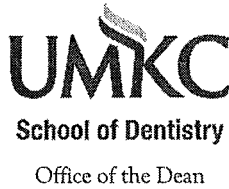
Another important factor is that our school is the only School of Pharmacy in the University of Missouri System. As you know, we collaborate with MU in Columbia to offer our PharmD program where students can complete all six years of the program on the MU campus. As we plan for growth of our pharmacy program and hiring of future faculty, one of the areas we would like to expand is in pharmacogenomics and precision medicine. Toward that end, we will be looking to collaborate with MU with our PhD program as well, hopefully being able to capitalize on the collective strengths of UM System faculty with interests in precision health and medicine. Furthermore, my understanding is that deans of schools at MU, UMSL and MUST also support the development of the Natural Sciences PhD program at UMKC, and that should assist us all in growing new collaborations.

Dr. Jerry Wyckoff serves as Director of Research and Graduate Studies in the School of Pharmacy. He and I have had many conversations about how we take the next step in growing our research efforts and our graduate program is key to that success. Joining the new Natural Sciences PhD program will help our program grow as well, and it is a natural succession in our efforts. Please feel free to reach out to me or Jerry if you have any questions. I want to thank Drs. Parisi, Dilks, and Liu and Provost Lundgren and all who have led the development of the Natural Sciences PhD program. I am very enthusiastic about this program and if there is any additional information you need from me, please feel free to contact me anytime.

Sincerely,

A handwritten signature in black ink, appearing to read "Russell B. Melchert". The signature is fluid and cursive, with a long horizontal stroke at the end.

Russell B. Melchert, PhD  
Dean and Professor



9/25/2023

Members of the Board of Curators,

As the Dean of UMKC School of Dentistry, I strongly endorse and support the transition from the current Interdisciplinary PhD (IPhD) program to the proposed Natural Sciences PhD. The School of Dentistry's Oral and Craniofacial Sciences (OCS) department has been a participating discipline in UMKC's IPhD program since its inception in the 1990's.

Because the current classification of instruction (CIP) code for the UMKC IPhD program is not recognized by the Department of Education, a program title and CIP code transition is necessary. Fortunately, such a transition will not require additional resources from our school or UMKC. Although the transition in program title and CIP Code appear to be minor modifications, the benefits are significant. For example, the Natural Sciences PhD would increase research recognition in the STEM fields, plus the organized combination of science disciplines would be positively viewed for federal grant application opportunities, such as NIH T32 or T90 training grants to support students and the program.

Being part of a viable and recognized PhD program is valuable for the School of Dentistry and in particular for our OCS department and their research-focused faculty. Although the OCS department is not large (7 faculty), the faculty have been very successful and productive researchers across the years with continuous federal funding, currently more than \$3M in total grant funds, and numerous related publications. It is also important to note that the OCS department currently has two Curators Distinguished Professors with one of them just recently selected by the Board of Curators. The updated PhD program will positively impact our ability to retain and continue to recruit top-tier faculty as well as highly qualified PhD students. Collectively, the updated Natural Sciences PhD program will be beneficial to the SOD and UMKC, but I also want to note that across UM-system institutions, there is support for UMKC's modified program with no concern for duplication or competition.

In closing, I enthusiastically endorse the Natural Sciences PhD program and anticipate associated positive outcomes related to enhanced excellence in STEM research and graduate education for UMKC and UM system. Thank you for your consideration and support.

Sincerely,

A handwritten signature in black ink that reads "Steven E. Haas". The signature is written in a cursive style.

Steven E. Haas, DMD, JD, MBA  
Dean, School of Dentistry  
816-235-2177  
steven.haas@umkc.edu



Dear Members of the Board of Curators,

As representatives of the UMKC Interdisciplinary PhD (IPhD) Committee, we wish to convey our endorsement of the transition from our existing IPhD program to the Natural Sciences PhD program presented in our university's proposal. We wish to underscore several compelling reasons why this transition would benefit our programs:

**1. Seamless CIP Code and Title Transition with No Additional Resource Demands:**

Our current CIP code classification lacks recognition within The Department of Education's Classification of Instructional Program (CIP) taxonomy system. The proposed transition entails a straightforward alteration of the CIP code and program title. Importantly, this transition does not necessitate the allocation of added resources; instead, it maximizes the utilization of our existing expertise, faculty, and resources. By doing so, we optimize our academic programs without imposing any additional financial burdens on the university.

**2. Enhanced Research Standing and Recognition in STEM:**

The shift to a Natural Sciences PhD program holds immense potential for elevating our research standing, particularly in STEM fields. The Department of Homeland Security maintains a comprehensive list of fields falling under the regulatory definition of "STEM field," which qualifies certain degrees for specific extension requirements. Our current program and CIP code fall outside this regulatory definition. Therefore, we view this change as a pivotal step towards enhancing our research standing and gaining recognition in STEM fields.

**3. Augmented Funding Opportunities and Acknowledgment for Research Excellence:**

Alongside these changes in program requirements, several benefits accrue, including enhanced funding opportunities, increased grant allocations, and improved Carnegie classification. These adjustments will ensure that we receive due credit for the exceptional research conducted within these specialized areas, which is currently not adequately acknowledged under our existing CIP code and IPhD structure. Such recognition is vital for advancing our research reputation, as well as for attracting top-tier faculty and students.

The members of the Interdisciplinary Executive Committee wholeheartedly endorse the establishment of a Natural Sciences PhD program as part of the proposed PhD transition plan. We believe that this decision strategically enhances our STEM classification, research recognition, Carnegie classification, and overall standing within the University of Missouri System. We earnestly seek your support and approval for this initiative, confident that it will



propel the University of Missouri-Kansas City to new heights of academic excellence. Thank you for your commitment to our university's progress and success.

Endorsed by the members of the IPhD Executive Committee:

<b>Dr. An-Lin Cheng</b>	<b>Biomedical and Health Informatics</b>
<b>Dr. Karen Bame</b>	<b>Cell Biology and Biophysics</b>
<b>Dr. Xiaobo Chen</b>	<b>Chemistry</b>
<b>Dr. Yugyung Lee</b>	<b>Computer Science</b>
<b>Dr. Candace Schlein</b>	<b>Curriculum and Instruction</b>
<b>Dr. Eric Camburn</b>	<b>Educational Leadership, Policy, and Foundations</b>
<b>Dr. Ahmed Hassan</b>	<b>Electrical and Computer Engineering</b>
<b>Dr. Ceki Halmen</b>	<b>Engineering</b>
<b>Dr. John Barton</b>	<b>English</b>
<b>Dr. Fengpeng Sun</b>	<b>Geosciences</b>
<b>Dr. Matthew Osborn</b>	<b>History</b>
<b>Dr. Liana Sega</b>	<b>Mathematics</b>
<b>Dr. Karen Bame</b>	<b>Molecular Biology and Biochemistry</b>
<b>Dr. Joseph Parisi</b>	<b>Music Education</b>
<b>Dr. Mary Walker</b>	<b>Oral and Craniofacial Sciences</b>
<b>Dr. Kun Cheng</b>	<b>Pharmaceutical Sciences</b>
<b>Dr. Hari Bhat</b>	<b>Pharmacology</b>
<b>Drs. Paul Rulis &amp; Mark Brodwin</b>	<b>Physics</b>
<b>Dr. Arif Ahmed</b>	<b>Public Affairs and Administration</b>
<b>Dr. Marc Garcelon</b>	<b>Social Science Consortium</b>



## College of Engineering and Computing

October 6, 2023

Dear University of Missouri Board of Curators,

I am writing to express my support for the proposed transition of UMKC's interdisciplinary PhD programs within their School of Science and Engineering to several individual Ph.D. programs with new CIP codes.

Our understanding is that this change will correct and improve how their degrees are being counted through the CIP code system. This change should benefit UMKC and the UM System and will have no foreseeable impact at Missouri S&T.

Sincerely,

A handwritten signature in black ink, appearing to read "David Borrok".

David Borrok  
Vice-Provost and Dean  
College of Engineering and Computing





Office of the Provost and Executive Vice Chancellor

October 5, 2023

Dear University of Missouri Board of Curators-

UMKC aims to achieve Carnegie R1 classification in the next 5-7 years. A critical action step toward this goal is to appropriately classify our research-based doctoral program CIP codes so that they are recognized in the Carnegie classification system. With this goal in mind, I am in full support of the transition of the PhD program in interdisciplinary studies (iPhD; not currently recognized by Carnegie) into eight independent PhD programs that are recognized in the Carnegie classification system. In addition to the critical role these programs will play in our degree program conferral data, this transition aligns with our strategic plan goals of: exceptional student learning, success, and experience (pillar one), helping UMKC become a thriving discovery enterprise (pillar two), transforming our community and region with impactful engagement (pillar three), and preparing students for the global workforce (pillar four). The program transition has been fully considered and planned by the faculty and leadership of UMKC, and is supported by the appropriate curricula, staffing, and market demand.

The **curricula** for the eight PhD programs will remain largely unchanged and is reviewed in detail on a program-by-program basis in the proposal. No additional instructional, student support, library, or assistantship resources will be necessary for this transition to be successful. Students will continue to be supported by existing faculty, staff, and student support structures on campus, and we will transition as many students as possible into the new degree programs by Fall 2024 to maximize doctoral degree conferrals in the coming years. Notably, students who do not want to transition will have the opportunity to remain in the iPhD program through degree completion; if our doctoral program proposal is approved, no new students will be admitted to the iPhD in the future and the program will be closed.

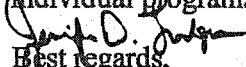
The **market demand** for each of these programs is currently strong, and we anticipate the transition will only enhance it. The 8 programs included in our proposal have the highest rates of student interest, graduation, employment, and long-term research synergy potential at UMKC. While we anticipate demand for each program to remain stable in the short term, the renaming of these programs is likely to have an immediate impact on our national and regional reputation as a

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research institution. Although we will keep our enrollments stable in the early years of this transition, faculty will be expected to increase assistantship funding through externally funded grants, thereby allowing us to increase student enrollment while also supporting our campus research goals.

I'm happy to answer any questions about this overall doctoral program transition or the individual programs included in it.



Best regards,

Jennifer D. Lundgren, PhD

Provost and Executive Vice Chancellor



School of Graduate Studies

October 5, 2023

Dear Members of the Board of Curators,

The Graduate Council at UMKC has voted to express its full support for the proposed transition from our current Interdisciplinary Ph D program to PhD's in the areas of Computer Science, Economics, Education, Engineering, Humanities, and Natural Sciences.

We are convinced that this transition would elevate the university's research status by giving us credit for doctoral research in the areas of STEM, Humanities, and Social Sciences. While we would be using new CIP codes and titles, these doctoral degrees can be delivered with existing faculty, courses, and administrative staff. The required courses for the newly titled and coded doctorates are unchanged from those required in the current Interdisciplinary PhD program, except that the secondary disciplines now only require nine hours of courses (under the current system, the "co-discipline" sometimes requires as many as fifteen hours of coursework). This promises to improve completion rates.

This change of codes and titles will better reflect the specialized research and academic focus within these designated areas, which can significantly contribute to elevating the university's research profile. This has the potential to increase funding opportunities from federal agencies, private organizations, and philanthropic sources. With focused academic programs, we can tailor our research proposals to meet the specific needs and priorities of these funding agencies, ultimately increasing our chances of securing research grants and contracts.

We strongly believe that these more narrowly focused doctoral programs will elevate our research reputation, improving our university's standing as a discovery enterprise, attracting a higher caliber of faculty and students, enhancing our regional, national, and international appeal as a go-to institution for advanced research and education.

In sum, because the proposed transition aligns with our university's long-term goals and aspirations, potentially giving us greater research prominence, increased funding, and a more dynamic academic environment that will advance the mission and reputation of UMKC and the entire UM-System, we request the Board of Curators to approve this proposal.

Thanks for your consideration.

*Stephen Dilks*

Stephen John Dilks,  
Associate Dean, School of Graduate Studies  
Chair, UMKC Graduate Council.