

Board of Curators Meeting - Public Session

University of Missouri System

Century Rooms A & B, Millennium Student Center, University of Missouri - St. Louis

Nov 16, 2023 8:00 AM - 2:30 PM CST

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Location: Century Room C, Millennium Student Center The Board of Curators will hold an executive session of the November 16, 2023 meeting, pursuant to Sections 610.021(1), 610.021(2), 610.021(3), 610.021(12) and 610.021(13) RSMo, for consideration of certain confidential or privileged communications with university counsel, personnel, property, litigation, contract items, all as authorized by law and upon approval by resolution of the Board of Curators.	
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XVII. Board of Curators Academic, Student Affairs, Research and Economic

Development Committee Meeting - Executive Session (2:40 PM, time is approximate)

Location: Century Room C, Millennium Student Center The Board of Curators will hold an executive session of the November 16, 2023 Academic, Student Affairs, Research and Economic Development Committee meeting, pursuant to Sections 610.021(1), 610.021(3) and 610.021(13) RSMo, for consideration of certain confidential or privileged communications with university counsel and personnel items, all as authorized by law and upon approval by resolution of the Academic, Student Affairs, Research and Economic Development Committee.

XVIII. Board of Curators Executive Session (2:45 PM, time is approximate)

Location: Century Room C, Millennium Student Center The Board of Curators will hold an executive session of the November 16, 2023 meeting, pursuant to Sections 610.021(1), 610.021(2), 610.021(3), 610.021(12) and 610.021(13) RSMo, for consideration of certain confidential or privileged communications with university counsel, personnel, property, litigation, contract items, all as authorized by law and upon approval by resolution of the Board of Curators.

XIX. Board of Curators Governance, Compensation and Human Resources Committee

Meeting - Executive Session (4:15 PM, time is approximate)

Location: Century Room C, Millennium Student Center The Governance, Compensation and Human Resources Committee will hold an executive session of the November 16, 2023 meeting, pursuant to Section 610.021(1), 610.021(3), 610.021(12) and 610.021(13) RSMo, for consideration of certain confidential or privileged communications with university counsel, contract and personnel items, as authorized by law and upon approval by resolution of the Governance, Compensation and

Human Resources Committee.



Vision

To advance the opportunities for success and well-being for Missouri, our nation and the world through transformative teaching, research, innovation, engagement and inclusion.

Mission

To achieve excellence in the discovery, dissemination, preservation and application of knowledge. With an unwavering commitment to academic freedom and freedom of expression, the university educates students to become leaders, promotes lifelong learning by Missouri's citizens, fosters meaningful research and creative works, and serves as a catalyst for innovation, thereby advancing the educational, health, cultural, social and economic interests to benefit the people of Missouri, the nation, and the world.

Missouri Compacts for Achieving Excellence

The Missouri Compacts for Achieving Excellence provide unifying principles that inform and guide the four universities and their strategic plans. Learn more about the compacts, below, at <http://umurl.us/prespri>.



Excellence in
Student Success



Excellence in
Research and
Creative Works



Excellence in
Engagement and
Outreach



Inclusive
Excellence



Excellence in
Planning, Operations
and Stewardship

Core Values

Our institution collectively embraces a series of core values that serve as the foundation upon which we build new knowledge and provide outstanding programs for students and citizens of our state and beyond.



- Academic freedom
- Access
- Accountability
- Civility
- Collaboration
- Creativity
- Discovery
- Engagement
- Excellence
- Freedom of expression
- Inclusion
- Innovation
- Integrity
- Respect
- Responsibility
- Transparency

Guiding Principles

1. Support courageous and proactive leadership that is articulate, unified and committed to excellence in carrying out our existing core missions of teaching, research, engagement and economic development and in meeting the changing needs of the world and the state.
2. Establish a collaborative environment in which UM System universities work together to achieve collective results that cannot be achieved individually and are committed to each other and our mutual success.
3. Exercise central authority that recognizes and respects institutional distinctiveness, appropriate deference and accountability.
4. Enact informed decisions based on collaboratively developed strategic directions and planning.
5. Identify and promote systemwide core values, including respect for all people, transparency, accountability, stewardship and purposeful self-assessment of performance.

Board Value Statement

Board of Curators of the University of Missouri establish the following statement of values to guide members in the governance of the University of Missouri pursuant to the Constitution and the Revised Statutes of the State of Missouri:

1. **Trustworthy & Transparent Communication.** We value an environment of openness, collaboration and honesty with each other above all else, and support open communication and the free expression of ideas. We will endeavor to communicate with each other and with all University stakeholders with honesty and integrity. We will perform our duties ethically and avoid conflicts of interest.
2. **Respect.** We are respectful of each other and all University stakeholders in our interactions. We believe that civility, courtesy, decency and tolerance are critical when engaging in discussions with others with whom we may not agree. We encourage independent judgment and the sharing of a diversity of thoughts, and accept others' unique perspectives as valuable contributions to governing discussions.
3. **Healthy Board Governance.** We are committed to a healthy culture of board governance, one that is dedicated to sustaining the trust and support for the University of Missouri. We will devote time and effort needed to responsibly and capably perform our duties. We will exercise responsible stewardship and uphold our fiduciary duties as Curators. We will fully prepare for, attend and participate in board meetings, and seek to continually increase our understanding of, and adherence to, the standards for effective board governance.
4. **Support and Hold Accountable Leadership.** We are committed to supporting the leadership throughout the University of Missouri, while also holding that leadership accountable for the effective management of the University. We will establish, communicate and monitor clear performance expectations for leadership directly reporting to the Board, and will hold such leadership accountable to maintain the highest standard of ethical behavior. In supporting University leadership, we will endeavor to avoid involvement in matters delegated to the Administration.
5. **Strategic Vision.** We are committed to fully understanding, supporting and, when appropriate, challenging the short and long-term strategic priorities of the University of Missouri's constituents. We will challenge University leadership to continually develop and assess strategic plans that will be effective in supporting the Missouri Compacts for Achieving Excellence: Excellence in Student Success, Excellence in Research and Creative Works, Excellence in Engagement and Outreach, Inclusive Excellence and Excellence in Operations, Planning and Stewardship.

UNIVERSITY OF MISSOURI
BOARD CHAIR REPORT

There are no materials for this information item.

No. 1

Recommended Action - Resolution for Darryl M. Chatman

It was endorsed by President Choi, recommended by Chair Williams, moved by Curator _____ and seconded by Curator _____, that the following resolution recognizing the dedicated service of Darryl M. Chatman, Jr. to the University be approved:

RESOLUTION

WHEREAS, Darryl M. Chatman, Jr. served the people of Missouri with distinction as a member of the University of Missouri Board of Curators from February 14, 2017 until January 26, 2023; and

WHEREAS, during his term, he was a member of several Standing Committees and the Executive Committee, and served as Chair of the Governance, Resources and Planning Committee; Academic, Student Affairs/Research and Economic Development Committee; and the Executive Committee in 2021 and 2022; and

WHEREAS, after Curator Chatman served as Vice Chair in 2019, he was elected Chair of the Board of Curators, beginning January 1, 2021 through December 31, 2021, and was re-elected to a second term, serving from January 1, 2022 until December 31, 2022; and

WHEREAS, while serving as Chair he ensured all voices were heard at the table and made a concerted effort to highlight top researchers from each university in his Chair reports, adding student mentees to that recognition as well; and

WHEREAS, Curator Chatman provided leadership during the COVID-19 pandemic through unprecedented times in higher education, the state and the country; and

WHEREAS, during his time as Curator he supported research enterprise growth across all four UM System universities and advocated for heightened recognition of Curators' Distinguished Professors. Most of all, he deeply cared for students, believing that all students should be provided support networks, outreach, and educational opportunities; and

WHEREAS, Darryl Chatman is a True Son of Old Mizzou. As an undergrad student athlete from 1992-1996, Darryl was a football Tiger linebacker nicknamed “Chopper,” who went on to earn four degrees from MU: a bachelor’s and two master’s degrees from CAFNR, and a Juris Doctor from the School of Law. He also earned a master’s degree in public administration from North Carolina State University; and

WHEREAS, he led the University Task Force in 2018 to review the University of Missouri System’s patterns of governance, leadership and operations. The result was a call for energetic and decisive leadership and a commitment to highly participatory governance wherein serious input is sought in advance of decisions made; and

WHEREAS, Curator Chatman believed in the mission of the University, and as a Curator, worked to achieve it and set the example of how a system of four distinct universities achieves excellence in teaching, research and engagement with Missourians, the nation and the world; and

WHEREAS, he received the 2017 Citation of Merit Award, given each year by the CAFNR Alumni Association for professional attainment by a CAFNR alumnus in their chosen career field, and received the CAFNR Column Award for Distinguished Alumni in 2019; and

WHEREAS, Curator Chatman also received the Distinguished Recent Graduate Award in 2017 at the University of Missouri-Columbia Law Day Awards ceremony. This award is presented to an outstanding alumnus who graduated within the past ten years; and

WHEREAS, he advocated for accountability in athletics to produce the best programs and student athletes possible; and

WHEREAS, Curator Chatman is a true professional. His contributions will have a lasting influence on the future of the University of Missouri System and the State:

NOW, THEREFORE, BE IT RESOLVED, that the Board of Curators, on behalf of the students, faculty, staff and alumni of the University of Missouri System, and on behalf of the citizens of the State of Missouri, does hereby adopt this resolution in sincere appreciation of the dedicated and devoted leadership of Darryl M. Chatman, Jr.;

AND ALSO, that his future relations with the University of Missouri System be formally recognized by bestowing the title of “Curator Emeritus” upon Darryl M. Chatman, Jr.; and

BE IT FURTHER RESOLVED that the Secretary of the Board of Curators cause this resolution to be spread upon the minutes of this meeting and that a duly inscribed copy thereof be furnished to Darryl M. Chatman, Jr.

Roll call vote:

YES

NO

Curator Blitz

Curator Brncic

Curator Fry

Curator Graves

Curator Holloway

Curator Layman

Curator Sinquefield

Curator Wenneker

Curator Williams

The motion _____.

PRESIDENT'S REPORT

Mun Y. Choi

Board of Curators Meeting

Nov 16, 2023



UM Leadership Appointments



Praveen Edara
*Interim Dean,
College of Engineering*



Tony Caruso
*Vice Chancellor of
Strategic Initiatives*



Jill Tanner
Chief of Staff



Victoria Verkamp
*Vice Chancellor of
University Advancement*

Admissions Update

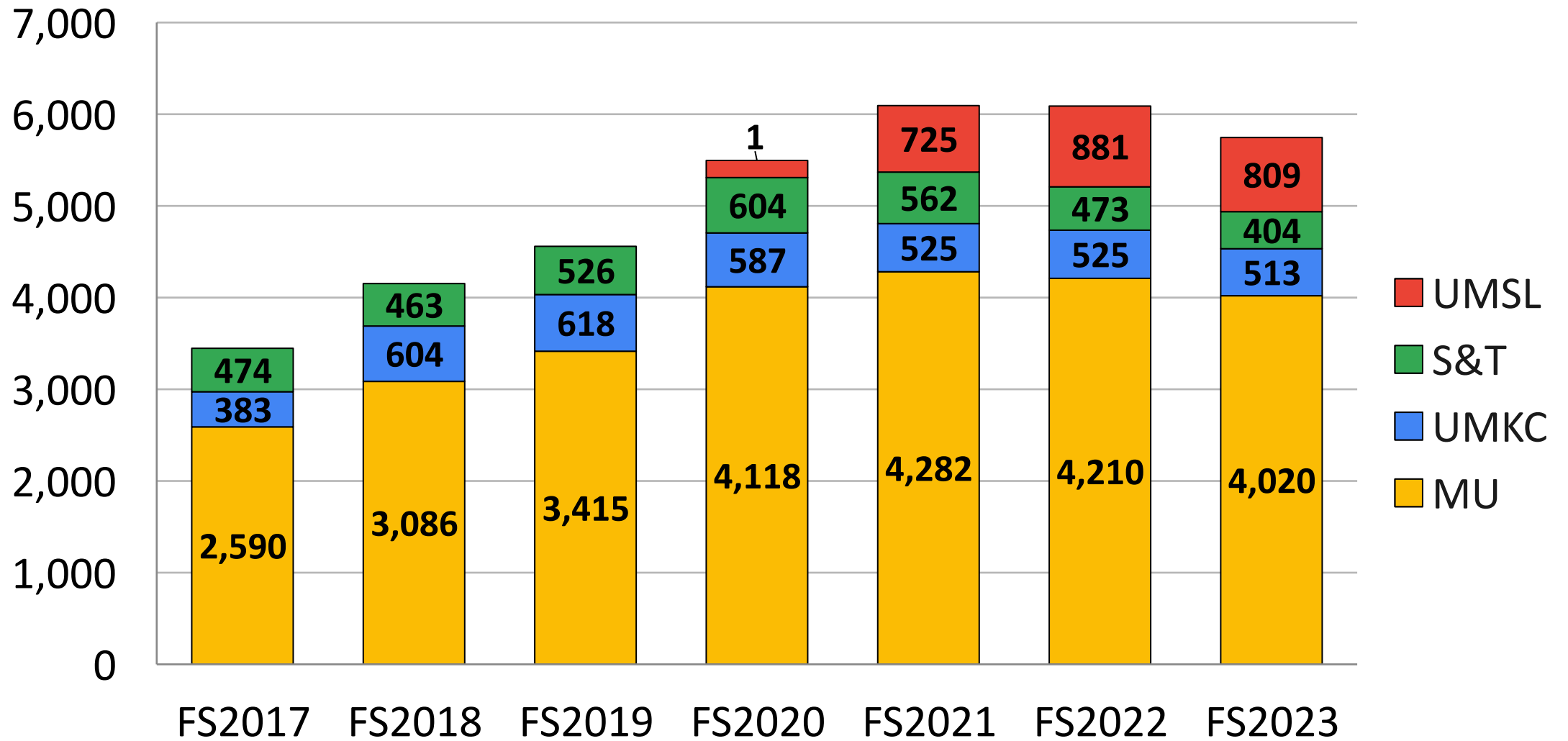
FTC Applicants

10/30	2021	2022	2023
MU	10,643	10,591	11,745
UMKC	2,669	2,781	2,495
S&T	2,252	3,044	3,238
UMSL	950	1,247	2,034

Transfer Applicants

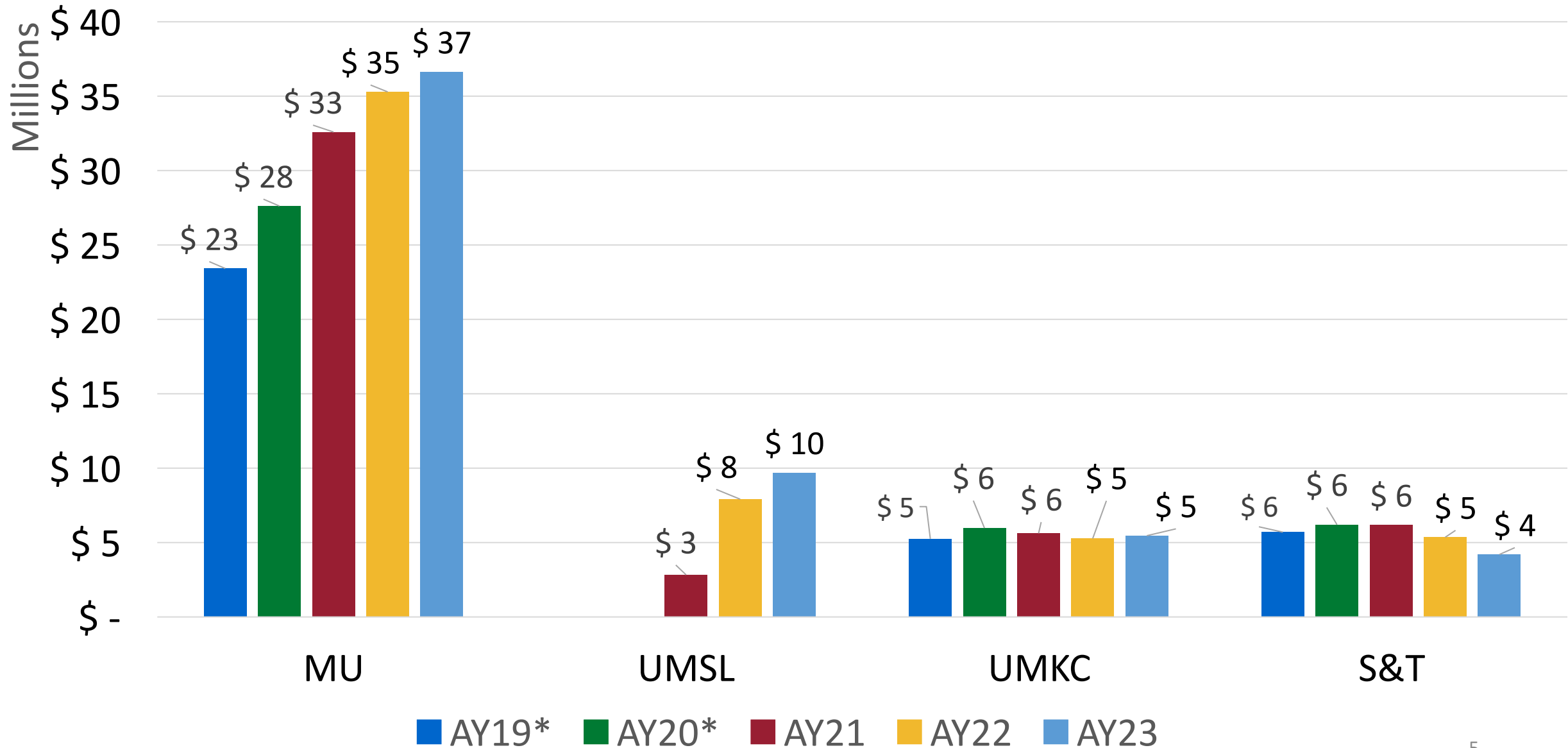
10/30	2021	2022	2023
MU	344	335	431
UMKC	328	318	281
S&T	58	105	244
UMSL	189	270	392

Online Students – Fall Semester



**UMSL did not code online students until FS20, so they are not included in the FS17, FS18 or FS19 totals.*

Online Course Revenues



Student Success



UMSL

Charlotte Richards
Supply chain management

Top 30 Honoree for the
NCAA Woman of the Year
Award



UMKC

Aleigha Dollens
Earth and Environmental Science

Recipient of Richard Hay Award from
the Geological Society of America



Cynthia Tang
Brian Thomas
Medicine

Recipients of the Ruth L. Kirschstein National
Research Service Award from the NIH.

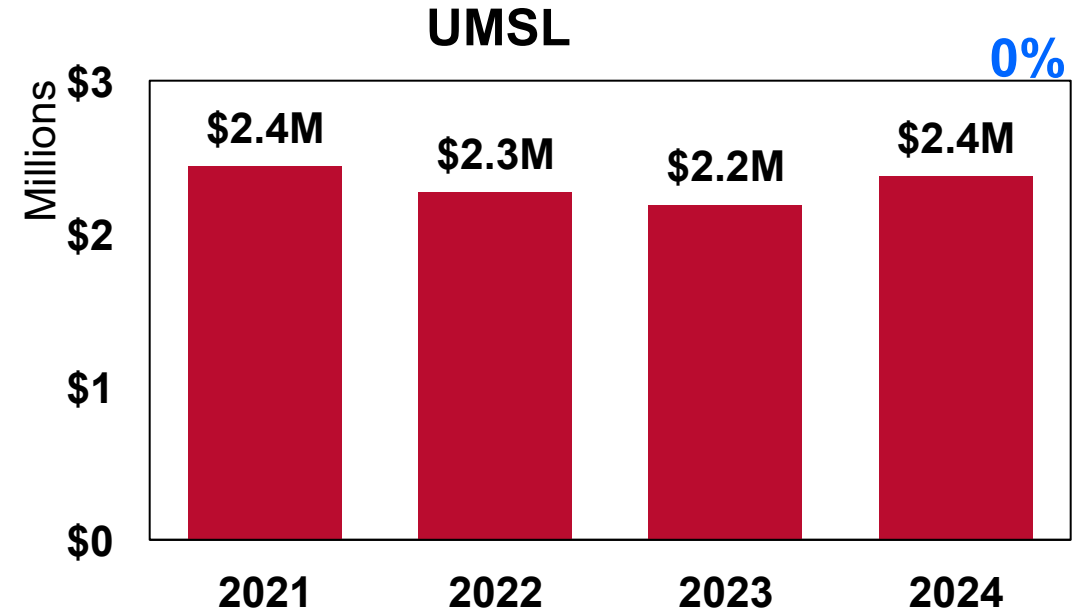
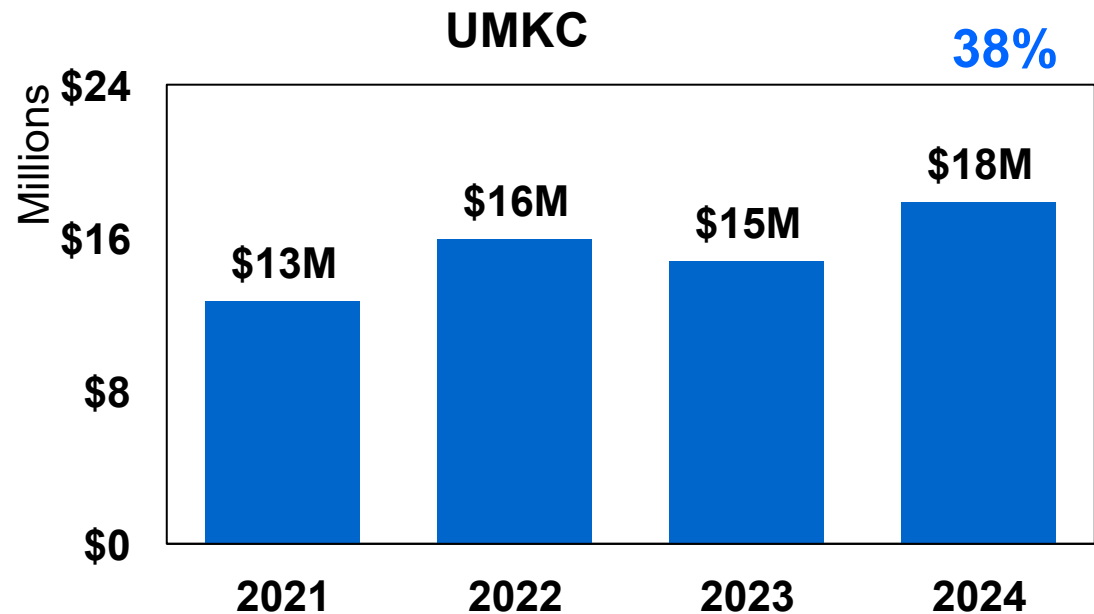
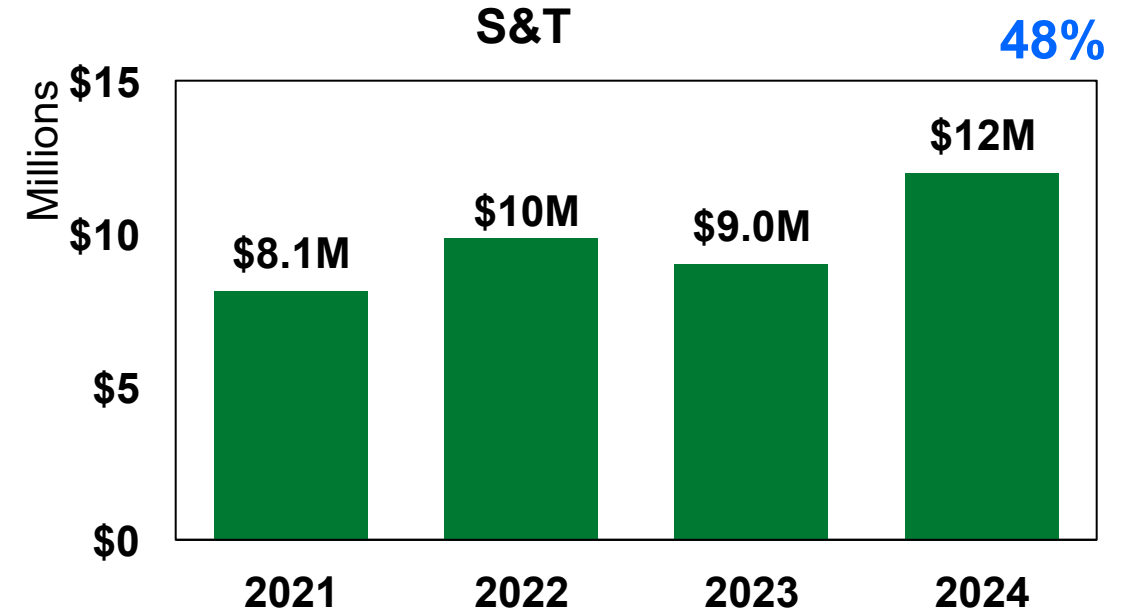
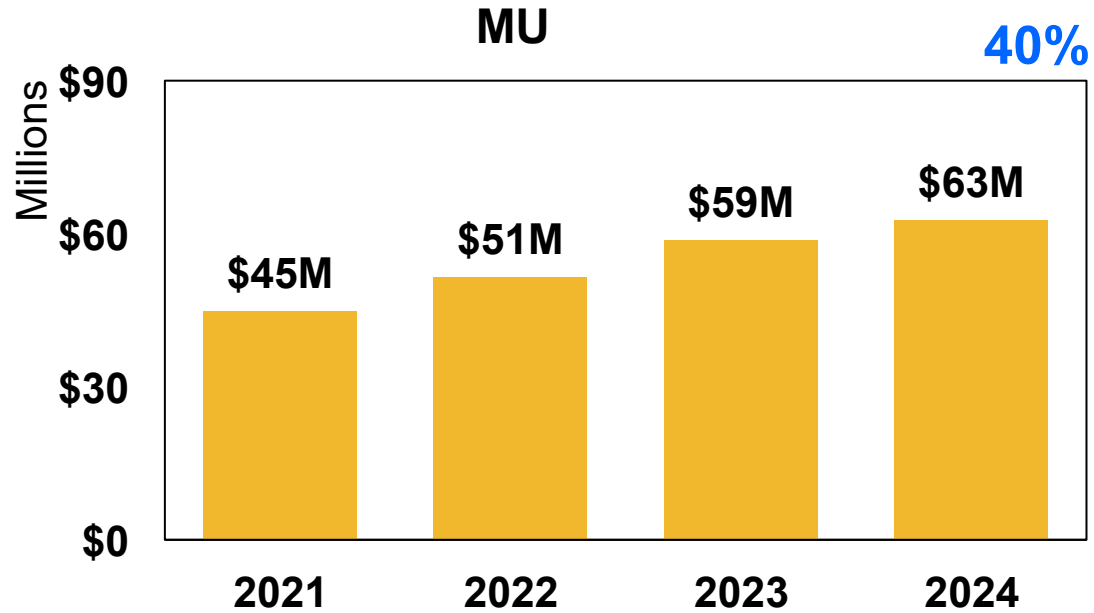


**MISSOURI
S&T**

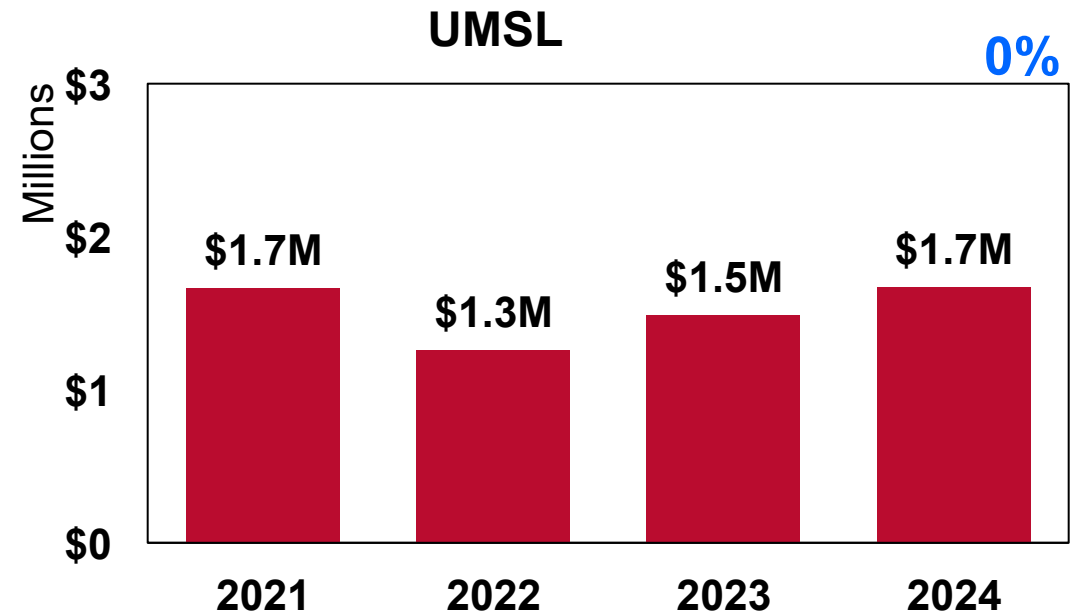
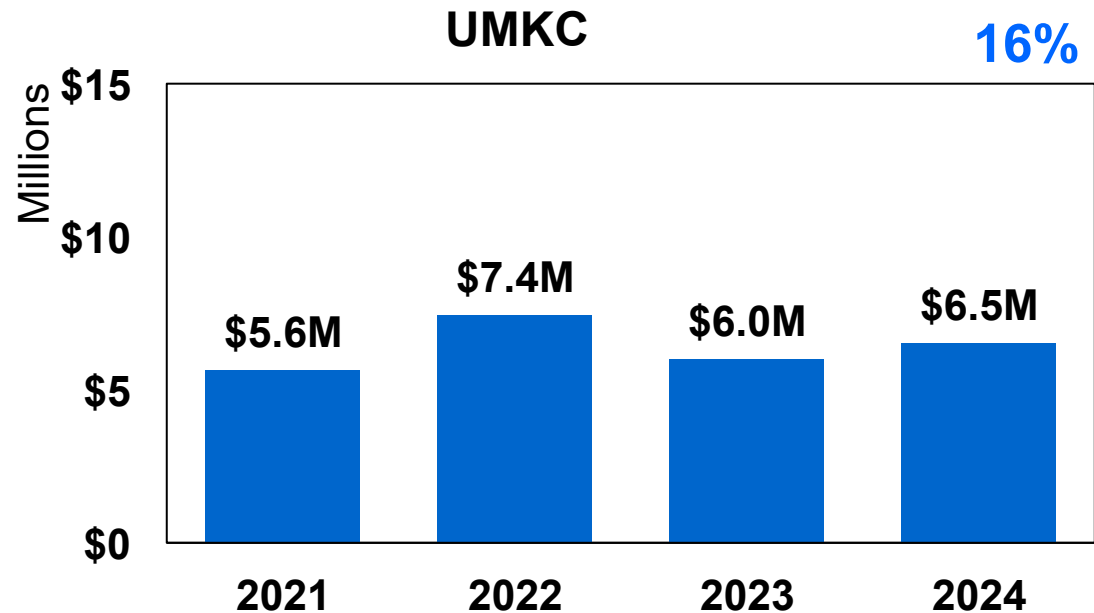
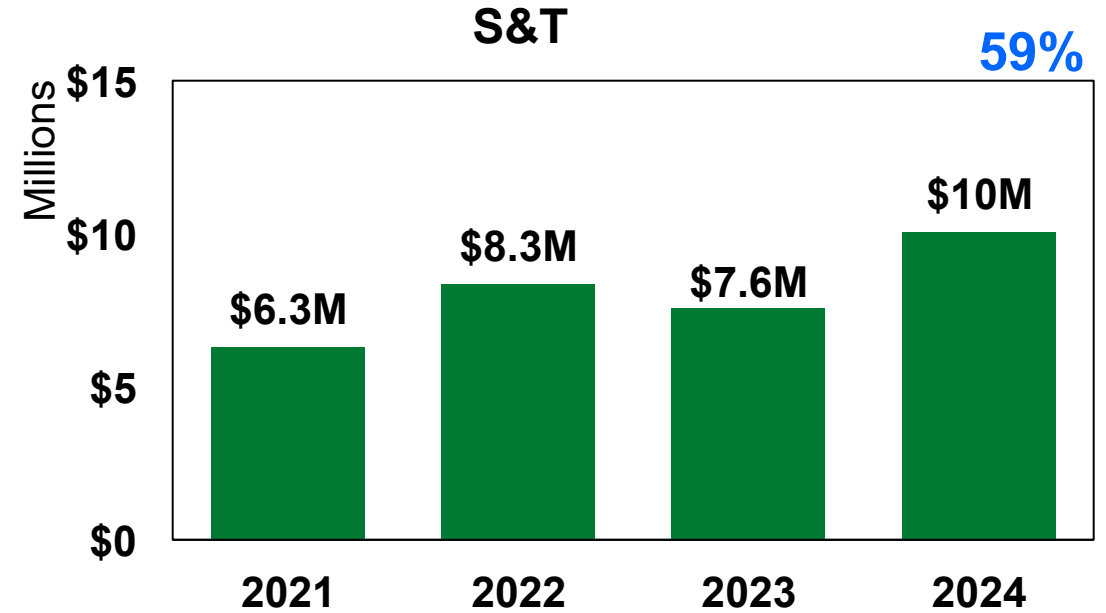
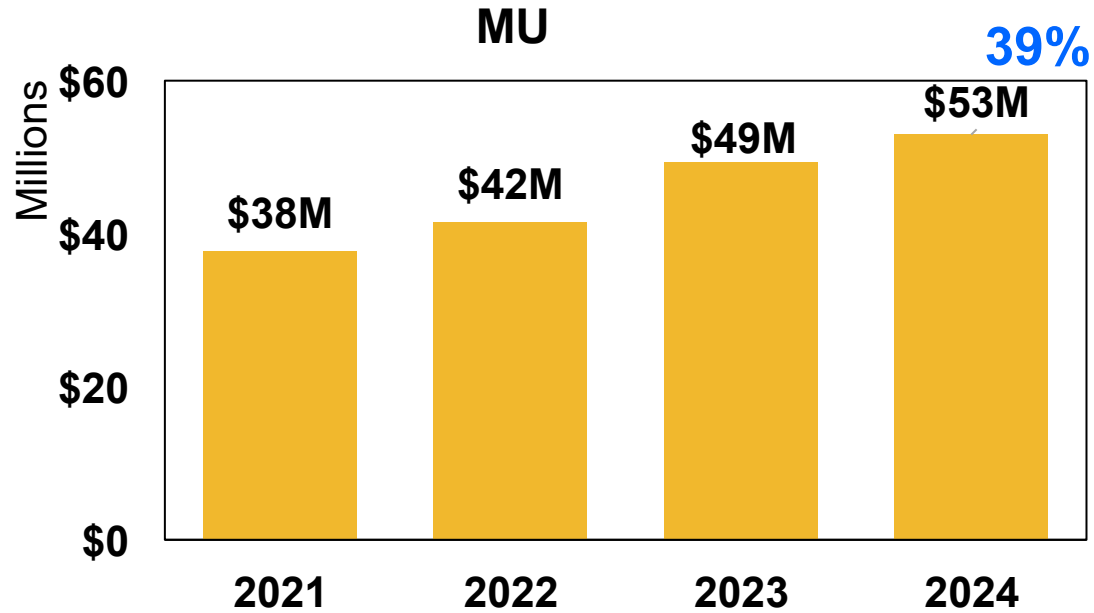
Hannah Butkovich
Civil Engineering

Named a national American
Society of Chemical Engineers
Ambassador. Only 26 students
selected for this role.

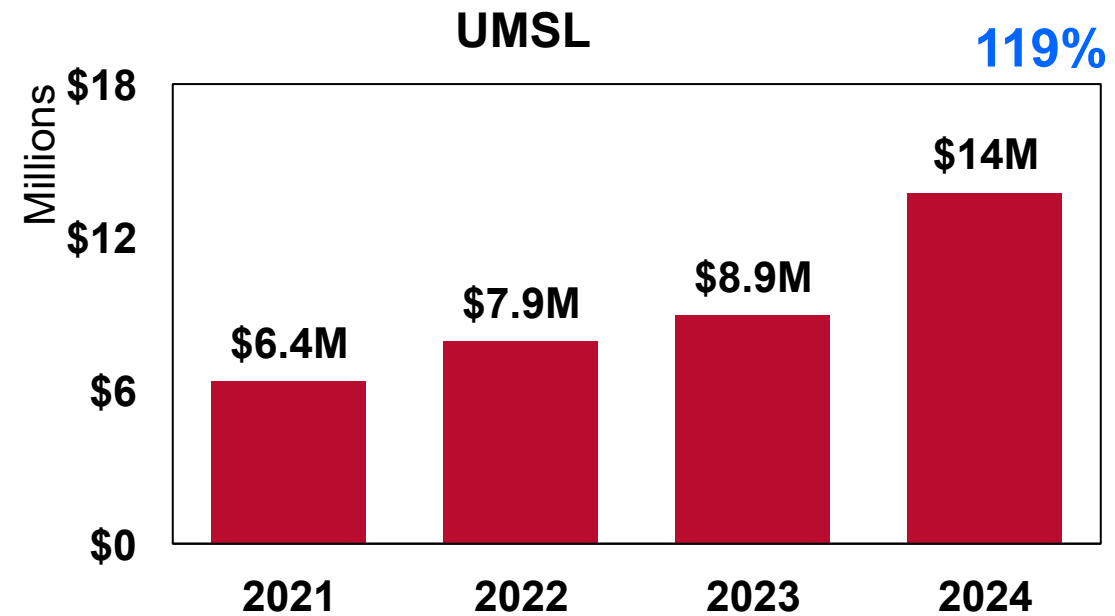
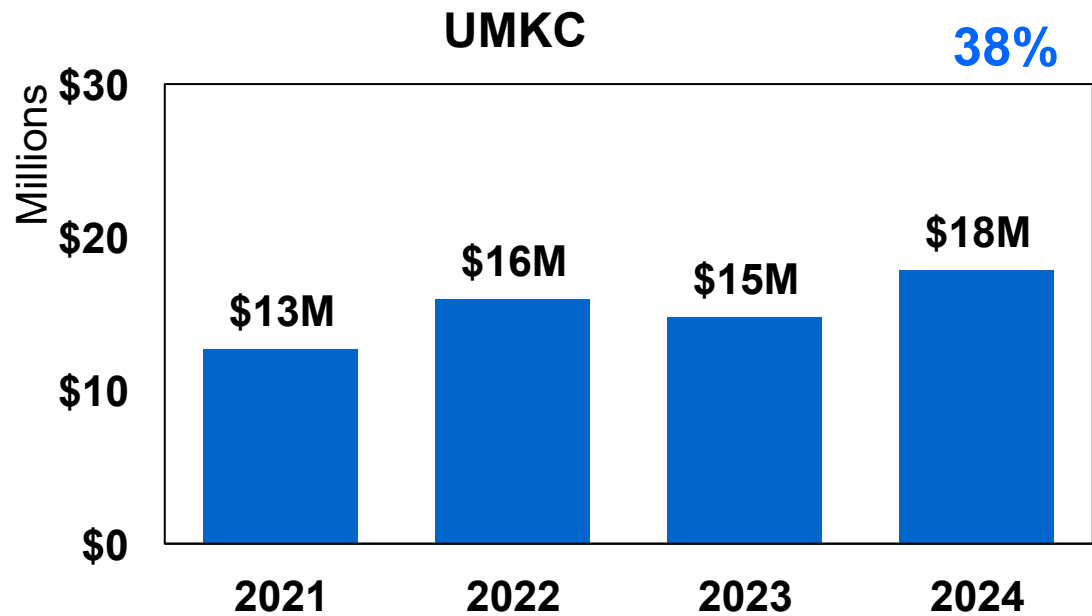
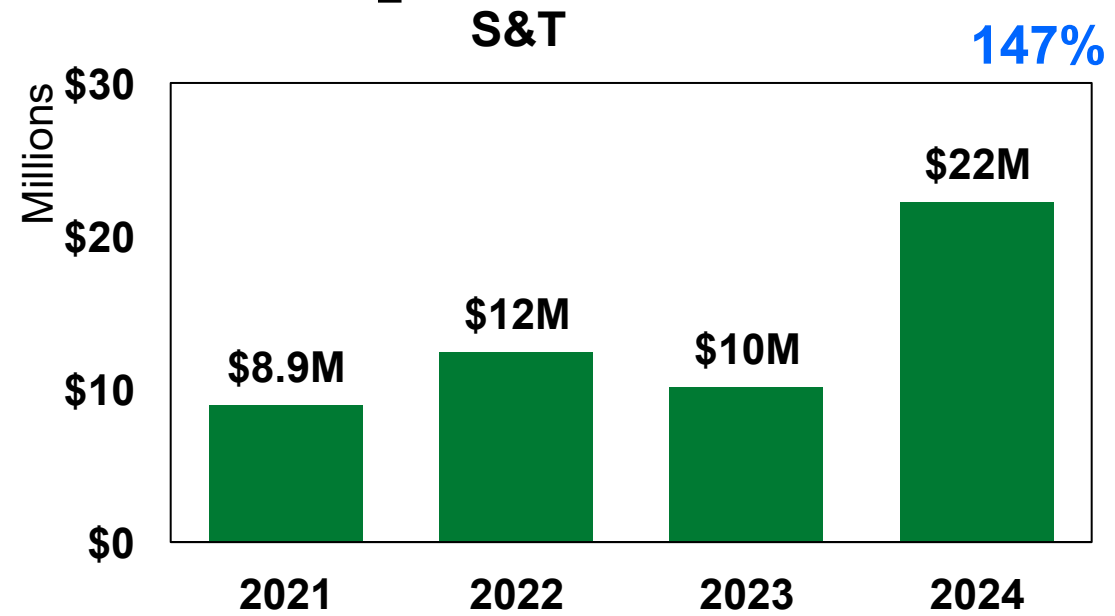
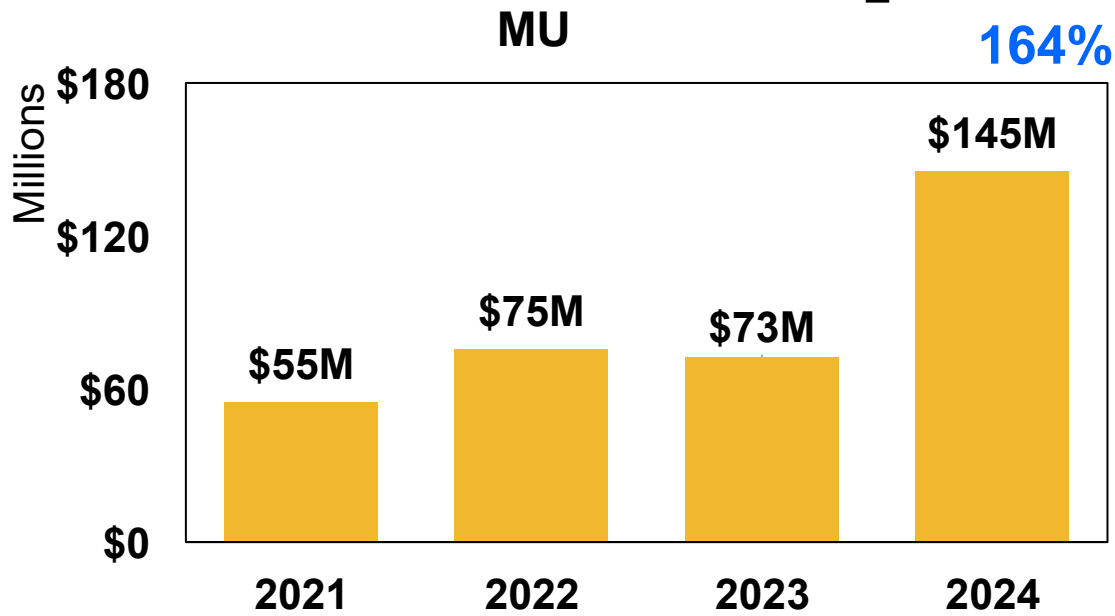
FYTD Total R&D Expenditures



FYTD Federal R&D Expenditures



FYTD Total Sponsored Expenditures



Faculty Success



UMSL

Jonathan Lidgus
College of Education

Awarded Missouri Leadership Award at the State-of-the-Art Conference



UMKC

Clancy Martin
Philosophy

Selected as Kirkus Prize finalist for *How Not to Kill Yourself: A Portrait of the Suicidal Mind*



Anne Sales
Nursing

Inducted as Fellow in the American Academy of Nursing



**MISSOURI
S&T**

Dimitri Feys
Civil Engineering

Inducted as Fellow of RILEM, the International Union of Laboratories and Experts in Construction Materials, Systems and Structures.

MU Major Grant



SPIKEs: Programmable Scalable Therapeutics for Immune-Directed Cancer-Killing

PI: Dr. Paul de Figueirido, *Molecular Microbiology and Immunology (School of Medicine) and Veterinary Pathobiology (College of Veterinary Medicine)*

\$20M

Sponsor: NIH ARPA-H

The goal of the project is to build an inexpensive and safe therapeutic using bacteria that can recruit and regulate tumor-targeting immune cells to help the body fight cancer cells without the side effects of traditional medications.

S&T Major Grant



The Missouri Defense Manufacturing Consortium

PI: Dr. Richard Billo, *Mechanical and Aerospace Engineering*

CPI: Dr. Ming Leu, *Mechanical and Aerospace Engineering*

\$5M

Sponsor: Office of Local Defense Community Co-op

This project aims to put collaborative effort toward aligning and addressing the Defense priorities with the critical skill needs of our region's Defense Industrial Base.



UMKC Major Grant



Covert Unmanned Cyber and Kountermeasures for Offensive Operations (CUCKOO)

PI: Dr. Travis Fields, *School of Science and Engineering*

CPI: Dr. Anthony Caruso, *School of Science and Engineering*

\$7M

Sponsor: Office of Naval Research

This project aims to create High Powered Microwave sources that disrupt intelligence, surveillance, reconnaissance and targeting systems at tactically relevant ranges using unmanned aircraft systems.



UMSL Major Grant

UMSL

Psychological Evaluation for St. Louis County Children and Adolescents

PI: Dr. Ashley Darling, *UMSL Center for Behavioral Health*
\$9.8M

Sponsor: St. Louis County Children's Service Fund

This project funds the UMSL Center for Behavioral Health (CBH), which provides psychological evaluations for children and adolescents, recommendations for appropriate treatment and helps patients transition into aftercare services.

PHOTO COMING

- 31 Tech Hubs were announced on October 23
- BioNexus KC (MU and UMKC are partners) was selected for Biologics and Biomanufacturing Hub
- Missouri S&T was selected for Critical Minerals and Materials for Advanced Energy Hub
- Tech Hubs are now eligible to apply for the next phase that will invest between \$50-\$75 million in each of 5-10 Designated Hubs.



MU Grants Over \$1M

PI	Co-PI	Total	Project	Sponsor
Matt Sanford	n/a	\$20M	NextGen MU Research Reactor Planning, Design & Licensing Study	NIST
Whitney Lefevre	K. Quinn	\$16M	Value-Based Medical Student Education Training Program	HRSA
Kevin Wells	J. Green, K. Lee, R. Prather, B. Telugu	\$6.6M	Swine Somatic Cell Gene Editing Testing Center	NIH
Sheila Grant	J. Ghosh, D. Grant, M. Siegel	\$5.5M	ART: Technology, Entrepreneurship and Commercialization Hub (ART:TECH)	NSF
Baolin Deng	D. Hall	\$5M	Sustainable water resource management in Missouri through technology and workforce development	EPA
Zhenguo Liu	Z. Gu, R. Korthuis, G. Li, L. Ma. T. Miltenberger	\$2.1M	Fine particulate matter exposure and small cerebrovascular inflammation	NIH
Keith Herman	F. Huang, W. Reinke	\$2M	Building Capacity for Threat Prevention, Assessment, and Response in Urban Missouri Schools	Dept. of Justice
Ai-Ling Lin	J. Cui, D. Davis,A. Ericsson, Z. Gu, L. Ma	\$1.6M	Gut-brain axis in Alzheimer's disease: translational 7T MRI markers and underlying mechanisms	NIH
Scott Brown	P. Westhoff	\$1.4M	State and Regional Farm Financial Analysis 2023	USDA
ChanwooPark	n/a	\$1.3M	Dual-Mode Hybrid Two-Phase Loop for Data Center Cooling	ARPA-E

UMKC, S&T and UMSL Grants Over \$1M

PI	CPI	Total	Project	Sponsor
Jannette Berkley-Patton	C. Bowe Thompson, J. Bruce, S. Ellison, A. Grimes, T. Johnson, J. Lightner, C. Lindsey, D. Newman, M. Meyers, J. Roberts, M. Simmer-Beck, M. Steele, Y. Lee	\$5M	Addressing Health Disparities on the Eastside	Jackson County
Sara Gardner	P. Cuddy, B. Rosemergey, M. Wacker	\$4M	Value-Based Medical Student Education Training Program	HRSA
Kristi Holsinger	n/a	\$1.5M	Student Career Pathways Expansion	DHEWD
Mariana Kotlaja	n/a	\$1.3M	Evaluating KC360 violence prevention programs running through the Department of Health	KC Health Department
Samuel Frimpong	V. Allada, K. Awuah-Offei, D. Burns, S.K. Madria, Y.S. Song, M. J. Zawodniok	\$2M	Research and Technological Innovations in Automation, Robotics, and Intelligent Mining Systems for Transformative Improvements in Workplace Safety, Health, and Efficiencies	CDC
Shoaib Usman	C.H.S. Giraldo	\$1.2M	Assessment after Engagement, Education & Experiential-learning (A-EEE)	Dept. of Energy
Jerry Dunn	n/a	\$1.7M	Trauma-Informed System of Care	St. Louis County
Jerry Dunn	n/a	\$1.3M	Forensic Services	St. Louis County

MU AAU Performance

(Normalized by Faculty Count)

	2018	2023	'23 – '18
Phase I R&D Expenditures	\$120	\$188	57%
Phase I HP Honors & Awards	27	55	104%
Phase I Citations	38	N/A	57% ('22-'18)
Phase I Books	60	47	-22%
Phase II R&D Expenditures	\$41	\$108	163%
Education			
Info – 6 Year Graduation Rate	69.0%	75.7%	6.7 pts
Info – 6 Year Pell Graduation Rate	55.1%	66.5%	11.4 pts



University of Missouri System

COLUMBIA | KANSAS CITY | ROLLA | ST. LOUIS

REVIEW CONSENT AGENDA

There are no materials for this information item.

CONSENT

Recommended Action - Consent Agenda

It was endorsed by President Choi, moved by Curator _____ and seconded by Curator _____, that the following items be approved by consent agenda:

CONSENT AGENDA

Action

- A. Minutes, September 7, 2023 Board of Curators Meeting
- B. Minutes, September 7, 2023 Board of Curators Committee Meetings
- C. Minutes, September 1, 2023 Board of Curators Special Meeting
- D. Minutes, October 26-27, 2023 Board of Curators Retreat

Roll call vote of the Board:

YES

NO

Curator Blitz

Curator Brncic

Curator Fry

Curator Graves

Curator Holloway

Curator Layman

Curator Sinuefield

Curator Wenneker

Curator Williams

The motion _____.

CONSENT AGENDA

November 16, 2023

Consent A

Recommended Action - Minutes, September 7, 2023 Board of Curators Meeting

It was moved by Curator _____ and seconded by Curator _____, that the minutes of the September 7, 2023 Board of Curators meeting be approved as presented.

Roll call vote:	YES	NO
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Curator Blitz

Curator Brncic

Curator Fry

Curator Graves

Curator Holloway

Curator Layman

Curator Sinquefield

Curator Wenneker

Curator Williams

The motion _____.

November 16, 2023

OPEN – CONSENT – A-1

Consent B

Recommended Action - Minutes, September 7, 2023 Board of Curators
Committee Meetings

It was moved by Curator _____ and seconded by Curator
_____, that the minutes of the September 7, 2023 Board of Curators committee
meetings be approved as presented.

Roll call vote:	YES	NO
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Curator Blitz

Curator Brncic

Curator Fry

Curator Graves

Curator Holloway

Curator Layman

Curator Sinquefield

Curator Wenneker

Curator Williams

The motion _____.

November 16, 2023

OPEN – CONSENT – B-1

Consent C

Recommended Action - Minutes, September 1, 2023 Board of Curators Special Meeting

It was moved by Curator _____ and seconded by Curator _____, that the minutes of the September 1, 2023 Board of Curators special meeting be approved as presented.

Roll call vote:

YES

NO

Curator Blitz

Curator Brncic

Curator Fry

Curator Graves

Curator Holloway

Curator Layman

Curator Sinquefield

Curator Wenneker

Curator Williams

The motion _____.

November 16, 2023

OPEN – CONSENT – C-1

Consent D

Recommended Action - Minutes, October 26-27, 2023 Board of Curators Retreat

It was moved by Curator _____ and seconded by Curator _____, that the minutes of the October 26-27, 2023 Board of Curators retreat be approved as presented.

Roll call vote:	YES	NO
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Curator Blitz

Curator Brncic

Curator Fry

Curator Graves

Curator Holloway

Curator Layman

Curator Sinquefield

Curator Wenneker

Curator Williams

The motion _____.

November 16, 2023

No. 1

Recommended Action – Resolution for Executive Session of the Board of Curators
Meeting November 16, 2023

It was moved by Curator _____ and seconded by Curator _____, that
there shall be an executive session with a closed record and closed vote of the Board of
Curators meeting November 16, 2023 for consideration of:

- **Section 610.021(1), RSMo**, relating to matters identified in that provision, which include legal actions, causes of action or litigation, and confidential or privileged communications with counsel; and
- **Section 610.021(2), RSMo**, relating to matters identified in that provision, which include leasing, purchase, or sale of real estate; and
- **Section 610.021(3), RSMo**, relating to matters identified in that provision, which include hiring, firing, disciplining, or promoting of particular employees; and
- **Section 610.021(12), RSMo**, relating to matters identified in that provision, which include sealed bids and related documents and sealed proposals and related documents or documents related to a negotiated contract; and
- **Section 610.021 (13), RSMo**, relating to matters identified in that provision, which include individually identifiable personnel records, performance ratings, or records pertaining to employees or applicants for employment.

Roll call vote of the Board:	YES	NO
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Curator Blitz		
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Curator Brncic		
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Curator Fry		
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Curator Graves		
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Curator Holloway		
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Curator Layman		
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Curator Sinuefield		
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Curator Wenneker		
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Curator Williams		
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The motion _____.

ACADEMIC, STUDENT AFFAIRS, RESEARCH AND ECONOMIC DEVELOPMENT COMMITTEE

Jeff L. Layman, Chair
Robert D. Blitz
Todd P. Graves
Jeanne Cairns Sinquefield

The Academic, Student Affairs, Research and Economic Development Committee ("Committee") will review and recommend policies to enhance quality and effectiveness of academic, student affairs, research and economic development and align the available resources with the University's academic mission.

I. Scope

In carrying out its responsibilities, the Committee reviews and makes recommendations to the Board of Curators on strategies and policies relating to student and faculty welfare, academic standards, educational and instructional quality, intercollegiate athletics, degree programs, economic development, research initiatives, and associated programs.

II. Executive Liaison

The Associate Vice President for Academic Affairs of the University, or some other person(s) designated by the President of the University, with the concurrence of the Board Chair and the Committee Chair, shall be the executive liaison to the committee and responsible for transmitting committee recommendations.

III. Ex Officio Member

The Student Representative to the Board of Curators shall be an ex officio member of the Committee.

IV. Responsibilities

In addition to the overall responsibilities of the Committee described above and in carrying out its responsibilities, the charge of the Committee shall include reviewing and making recommendations to the Board on the following matters:

- A. Selection of Curators' Distinguished Professors;
- B. Approval and review of new degree programs;
- C. Intercollegiate athletics, as specifically outlined in Section 270.060 of the Collected Rules and Regulations with a commitment to the academic success, and physical and social development of student-athletes;
- D. Changes to university-level admissions requirements, academic standards, student services, and graduation requirements;
- E. Quarterly and annual reports providing information on academic programs that have been added, deactivated, or deleted;
- F. Provide oversight over the University of Missouri System's diversity, equity and inclusion programs;
- G. Highlight successful research and economic development efforts and partnerships; linking research and commercialization from the University with business and industry across the state and around the world.
- H. Additional matters customarily addressed by the academic, student affairs, research & economic development committee of a governing board for an institution of higher education.

Executive Summary

Intercollegiate Athletics Annual Report

Pursuant to Collected Rule and Regulation 270.060, Intercollegiate Athletics Section (E) relating to Campus Athletic Directors and Compliance Officers, the attached reports for the 2022-2023 academic year from each of the four UM universities is submitted for your information. The report includes information relating to student-athlete admissions exceptions, academic progress of student-athletes, graduation rates by sport, financial performance, and other comments. More detailed information relating to each report can be found in the appendix of this section.

Athletic Directors will be available during the Board of Curators meeting hosted at their respective campuses to present and answer any questions you have regarding the contents of these reports.

October 23, 2023

Mun Y. Choi, Ph.D.
President
University of Missouri System
105 Jesse Hall
Columbia, MO 65211

President Choi,

This letter serves as the 2022-2023 annual athletics report required by CRR 270.060 (E). More specifically, this letter summarizes data provided per subparts of CRR 270.060 (E) (1) through (5).

1. Rates of admissions exceptions for Athletics as compared to campus admissions exceptions.

At the University of Missouri – St. Louis the admission exceptions are consistently 80% or higher for the general population as compared to Intercollegiate Athletics.

Rationale includes:

- Requirements of the NCAA for a prospective student-athlete and the core courses they must successfully complete while in high school establishes a strong baseline for admissions.
- Coaches are recruiting earlier in each cycle; therefore, prospective students have time to meet university standards and not qualify for an exception. (i.e. Standardized Test Scores retake, summer school courses in a junior college)

2. Academic success rate by sport: Cohort is from 2016-2027

Academic success rates include first-time freshman and all transfer students.

- Overall academic success rate for the entire department is 82%
- Tendencies are the female sports success rates are higher. 86% versus 79%
- Comprehensive plan from the Academic Coordinator for Athletics to each student and coach allows a true plan to earn a diploma. Students do not get lost within a very complex system of degrees and NCAA restrictive rules.
- Individual sports (tennis, and golf) are consistently higher than team sports.
- Requirements of “Study Hall” focus on new students to the university and the transition period. Strong established relationship between the academic advisor and each student to develop a plan for success.
- Monthly meeting between the FAR, Associate Director and Assistant Director for Academics to discuss and strategize plans for students identified as concerns.

3. Graduation rate by sport, as defined by the NCAA:

- Graduation rates are based only on first time, full time freshman.
- Cohorts for each UMSL sport of true freshman are very small
- 56% of freshman for this cohort is lower, due to very small cohort. Athletics has made a conscious effort to increase the cohort size of freshman in the last four years.

4. Financial performance of all operations of the Department of Intercollegiate Athletics.

- Overall, the athletic department met the needs of each team and their competitive success. Very strategic in how the money was used to offset increases in every facet that we work with (travel, hotels, officials, insurance coverage, scholarships)
- Each team has been engaged in fundraising opportunities to offset rising costs.
- Department of Athletics had a net \$146,000 positive return to the university.

5. Substantive Issues and Plans for resolving / addressing such issues

- Overall winning percentage of the program is .622
- Overall grade point average of the 19 sports is 3.4 (21st consecutive semester of above 3.0)
- First time all 19 teams are above a cumulative 3.0 grade point average.
- 174 students achieved Academic All-GLVC Accolades with a cumulative grade point of 3.3 or above.
- Addition of an appointed staff person from Advancement to work on alumni and fundraising activities for athletics.

2022-2023 - Most Successful Athletic Year for UMSL

- 1... GLVC Coach of the Year
- 1... GLVC Paragon Award Winner
- 2... GLVC Scholar-Athletes of the Year
- 2... Midwest Regional Championships
- 3... GLVC Player of the Year
- 3... GLVC Freshman of the Year
- 4... Academic All-Americans
- 6... Individual student-athletes qualified for NCAA Championships
- 9... NCAA Tournament team appearances
- 10... All-Americans
- 28... GLVC Player of the Week selections
- 34... All-GLVC honorees
- 174... Student-athletes named Academic All-GLVC

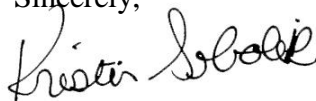
Overall teams record with golf and swimming head-to-head: 412-248-11 (.622)

HIGHLIGHTS

- **Charlotte Richards has been selected as the NCAA Woman of the Year Finalist.**
- **UMSL served as the 2023 host for the Women's Golf National Championship.**
- Volleyball and Men's Basketball each won Midwest Region championships. Volleyball advanced to the national semifinals and men's basketball made it to the Elite Eight.
- Finished 50th /out of 304 in the NACDA Learfield Division II Cup Standings with 358.75 points. It's the highest finish in school history.
- **Charlotte Richards** became the first female and second Triton student-athlete overall to be awarded the GLVC's Richard F. Scharf Paragon Award.
- Nine teams earned NCAA Tournament bids, including women's golf which was their 13th straight, and men's golf, which was their 10th straight.

- Six student-athletes earned GLVC specialty awards, including sophomore **Tove Brunell**, who was the Women's Golf Player of the Year, senior **Charlotte Richards**, who was the Volleyball Player of the Year and senior **Joel Sylven**, who was the Men's Golf Player of the Year.
- Senior **Isaiah Fuller** was named the Men's Basketball Defensive Player of the Year marking the fourth straight year a Triton player has won that honor.
- 10 student-athletes earned All-America honors, including volleyball senior **Charlotte Richards** (first team), women's golf sophomore **Tove Brunell** (first team), women's swimming senior **Zara Konstapel** (first team), men's swimming senior **Jon Osa** (first team) and men's golf senior **Joel Sylven** (third team).
- A school record 174 student-athletes were named to the Academic All-GLVC team for having a cumulative GPA during the year of 3.3 or higher.

Sincerely,

A handwritten signature in black ink, appearing to read "Kristin Sobolik". The signature is fluid and cursive, with the first name "Kristin" and last name "Sobolik" clearly distinguishable.

Kristin Sobolik
Chancellor

2022-2023 ANNUAL REPORT
Department of Intercollegiate Athletics

UMSL

List of Sponsored Sports

Men's Sports

X	Baseball
X	Basketball
x	Cross Country
	Football
X	Golf
x	Indoor Track & Field
x	Outdoor Track & Field
	Rifle
X	Soccer
X	Tennis
x	Swimming & Diving
	Wrestling

Women's Sports

X	Basketball
x	Cross Country
X	Golf
	Gymnastics
x	Indoor Track & Field
x	Outdoor Track & Field
	Rifle
X	Soccer
x	Softball
x	Swimming & Diving
X	Tennis
X	Volleyball

UMSL EADA / NCAA REPORT 2022-2023

REVENUE																	
Sport	Mens Baseball	Mens Basketball	Mens CC, Track & Field	Mens Golf	Mens Soccer	Mens Swimming	Mens Tennis	Other	Womens Basketball	Womens CC, Track & Field	Womens Golf	Womens Soccer	Womens Softball	Womens Swimming	Womens Tennis	Womens Volleyball	Grand Total
01 Ticket Sales	1,842.00	3,636.00			3,269.00	978.00			3,553.85			3,269.00	1,613.00	978.00	2,720.00		21,858.85
04 Direct Institutional Support	(349,437.96)	(577,217.66)	(119,359.08)	(175,708.72)	(254,282.51)	(181,674.81)	(102,911.86)	(1,817,382.41)	(129,403.52)	(457,847.42)	(234,853.41)	(290,673.19)	(405,485.59)	(184,530.36)	(91,766.73)	(268,284.91)	(5,640,820.14)
07 Guarantees		(6,000.00)							(2,000.00)								(8,000.00)
08 Contributions	(6,800.00)	(29,200.00)	(3,000.00)	(500.00)	(150.00)		(5,675.00)	(7,325.00)	(300.00)			(500.00)		(16,000.00)	(100.00)	(5,500.00)	(75,050.00)
12 NCAA Distributions		(30,400.00)				(2,963.55)		(14,660.00)			(4,881.28)	(3,220.00)	(15,715.00)	(1,975.70)		(17,617.50)	(91,433.03)
14 Program, Novelty, Parking and Concession Sales								(16,229.08)									(16,229.08)
15 Royalties, Licensing, Advertisement and Sponsorships								(14,961.87)									(14,961.87)
16 Sports Camp Revenues	(5,490.00)				(1,600.00)				(1,030.00)				(1,120.00)				(9,240.00)
17 Athletics Restricted Endowment and Investments	(7,396.75)	(5,148.09)		(1,036.30)	(1,805.66)	(1,886.14)			(1,182.34)					(1,180.53)			(19,635.81)
18 Other Operating Revenue	(39,251.00)	(2,506.36)	(1,392.75)	(3,367.50)	(2,000.00)	(6,572.87)	(1,404.13)	(121,952.08)	(1,392.75)		(62,564.24)			(6,572.88)	(1,164.12)		(250,140.68)
Grand Total	(408,375.71)	(650,472.11)	(123,751.83)	(180,612.52)	(259,838.17)	(193,097.37)	(109,990.99)	(2,017,773.91)	(130,796.27)	(462,359.76)	(302,298.93)	(294,393.19)	(422,320.59)	(210,259.47)	(93,030.85)	(291,402.41)	(6,150,774.08)
EXPENSES																	
20 Athletic Student Aid	124,250.00	202,838.90	41,500.00	59,350.20	106,417.73	60,927.25	42,800.00	764,981.44	50,500.00	182,132.90	68,500.00	134,536.40	141,217.67	65,315.50	35,300.00	119,367.20	2,199,935.19
21 Guarantees		4,750.00															4,750.00
22 Coaching Salaries, Benefits and Bonuses paid by the	140,738.48	231,457.18	43,296.14	41,495.97	87,576.78	60,295.04	39,520.09		43,296.13	188,733.51	36,224.49	91,483.01	166,036.49	60,295.15	36,290.68	78,885.13	1,345,624.27
24 Support Staff/Administrative Compensation, Benefit								927,637.34									927,637.34
27 Recruiting	6,605.28	5,974.68	1,426.21	1,005.23	899.13	1,730.36		84.98	343.94	5,211.43	581.13	1,198.49	1,683.34	2,086.11	34.76	1,660.70	30,525.77
28 Team Travel	29,260.24	116,191.95	15,909.13	41,446.83	30,799.54	45,262.79	5,797.57	6,040.08	16,237.84	40,726.79	74,965.96	37,643.95	65,678.82	37,561.50	6,143.00	33,924.43	603,590.42
29 Sports Equipment, Uniforms & Supplies	39,634.42	18,785.54	7,288.57	13,518.84	10,664.45	9,551.09	8,934.77	23,256.34	7,288.58	14,065.02	13,112.88	10,755.55	16,947.12	11,674.55	8,202.59	13,736.45	227,416.76
30 Game Expenses	16,295.00	18,894.77	350.00	883.50	6,432.00	570.50	217.28	13,014.54	350.00	17,063.77	5,157.50	4,883.00	6,030.00		450.00	221.60	103,248.46
31 Fund Raising, Marketing, and Promotion	389.94	1,555.60	150.00	25.00	7.50	283.75	2,650.16			15.00	8,930.60			25.00		5.00	14,312.55
32 Sports Camp Expenses	63.70				17.00												88.35
33 Spirit Groups							5,000.00						7.65				5,000.00
34 Athletic Facilities Deb Service, Leases and Rental Fees	2,700.00		2,500.00	5,016.00	732.00		1,890.50		2,500.00		25,415.00	665.00			1,990.50		43,409.00
35 Direct Overhead and Administrative Expenses	8,678.44	2,561.02		9,267.47	841.40		142.57	144,375.71	4.65	2,544.98	17,729.90	749.50	14,830.55		142.57	16,788.88	218,657.64
37 Medical Expenses and Insurance	16,000.00	6,000.00	5,300.00	5,685.00	9,600.00	4,600.00	3,200.00	20,269.00	7,300.00	5,153.20	2,700.00	9,675.00	6,150.00	4,600.00	3,100.00	6,895.00	116,227.20
38 Memberships and Dues	390.00	640.00	837.50	275.00	395.00	1,125.00	192.50	27,447.26	837.50	1,200.00	225.00		195.00	1,125.00	192.50	200.00	35,277.26
39 Student Athlete Meals (Non Travel)	1,005.66	3,008.27	873.15	104.81	545.46	917.96	84.32	213.86	873.18	1,404.78	173.63	631.81	379.96	5,339.62	859.97	1,811.19	18,227.63
40 Other Operating Expenses	8,394.53	19,709.04	274.88	5,485.13	879.02	2,800.17	882.04	14,111.55	68.20	2,716.38	36,013.85	1,671.48	3,368.50	2,719.96	814.01	6,083.43	105,992.17
56 Athletics Related Capital Expenditures	5,003.47																5,003.47
Grand Total	399,409.16	632,366.95	119,705.58	183,558.98	255,807.01	187,780.16	103,945.39	1,949,082.26	129,600.02	460,967.76	289,729.94	293,918.19	422,525.10	191,167.39	93,297.18	292,062.41	6,004,923.48
EXCESS	(8,966.55)	(18,105.16)	(4,046.25)	2,946.46	(4,031.16)	(5,317.21)	(6,045.60)	(68,691.65)	(1,196.25)	(1,392.00)	(12,568.99)	(475.00)	204.51	(19,092.08)	266.33	660.00	(145,850.60)
Positive																	

Positive

Positive

2022-2023 ANNUAL REPORT
Department of Intercollegiate Athletics

UMLS

Athletic Participation by Student Athletes

Men's Sports	Scholarship	Walk-On	Total	White	Black	Asian	Hispanic	American Indian	Native Hawaiian	Two or More	Other	Non-res. Alien
Baseball	27	20	47	42	1		2			2		
Basketball	15	1	16	4	11					1		
Cross Country	13	1	14	12			1					1
Golf	9	2	11	5								6
Soccer	20	5	25	19		1	1					4
Swimming	14	6	20	15						2		3
Tennis	5	4	9	1						1		7
Track and Field	0	11	11	9			1					1
Subtotal	103	50	153	107	12	1	5	0	0	6	0	22
Women's Sports	Scholarship	Walk-On	Total	White	Black	Asian	Hispanic	American Indian	Native Hawaiian	Two or More	Other	Non-res. Alien
Basketball	13	0	13	9	3					1		
Cross Country	9	4	13	9	4							
Golf	7	0	7	1		2						4
Soccer	25	9	24	24	2		1			4		2
Softball	17	0	17	17								
Swimming	17	7	24	16	1							7
Tennis	4	2	6									6
Track and Field	1	11	12	8	4							
Volleyball	16	0	16	14	1					1		
Subtotal	109	33	132	98	15	2	1	0	0	6	0	19
Grand Total	212	83	285	205	27	3	6	0	0	12	0	41

NOTE: Scholarship student-athletes include all students receiving athletic aid awards, including post-eligible and medical awards.

2022-2023 ANNUAL REPORT
Department of Intercollegiate Athletics

University of Missouri - St. Louis

Academic Success Rate

UMSL ONLY - Division II

2016-2027 Graduation Years

Men's Sports (indicate if not applicable--n/a)	ASR score	Fed Rate
Baseball	78	46
Basketball	65	57
Golf	83	78
Soccer	84	87
Swimming & Diving	69	55
Tennis	100	67
Women's Sports (indicate if not applicable--n/a)	ASR Score	Fed Rate
Basketball	81	25
Golf	100	100
Soccer	84	47
Softball	77	72
Swimming & Diving	86	70
Tennis	88	80
Volleyball	95	65

2022-2023 Annual Report
Department of Intercollegiate Athletics

UMSL

Grade Point Averages by Semester

	2019-2020		2020-2021		2021-2022		2022-2023		4-Year
Men's Sports	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Average
Baseball	2.944	3.386	3.391	3.264	3.257	3.145	3.267	3.104	3.220
Basketball	2.900	2.876	2.900	2.818	2.584	2.816	3.155	3.126	2.897
Golf	3.463	3.562	3.586	3.440	3.539	3.615	3.602	3.618	3.553
Soccer	2.960	2.836	3.000	3.130	2.974	3.105	3.124	3.321	3.056
Swimming	3.708	3.730	3.080	3.227	3.038	3.234	3.158	3.174	3.294
Tennis	2.993	3.081	3.588	3.705	3.820	3.488	3.519	3.414	3.451
Track and Field	n/a	n/a	3.444	3.304	3.484	2.877	2.984	3.418	3.374
Average	3.161	3.245	3.284	3.270	3.242	3.183	3.258	3.311	3.245

	2019 - 2020		2020-2021		2021-2022		2022-2023		4-Year
Women's Sports	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Average
Basketball	3.573	3.838	3.471	3.466	3.389	3.431	3.470	3.323	3.495
Golf	2.650	3.496	3.874	3.938	3.699	3.655	3.766	3.832	3.614
Soccer	3.533	3.427	3.430	3.341	3.457	3.293	3.435	3.471	3.423
Softball	3.657	3.819	3.657	3.552	3.488	3.456	3.793	3.520	3.618
Tennis	3.862	3.905	3.862	3.905	3.904	3.782	3.750	3.868	3.855
Track and Field	n/a	n/a	3.575	3.160	3.382	3.527	3.451	3.414	3.418
Swimming	3.630	3.692	3.503	3.458	3.594	3.493	3.542	3.650	3.570
Volleyball	3.600	3.598	3.800	3.699	3.538	3.777	3.697	3.575	3.661
Average	3.489	3.656	3.672	3.579	3.580	3.569	3.633	3.619	3.582

Overall Average	3.344	3.480	3.477	3.427	3.410	3.380	3.448	3.455	3.433
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NOTE: Scholarship student-athletes include all students receiving athletic aid awards, including post-eligible and medical awards.

2022-2023 ANNUAL REPORT
Department of Intercollegiate Athletics

UMSL

STUDENT-ATHLETE GRADUATION RATES (Freshman cohort)

Four-year average (federal IPEDS rate)	All Students	Student Athletes	Academic Success
2021 (2016-2017 freshman cohort)	62%	56%	82%
2020 (2015-2016 freshman cohort)	61%	68%	85%
2019 (2014-2015 freshman cohort)	52%	72%	83%
2018 (2013-2014 freshman cohort)	57%	64%	82%
2017 (2012-2013, freshman cohort)	55%	62%	83%

2022-2023 ANNUAL REPORT
Department of Intercollegiate Athletics

UMSL

Admission Exceptions

	Summer 2022	Fall 2022	Winter 2023	Total
Student-Athlete Admission Exceptions (<i># of individual exceptions</i>)	0	5	0	5
All Student Admission Exceptions (<i># of individual exceptions</i>)	1	108	5	114
Percent of Admissions Exceptions who are Student-Athletes	0.00%	4.63%	0.00%	4.39%

Intercollegiate Athletics Reports

2022-2023

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Report 1

University of Missouri-Columbia

October 27, 2023

Michael Williams
Board of Curators
Board of Curators Office
316 University Hall
Columbia, MO 65211

Dear Curator Williams,

This letter serves as the 2022-2023 annual athletics report required by CRR 270.060 (E). More specifically, this letter summarizes data provided per subparts of CRR 270.060 (E) (1) through (5).

1. Rates of admissions exceptions for Athletics as compared to campus admissions exceptions.

The University of Missouri does not currently admit students (student-athlete or otherwise) on academic probation for the following reasons and therefore has no exceptions to report for the 2022-2023 academic year.

All test-optional applicants are reviewed for admission under a comprehensive and holistic process taking into account successful completion of minimum core curriculum, high school performance, accelerated high school coursework, a writing sample and academic competitiveness of the high school. Pursuant to action taken by Undergraduate Deans in September 2020 effective for the 2021-22 academic year and thereafter, a student who would have been normally admitted conditionally may now be admitted fully without being placed on academic probation to begin their academic career at the University of Missouri.

2. Academic Progress Rates ("APR") by sport, as defined by the NCAA (National Collegiate Athletic Association), if applicable.

NCAA rules require each sport to have a four-year APR rate above 930 in order to avoid penalties. All Mizzou Athletics women's team APR rates were above 994 while all men's team APR rates were above 968. The Football team APR was 989, while the Men's Basketball team APR was 968. Complete APR details can be found in the attached annual athletics report (spreadsheet).

3. Graduation rates by sport, as defined by the NCAA if applicable.

There are two main metrics used to track student-athlete graduation rates, the Federal Graduation Rate ("FGR") and Graduation Success Rate ("GSR"). Both methods analyze the graduation rates from freshmen cohorts over a four-year period, beginning ten years prior. For example, the most recent 2022-2023 FGR and GSR rates are generated by looking at the freshmen cohorts from 2013-2014, 2014-2015, 2015-2016 and 2016-2017. The primary difference between the two metrics is that the FGR does not take into account transfers to or from any cohort, while the GSR does. For 2022-2023, the FGR was 65% and the GSR (four-year cohort) was 87%. The GSR for the Football team was 74%, while the Men's Basketball team was at 88%. Complete graduation rate details can be found in the attached annual athletics report (spreadsheet).

4. Financial performance of all operations of the Department of Intercollegiate Athletics.

The department had a \$18,990,057.00 overall budget deficit in 2022-23. More detailed information regarding the budget and financial picture can be found in the attached annual athletics report (spreadsheet).

5. Those items as the President may from time to time direct be added to the annual reports.

Introduction:

The Mizzou Athletics Department mission, vision and values were collectively established in the Fall of 2021. Adding to this, in 2022, we created, communicated and implemented our Mizzou Momentum strategic plan, identifying what success looks like and establishing a department scorecard. In 2023, we began operationalizing our strategic plan and continuing to develop our staff.

Strategic Plan:

Understanding where we have been is the start to determine where we want to go. We aim to be the modern model for intercollegiate athletics success and our path towards excellence requires that we regularly hold ourselves accountable. Mizzou Momentum was created in 2022-23 to serve as our road map – defining our mission, vision, core values and our strategic priorities for the future. As we look to the future, we will continue to invest in our coaches and staff, sustain a best-in-class NIL program, develop a facilities master plan and engage in a branding campaign.

Student-Athlete Academic Highlights:

Record academic success was achieved during the 2022-23 academic year. One-hundred and twenty-three student-athletes graduated in 2022-23, with 24 earning degrees in the Fall, 82 in the Spring and 17 in the summer semester. Three hundred and eleven student-athletes earned a 3.00 GPA or higher in Fall 2022 while 202 student-athletes earned a 3.00 GPA or higher in Spring 2023. While these totals account for approximately 60% of the total student-athlete population we look forward to increasing these numbers in the coming years.

University of Missouri student-athletes collectively had a record academic performance in Fall 2022 with an overall department GPA of 3.32 followed by another record-setting semester in Spring 2023 with a 3.35. Academically, 17 sports in the Fall and 17 sports in the Spring recorded team GPAs of 3.00 or better. A comprehensive list of sports that achieved a 3.0 or better team GPA is below.

- Fall – 17 (Baseball, Men's Basketball, Men's Golf, Men's Swimming, Men's Track, Wrestling, Men's Cross Country, Women's Basketball, Women's Golf, Gymnastics, Softball, Soccer, Women's Swimming, Tennis, Women's Track, Volleyball, Women's Cross Country)
- Spring – 17 (Baseball, Men's Basketball, Football, Men's Golf, Men's Swimming, Men's Track, Men's Cross Country, Women's Basketball, Women's Golf, Gymnastics, Softball, Soccer, Women's Swimming, Tennis, Women's Track, Volleyball, Women's Cross Country)

The 2022-23 academic year also brought 13 record team GPAs. Sports with record-setting team GPAs include:

- Fall – Baseball, Men's Basketball, Men's Golf, Men's Track and Field, Women's Basketball, Women's Golf, Softball, Soccer, Women's Swimming
- Spring (exempting Spring 2020 due to the campus satisfactory/unsatisfactory policy) – Baseball, Football, Gymnastics, Men's Basketball, Men's Cross Country, Men's Golf, Men's Track and Field, Soccer, Softball, Women's Basketball, Women's Cross Country

Institutionally, 434 student-athletes were recognized on their respective Dean's List at Mizzou, 232 in the Fall and 202 in the Spring.

Numerous Mizzou Athletics teams and individual student-athletes received national recognition for their academics in 2022-23. These national awards include:

- Three hundred and forty-eight student-athletes on the SEC Honor Roll. A more specific breakdown of those on the SEC Honor Roll can be found below.
 - Fall (Football, Soccer, Volleyball, Cross Country) – 98 student-athletes on the SEC Honor Roll
 - Winter (Men's Basketball, Women's Basketball, Gymnastics, Men's Swimming and Diving, Women's Swimming and Diving) - 61 student-athletes on the SEC Honor Roll
 - Spring (Baseball, Men's Golf, Women's Golf, Men's Track and Field, Women's Track and Field, Softball, Tennis) – 108 student-athletes on the SEC Honor Roll
 - First-year student-athletes – 81 student-athletes on the SEC Honor Roll
- Eleven wrestling student-athletes on the Big 12 Honor Roll.
- The Men's and Women's Cross Country teams received the 2022 NCAA Division-I All-Academic Team honors.
- The Men's and Women's Track and Field teams received the 2022 USTFCCCA All-Academic team honor and 16 individual Track and Field athletes earned All-Academic Individual Recognition: Christopher Conrad, Rece Rowan, Mitchell Small, Valentina Barrios Bornacelli, Skylar Ciccolini, Claudina Diaz, Arianna Fisher, Mara Haeusler, Kaia Harris, Atina Kamasi, Sydney Oberdiek, Emily Offenheiser, Sophia Rivera Hassemer, Kelsey Schweizer, Isabella Sokolova, and Erin Zimmerman.
- Fourteen members of the Wrestling team were named to the Academic All-Big 12 Team. First Team: Noah Surtin, Logan Gioffre, Peyton Mocco, Allan Art, Jesse Cassatt, Rocky Elam, Keegan O'Toole, Ellis Pflieger, Nate Pulliam, Connor Brown, and Jarrett Jacques. Second Team: Zack Elam, Mitchell Bohlken, and Seth Nitzel.
- Seven members of the Wrestling team were named NWCA Division I Scholar All-Americans: Noah Surtin, Allan Hart, Jarrett Jacques, Keegan O'Toole, Peyton Mocco, and Rocky Elam.
- Thirty members of the Men's and Women's Swimming and Diving teams were selected to the 2021-2022 CSCAA Scholar All-America Team. First Team: Grant Bochenski, Jack Dahlgren, Will Goodwin, Kevin Hammer, Carlo Lopez, Ben Patton, Clement Secchi, Eric Storms, Calvin Windle, Katrina Brathwaite, Molly Gowans, Malin Grosse, Alex Moderski, Meredith Rees, Sierra Smith, and Taylor Williams. Second Team: Sam Brown, Will Gallagher, Mikolaj Malec, Frederik Rindshoej, Paul Shutt, Sydney Bales, Karolina Bank, Holley Dennis, Amy Feddersen, Ashely Gill, Grace Hanson, Sarah Rousseau, Paige Striley, and Kayla Wilson. Both teams were also awarded team honors for both the Fall 2022 and Spring 2023 semesters.
- Keegan O'Toole (Wrestling) was named a Second Team 2023 CoSIDA Academic All-American. Alex Honnold (Softball) was named a Third Team 2023 CoSIDA Academic All-American.
- Fourteen members of the Softball team were recognized as Easton/NFCA All-America Scholar-Athletes: Katie Chester, Kendal Cook, Kara Daly, Maddie Gallagher, Cierra Harrison, Vanessa Hollingsworth, Alex Honnold, Jayci Kruse, Addie Lange, Kayley Lenger, Hannah McGivern, Megan Moll, Emma Nichols, and Megan Schumacher.

In an effort to maximize our student-athletes' academic success in 2022-23, approximately 14,000 student-athlete tutoring appointments were scheduled to aid student-athletes in understanding their course material, and approximately 6,000 mentoring appointments were scheduled to enhance student-athletes' study skills and assist with time management. We look forward to continuing to provide excellent academic services, building on these numbers and setting records in the classroom.

Holistic Student-Athlete Development:

Assessment: Surveys from Spring 2022 influenced our focuses for the summer, 2022 planning and fall/spring implementation. Five areas were identified as opportunities for growth by our student-athletes, followed by our 2023 actions to address.

- i. **Facilities:** In 2022 we performed a preliminary needs assessment, and a more intensive structural study was performed in Spring 2023. Further, we are working collaboratively with our Curators, campus colleagues, coaches, student-athletes and donors on short- and longer-term facilities planning so that all of our student-athletes have safe and user-friendly facilities.
- ii. **Mental Health:** We have continued to assess this area for efficacy. In 2022-23 we hired three new counselors and implemented a partnership with the School of Social Work. During the summer of 2023 we added a licensed social worker to our team as well as replacing our post-doctoral intern to bring our staffing level to four total mental health professionals. During the fall 2022 term, we provided education as part of our Mental Health week. Additionally, during the fall and spring semesters, we provided mid-term and finals week mental health programming to help our student-athletes reduce anxiety and teach mindfulness techniques.
- iii. **Connectivity:** This was made a priority, and several new department-wide initiatives were implemented, including a Welcome Back barbecue, team dinners, career seminars, and a Spring Olympics. Additionally, we hosted the 2022-23 Roars Awards Ceremony for all student-athletes and hosted two belonging events, one in November and another in February at the South End Zone facility.
- iv. **Nutrition:** We hired a second nutritionist and enhanced the nutritional budget which has been noted as “exceeding expectations” on a recent survey. We recently budgeted for an additional nutritionist in football who officially started on July 1, 2023. Our student-athlete experience survey showed a 10% increase in satisfaction ratings compared to last year due to enhanced staffing and resources in this area.
- v. **Training Table:** We set clear expectations, provided feedback loops and enhanced the training table budgets resulting in an “exceeding expectations” on a recent survey. This area is a great opportunity for connectivity, and as we evaluate facilities, a training table that serves all student-athletes can be a differentiator and great advantage. This is an area of continual growth for our department. This year, our culinary team hosted cooking demos for student-athletes in collaboration with the RD department on campus. This summer, we added a chef to our team as well as a new smoothie machine. These two investments will help support our student-athletes' nutritional needs. Long-term, we would like one centrally located training table and sports science center where all student-athletes fuel and connect.

Academics: Please find a separate section on student-athlete academic achievements above.

Strength and Conditioning: This area is critical for our success. While our student-athlete and coaches' surveys rate this area as “exceeding expectations,” this spring, we began an assessment of this area to ensure maximum efficacy. As a result, we converted a part-time staff position into a full-time role to further strengthen this area.

Sports Medicine: We restructured this unit with a model that consists of a Director of Olympic Sports Medicine and a Director of Football Sports Medicine. This reporting structure is consistent with other sports medicine units in the SEC and will allow for enhanced day-to-day support of our Olympic sport programs while allowing our Head Football ATC to move into a director role. Our Head Football ATC will have direct oversight of all aspects related to football sports medicine.

Career Placement: We expect that 100% of our student-athletes secure either full-time employment or continue their education following completion of their degree at Mizzou. We achieved this goal in Fall 2022. Every graduate had secured either full-time employment or continued their education. In addition, 100% of our spring 2023 graduates have secured a successful career placement. Enhancing individualized career planning for our student-athletes remains a focus, and we see this service as a point of differentiation among our peers.

Student-Athlete Programming: We are continuing to refine this area. We recently launched a Mizzou letterwinners mentoring program and created micro-internships for our student-athletes in Columbia, St. Louis, Jefferson City, and Kansas City during spring break that allows them to acquire real-world experiences in these communities. We will continue to enhance this area to be the model in our conference. We successfully hosted a Career Fair in April 2023 that allowed our student-athletes to network with over 40 businesses, hear from former student-athletes and gain experiential learning opportunities through practicing their elevator pitches and speed networking with local businesses. This summer we hosted an experiential learning opportunity for student-athletes in St. Louis where they will be able to job shadow individuals.

The 2022-23 individual honors and achievements include:

- Arianna Fisher (Women's Track & Field) and Jarrett Jacques (Wrestling) were both finalists for the SEC Boyd McWhorter Postgraduate Scholarship earning \$10,000 postgraduate scholarships.
- Amy Feddersen (Women's Swim & Dive) and Will Goodwin (Men's Swim & Dive) were both finalists for the SEC Brad Davis Community Service Award earning \$5,000 postgraduate scholarships.
- Haley Troup (Women's Basketball) was selected to participate in the NCAA's inaugural Above the Rim Program at the 2023 Women's Final Four, meeting with top leaders in the industry.
- Darius Robinson (Football) represented the University of Missouri at the SEC Football Leadership Council in Birmingham, Alabama, in February and June.
- Jude Dierker (Men's Swimming and Diving), Grace Pettet (Women's Soccer), Romary Cardenas Rifka (Women's Tennis), and Peyton Mocco (Men's Wrestling) represented the University of Missouri at SEC SAAC in Birmingham, Alabama, in February and June.
- Nick Honor (Men's Basketball) and Hayley Frank (Women's Basketball) represented the University of Missouri at the SEC Basketball Leadership Council in Birmingham, Alabama, in June.
- Jude Dierker (Men's Swimming and Diving) was named Vice Chair of SEC SAAC and attended the SEC meetings in Destin, Florida.
- Kobe Brown (Men's Basketball) was a semifinalist for the Arthur Ashe Junior Sports Scholar Award.
- Kobe Brown (Men's Basketball) and Megan Moll (Softball) won the MU Letter Winners Club Award.
- Kobe Brown (Men's Basketball - Winner), Caroline Lyman (Soccer), Jarrett Jacques (Wrestling), Arianna Fisher (Women's Track and Field), and Jack Dahlgren (Men's Swimming and Diving) were all honored with the AD Leadership Award Scholarships.
- Atina Kamasi (Javelin) and Mikayla Reed (Distance) of Women's Track and Field both were accepted into the Career in Sports Forum NCAA Programming in June. Only 200 student-athletes across all levels of the NCAA are accepted into this program.
- Marc Poland (Men's Track and Field) participated in the SEC Student-Athlete Volunteer Program for SEC Media Day in July 2022 and for the Women's Basketball SEC Tournament at the end of February 2023.
- Isabella Alessio (Women's Soccer) and Mitchell Small (Men's Track and Field) were selected to participate in the 2022 SEC Career Tour hosted in Atlanta, Georgia.

Name, Image and Likeness:

Amended Missouri Law: To best assist our coaches and to gain a competitive advantage, we worked collaboratively with our governmental affairs and general counsel colleagues and legislators to create a cutting-edge approach to NIL benefiting our students and providing coaches with a competitive advantage.

Innovative Partnerships: To become a national leader in Name, Image, and Likeness (“NIL”) the Athletics Department developed a variety of new and innovative partnerships during 2022-23, most notably with the St. Louis Sports Commission, resulting in *Mizzou to the Lou*. We partnered with the BrandR Group, a national group licensing company, which provides additional and enhanced opportunities for our student-athletes. In 2023, we hired a marketing agency to help with the promotion of our Tiger Scholarship Fund.

Enhanced Education: To support our student-athletes’ NIL pursuits we have continued to equip them with new and innovative educational opportunities. Each month student-athletes have an opportunity to attend, either in-person or virtually, NIL education sessions. Recent topical areas include taxes, financial planning, contracts, and personal branding. Likewise, through a partnership with the university’s Office of Financial Success, our student-athletes have an opportunity to utilize the university’s Tax Lab to assist with their tax filings. In addition, in collaboration with the School of Journalism we created an NIL course for student-athletes that began in the Fall of 2023. Lastly, we hosted an NIL educational event that focused on financial literacy and changes to the Missouri state law in conjunction with our third-party marketing agency.

Diversity, Equity, Inclusion and Belonging:

The University of Missouri Department of Athletics strives to create a diverse and inclusive workplace and athletic department. During the 2022-2023 school year we restructured our affinity groups to provide enhanced leadership opportunities for our student-athletes.

- **Affinity Groups:** The following groups continued to meet monthly to be educated, bring awareness to societal concerns, and celebrate differences: Student-Athletes Fostering Equality (SAFE), Black Student-Athlete Association (BSAA), and Female Athletic Minorities at Mizzou (FAMM).
- **Black Student-Athlete Summit:** Student-athletes (11) and staff (6) attended the Black Student-Athlete Summit hosted by UCLA in May 2023. This Summit is a three-day conference that focuses on the holistic development of the Black student-athlete and empowers them to maximize their college experience while also providing them with career networking opportunities.
- **Mentoring Program:** Mizzou Athletics has a strong focus on belonging. One way we promote belonging is through our new staff mentorship program. The program was designed to assist with onboarding, encourage professional and personal growth, develop leaders and build a trusting network that can foster employee engagement.
- **SEC Meetings:** Continued participation in monthly SEC Diversity, Equity, and Inclusion meetings. This participation helped us increase our networking resources, and it also kept us up-to-date and ready to assist with conference-wide initiatives.

Compliance and Rules Education Enhancements:

- **Building the Compliance Team:** This year, we hired a new staff and transitioned compliance responsibilities within the team. The result has been enhanced communications and coordination of duties. We now have six full-time staff members in compliance with two new staff members starting this summer.
- **Commitment to Education:** Because institutional control requires a robust education program, we have tracked our education efforts since July 1, 2022, to ensure timely and proper education of staff, student-athletes, and donors. In 2022-23, we have provided over 1,131 education touchpoints to coaches, staff, student-athletes, and donors (**Note:** Education touchpoints include every compliance education meeting, email, text message, phone conversation, etc., that was provided by the compliance office).
- **Implementation of External Compliance Audit Recommendations:** Based on the twenty-seven compliance audit recommendations provided by Bond, Schoeneck & King PLLC (“BSK”) last academic year, we have implemented changes to our systems and processes. To date, we have implemented more

than twenty of those audit recommendations including the creation of a dotted report line from the Sr. Associate AD for Compliance to the University President, and an increase of monthly monitoring efforts of each sport. Note: We have reviewed the implementation of those recommendations and begun operationally revising those efforts considering anticipated legislative changes for the 2023-24 academic year.

Outreach and Engagement:

After a review of our season ticket numbers and fan survey data, we began work of engaging the state of Missouri and our season ticket base. We recognize the importance of community outreach and engagement at Mizzou and systematically took part in grassroots efforts that led to record high attendance in 2022-23:

- **Football Attendance:** We achieved an average football attendance of 54,525, a 17.2% increase year over year in 2022. This was the highest increase in the SEC.
- **Student Football Attendance:** We averaged 6,488 students per football game and are up 121% in student attendance across all sports.
- **Men's Basketball Attendance:** We led the country in attendance growth with an increase of 63%.
- **Attendance Highlights:** Our total attendance increases were led by seven Men's Basketball sellouts as well as new single-game attendance records for Gymnastics, Wrestling, Softball and Baseball. Both the Baseball and Softball programs set single-season home attendance records.
-

Athletic Highlights:

Mizzou Athletics made remarkable progress on the field of play in 2022-23 and climbed seven spots to No. 50 in the Learfield Directors' Cup standings. Mizzou Athletics' athletic highlights are as follows:

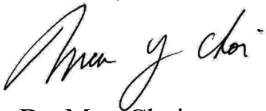
- Wrestler Keegan O'Toole captured his second straight NCAA championship in the 165-pound weight class and helped lead the wrestling program to a 12th consecutive conference championship. The Tigers won the Big 12 Conference Championship for the second straight year and finished fifth at the NCAA Championships with five wrestlers earning All-American honors.
- Under first-year coach Dennis Gates, Men's Basketball enjoyed a breakthrough season, winning 25 games with a fourth-place finish in the SEC. Behind All-SEC senior forward Kobe Brown, the conference's Scholar Athlete of the Year, the Tigers earned a first-round bye in the SEC Tournament for the first time in program history then won their first game in the NCAA Tournament in 13 years, beating Utah State to reach the second round in Sacramento, California. The Tigers saw a 63-percent increase in attendance at Mizzou Arena and sold out seven home games. After the season, Brown became the program's first first-round NBA draft selection since 2018, going to the Los Angeles Clippers with the No. 30 overall pick.
- Football reached bowl eligibility for the third year in a row, all coming under head coach Eliah Drinkwitz. The Tigers went 5-2 at Faurot Field in 2022, only falling to Georgia, the eventual national champion, and Kentucky. The program's average attendance reached 54,525, a 17-percent increase from 2021 and the program's highest since 2015. That attendance increase led the SEC. After the season, All-SEC defensive end Isaiah McGuire was chosen by the Cleveland Browns in the fourth round of the 2023 NFL Draft.
- Seven Mizzou teams overall qualified for postseason play: Men's and Women's Basketball, Football, Men's Golf, Gymnastics, Softball and Wrestling. Mizzou's Swimming and Diving teams and Track and Field Teams both sent individuals to NCAA competition.
- Three individuals captured conference championships, led by Roberto Vilches, who swept the high jump titles at both the SEC Indoor and Outdoor Championships. Gymnast Jocelyn Moore won the vault title at

the SEC Championships, while wrestler Rocky Elam earned an individual title at the Big 12 Championships.

- Mizzou featured 19 individual All-American performers across its sports programs: seven student-athletes in Track and Field, five in Wrestling, three in Gymnastics, one in Softball and three in Swimming and Diving plus three Swimming relay teams.
- Gates was one of Mizzou's three first-year head coaches for the 2022-23 year, along with Caroline Westrup (Women's Golf) and Bianca Turati (Tennis), who took over as interim coach midway through the season then was promoted to head coach in May. Three more new coaches joined Mizzou for the 2023-24 year: Dawn Sullivan (Volleyball), Kerrick Jackson (Baseball) and Glen Millican (Men's Golf.) Jackson, hired in June as the baseball program's 15th head coach, is a St. Louis native who came to Mizzou after one season as the head coach at Memphis. He was a Mizzou assistant from 2011-15. Sullivan, an All-American player at Kansas State, came to Mizzou after five years as the head coach at Nevada-Las Vegas. Prior to Mizzou, Millican was the head coach at New Mexico for 22 years and won eight conference championships.
- The Mizzou Intercollegiate Athletics Hall of Fame added a six-member class in September: Nick Adcock (Track and Field), Justin Gage (Football, Basketball), Drake Houdashelt (Wrestling), Tim Jamieson (Baseball), Karissa Schweizer (Cross Country/Track and Field) and Fabian Schwingenschlögl (Swimming and Diving).

We are hopeful that this information is helpful to you and to the Board of Curators. Please feel free to contact me for any additional questions you may have.

Sincerely,



Dr. Mun Choi
President and Chancellor
University of Missouri

Enclosures:

Annual Athletic Department Report 2022-23- Missouri – Columbia

Cc: Desiree Reed-Francois, MU Director of Intercollegiate Athletics

Report 2

**Missouri University
of
Science and Technology**

October 30, 2023

Mun Y. Choi, Ph.D.
President
University of Missouri System
105 Jesse Hall
Columbia, MO 65211

Dear President Choi:

This letter serves as the 2022-23 annual Athletics report required by CRR 270.060 (E). More specifically, this letter summarizes data provided per subparts of CRR 270.060 (E) (1) through (5).

1. Rates of admissions exceptions for Athletics as compared to campus admissions exceptions.
 - Admissions for student-athletes are handled in the same manner as the general student body. Athletics does not request admission exceptions. There were six admission exceptions for student-athletes as compared to 165 for the general student body. Student-athletes represented 3.64% of the total student body with admissions exceptions.
2. Academic progress rates by sport, as defined by the NCAA if applicable.
 - NCAA Division II does not have Academic Progress Rates.
 - NCAA Division II does have a different measure, Academic Success Rates, which are included on the attached report showing an 78% academic success rate for student- athletes.
3. Graduation rates by sport, as defined by the NCAA if applicable.
 - Graduation rates for student-athletes continue to be significantly higher than the general student body. For the 2016 cohort, student-athletes were at 72% graduation rate while the general student body was at 65%.
 - See attached report for disaggregated graduation rates data by sport.
4. Financial performance of all operations of the Department of Intercollegiate Athletics.
 - Direct institutional support increased by \$472,258, student activity fee increased by \$170,971, and contributions increased by \$155,721. However, expenses increased by 1,188.867. Although there was an increase in revenue, the athletic department ended the year with an anticipated deficit

due to increased travel expenses -- especially bus, hotel, and insurance premium costs. This deficit was covered by the remaining balance retained in 2021-22.

- The following financial support was secured in athletics in 2022-23
 - \$318,621 was secured in contributions, an increase of \$155,721 from 2021-22
 - \$247,434 was secured in endowments and investment income
 - \$92,474 was fundraised by athletic teams
 - \$70,491 was earned through athletic camps
 - And, a total of \$78,217 was secured through sponsorships, ticket sales, concessions, and parking.

5. Those items as the President may from time to time direct be added to the annual reports.

ACADEMIC HONORS

- 269 Academic All-GLVC Honorees {3.3 GPA+}
- 72 GLVC Brother Gaffney Distinguished Scholar Award (4.0 GPA)
- 48 GLVC Council of President Academic Excellence Award {3.5+ and exhausted eligibility}
- 13 GLVC Team Academic Awards (Team GPA 3.3+)
- 38 CoSIDA Academic All-District Selections
- 5 CoSIDA Academic All-America Selections

ATHLETIC HONORS

- 8th place finish in men's golf at the NCAA II Championships
- 2 Great Lakes Valley Conference (GLVC) Team Championship in Men's Indoor & Outdoor Track & Field
- 72 GLVC All-Conference Student-Athletes
- 23 GLVC Player of the Week Selections
- 12 GLVC Individual Champion Student-Athletes
- 3 GLVC Freshman of the Year
- 4 GLVC Players of the Year
- 18 Individual NCAA Championship Appearances
- 16 NCAA All-America Honorees

Sincerely,



Mo. Dehghani, Ph.D.
Chancellor

MMD:chg

Report 3

University of Missouri- Kansas City



Office of the Chancellor

August 18, 2023

Mun Y. Choi, Ph.D.
President
University of Missouri System
321 University Hall
Columbia, MO 65211

Dear Dr. Choi,

This letter serves as a brief summary of the 2022-23 data provided in the annual athletics report required by CCR 270.060 (E). More specifically, this letter summarizes data provided per subparts (a) through (E) of CCR 270.060 (E).

- a. Rates of admissions exceptions for Athletics as compared to campus admissions exceptions.

There were 679 student admissions exceptions made, 14 of which were made for student-athletes.

- b. Academic Progress Rates (APR) by sport, as defined by the NCAA, if applicable.

The NCAA's APR is a measurement of eligibility and retention. As determined by the NCAA all varsity teams are evaluated and need to meet the minimum multi-year threshold score of 930. The maximum score a team can achieve is 1000. The APR score is a four-year average.

The majority of Kansas City Athletics teams scored above 950. Men's basketball scored 938, because of a coaching change and the new NCAA Transfer Portal and is being monitored closely. Women's basketball and volleyball remained high at 985. Women's soccer scored 995, ranked in the top half of the conference. Women's tennis scored 991, and Women's cross country 992. Complete APR details can be found in the attached annual athletics report (spreadsheet).

- c. Graduation Success Rate (GSR) by sport, as defined by the NCAA if applicable.

There are two main metrics used to track student-athlete graduation rates, the Federal Graduation Rate (FGR) and the Graduation Success Rate (GSR). Both methods analyze the percentage of students who complete a BA/BS within a six-year time frame. The FGR counts all transfers as academic failures, however the GSR calculation allows for transfers in and out. In the GSR calculation, student-athletes who depart a school while in good academic standing (meeting the NCAA's Progress Towards Degree standards) are passed from one school's cohort to another school's cohort.

For 2022-23 Kansas City's GSR was 95%, above the NCAA average of 89%. The federal rate was 69% for student-athletes and 55% for UMKC students. The GSR for men's basketball was 100%, while women's basketball scored 100%. Four of Kansas City's teams scored 100%, and 14/14 team were at 80% and higher. Complete GSR details can be found in the attached annual athletics report (spreadsheet).

- d. Financial performances of all operations of the Department of Intercollegiate Athletics.

The department had a total expense sum of \$15,225,069 for Fiscal Year 2023. The department finished the fiscal year with a positive change in net assets of \$452,443. The department reached its revenue goals in the areas of ticket sales of \$130,966. In the area of sponsorships, the department also met its goals of \$518,472. Gift revenue reached \$744,898. More detailed information regarding the budget and financial picture can be found in the attached annual athletics report.

- e. Those items as the President may from time to time direct be added to the annual reports.

Academic Highlights:

Kansas City Athletics continues to produce strong results in the classroom. The cumulative GPA for student-athletes rose to 3.36 after the spring semester, with 12 of 14 teams achieving a GPA above 3.0. Leading the way in GPA was women's tennis at 3.65, followed closely by men's golf at 3.64, and women's soccer at 3.63. The Graduation Success Rate also continued to climb, reaching 95%.

Leadership Highlights:

Dr. Martin hired several new coaches including Men's Basketball Head Coach, Marvin Menzies. Coach Menzies has a wealth of experience, including 5 NCAA tournament appearances. He served as the head coach at UNLV, and New Mexico State before taking on the role in Kansas City. Martin also hired Dionnah Jackson-Durrett as Kansas City's new Head Women's Basketball coach. Jackson-Durrett came to Kansas City after time as a top assistant at both Texas and Mississippi State. During her playing career at Oklahoma, she was named a finalist for the Wade and Naismith National Player of the Year.

Outside of Basketball, Martin signed Head Men's Soccer Coach, Ryan Pore, to a three-year extension. Ryan has reinvigorated the winning ways of the program and secured many local recruits, drawing attention from the local fan base. Martin also renewed the contract of Head Men's Golf Coach, JW Vandeborn. Vandeborn continues to win championships for the golf program and advance his team onto the NCAA Tournament.

Athletic Highlights:

Competitively Kansas City Athletics performed well. Men's golf, under the leadership of JW Vandenberg, won the Summit League Championship. Our men's soccer program, led by Ryan Pore, advanced to the Summit League Championship match for the first time in several years. Men's soccer is poised this coming year to perform well on the field, playing several competitive matches against Tulsa, Creighton, and Drake. Under first year Head Coach, Dionnah Jackson-Durrett, the women's basketball program made a run in the Summit League tournament to the Quarter Finals. Additionally, women's tennis claimed second place in the regular season, with Laura Munoz-Baroja being named Scholar of the Championship by the Summit League.

Newcomer Successes:

- E'Lease Stafford (WBB) - Newcomer of the Year
- Lucas Dutartre (Golf) - Newcomer of the Year
- RayQuawndis Mitchell (MBB) - All-Newcomer Team
- Christian Koffi (MSOC) - All-Newcomer Team
- Madison Page (WSOC) - All-Newcomer Team
- Madelyn Muhr (WSOC) - All-Newcomer Team
- Kimora Whetstone (VB) - All-Freshman Team

We are hopeful that this information is helpful to you and to the Board of Curators. Please feel free to contact me for any additional questions you may have.

Sincerely,



C. Mauli Agrawal, Ph.D.
Chancellor

Enclosures:

Annual Athletic Department Report 2022-23 – Kansas City

Appendices

Intercollegiate Athletics Additional Information

2022-2023

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Appendix A

University of Missouri-Columbia

1. List of Sports
2. Budget
3. Student Data
 - a. Participation
 - b. Academic Progress
 - c. GPA
 - d. Graduation Rates
 - e. Admission Exceptions

2022-23 ANNUAL REPORT
Department of Intercollegiate Athletics
University of Missouri - Columbia
List of Sponsored Sports

Men's Sports

- ☒ Baseball
- ☒ Basketball
- ☒ Cross Country
- ☒ Football
- ☒ Golf
- ☒ Indoor Track & Field
- ☒ Outdoor Track & Field
- ☐ Rifle
- ☐ Soccer
- ☒ Swimming & Diving
- ☒ Wrestling

Women's Sports

- ☒ Basketball
- ☒ Cross Country
- ☒ Golf
- ☒ Gymnastics
- ☒ Indoor Track & Field
- ☒ Outdoor Track & Field
- ☐ Rifle
- ☒ Soccer
- ☒ Softball
- ☒ Swimming & Diving
- ☒ Tennis
- ☒ Volleyball

2022-23 Annual Report
Department of Intercollegiate Athletics
University of Missouri - Columbia
FY2023 Actuals

Revenues:	Football	Men's Basketball	Women's Basketball	Other Sports	Non-Program Specific	Operating Total	Capital Projects	Total
Ticket Sales	10,385,202	4,546,050	169,914	389,404	1,471,095	16,961,664	-	16,961,664
Guarantees	-	63,341	6,000	17,000	-	86,341	-	86,341
Contributions	5,671,234	1,249,063	248,284	713,464	10,959,905	18,841,950	9,265,722	28,107,672
Direct Institutional Support	-	-	-	-	22,798,730	22,798,730	-	22,798,730
Indirect Facilities and Administrative Support	685,275	194,417	-	-	-	879,691	-	879,691
NCAA/Conference Distributions incl. All Tournament Revenues	11,420,731	3,316,212	-	-	1,093,417	15,830,360	-	15,830,360
Broadcast, Television, Radio, and Internet Rights	15,715,000	4,255,307	-	-	17,549,300	37,519,607	-	37,519,607
Program Sales, Concessions, Novelty Sales, and Parking	1,905,531	707,085	78,535	140,568	401,328	3,233,046	-	3,233,046
Royalties, Advertisements, and Sponsorships	-	-	-	-	8,437,186	8,437,186	-	8,437,186
Endowment and Investment Income	-	-	-	-	1,361,755	1,361,755	19,340	1,381,095
Other Revenues	280,517	520,817	88,267	2,442,166	2,991,128	6,322,895	-	6,322,895
Total Revenues	46,063,488	14,852,293	590,999	3,702,602	67,063,844	132,273,226	9,285,062	141,558,289

Expenses:	Football	Men's Basketball	Women's Basketball	Other Sports	Non-Program Specific	Operating Total	Capital Projects	Total
Athletics Student Aid	4,081,547	623,887	629,085	7,225,544	200,674	12,760,737	-	12,760,737
Guarantees	3,610,189	692,481	134,498	156,911	-	4,594,079	-	4,594,079
Coaching Salaries, Benefits, & Bonuses Paid by the University	12,711,841	4,518,056	1,433,797	7,069,582	-	25,733,276	-	25,733,276
Support Salaries Paid by the University	4,643,584	845,723	415,151	1,258,941	19,060,069	26,223,469	-	26,223,469
Recruiting	1,204,075	557,333	134,470	588,396	-	2,484,274	-	2,484,274
Team Travel	1,090,862	1,648,823	925,887	4,083,715	173,088	7,922,375	-	7,922,375
Equipment, Uniforms, and Supplies	2,281,815	374,074	71,237	1,176,067	-	3,903,193	670,653	4,573,846
Game Expenses	1,383,721	582,249	272,099	482,513	1,659,815	4,380,397	-	4,380,397
Fundraising, Marketing, and Promotion	5,269	8,453	2,642	2,366	1,492,583	1,511,312	-	1,511,312
Direct Facilities, Maintenance, and Rental	457,790	138,185	30,951	418,887	20,055,986	21,101,799	26,529,630	47,631,429
Spirit Groups	-	-	-	-	464,290	464,290	-	464,290
Indirect Facilities and Administrative Support	685,275	194,417	-	-	-	879,691	-	879,691
Medical Expense and Medical Insurance	114,183	8,000	-	-	1,240,384	1,362,566	-	1,362,566
Membership and Dues	6,355	13,717	5,393	95,670	126,041	247,176	-	247,176
Other Operating Expenses	4,288,844	3,972,877	286,247	3,421,646	6,734,978	18,704,592	1,074,837	19,779,429
Total Expenses	36,565,350	14,178,273	4,341,457	25,980,238	51,207,908	132,273,226	28,275,120	160,548,345
Excess (Deficiency of Revenues over Expenses)	9,498,138	674,020	(3,750,457)	(22,277,636)	15,855,936	1	(18,990,057)	(18,990,057)

Net Assets	6/30/2023	6/30/2022
Unrestricted	5,666,079.71	5,714,899.24
Restricted Expendable	(16,736,583.35)	2,204,654.49
Restricted Non-expendable	41,628,376.48	41,263,879.79
TOTAL	30,557,872.84	49,183,433.52

2022-23 ANNUAL REPORT
Department of Intercollegiate Athletics
University of Missouri - Columbia
Athletic Participation by Student Athletes

Men's Sports (indicate if not applicable--n/a)	Scholarship	Walk-On	Total
Baseball	27	17	44
Basketball	14	2	16
Football	110	36	146
Golf	8	0	8
Rifle	0	0	0
Soccer	0	0	0
Swimming & Diving	30	2	32
Track & Field/Cross Country	19	31	50
Wrestling	30	12	42
Subtotal	238	100	338

Women's Sports (indicate if not applicable--n/a)	Scholarship	Walk-On	Total
Basketball	13	0	13
Gymnastics	14	10	24
Golf	8	5	13
Rifle	0	0	0
Soccer	34	2	36
Softball	22	4	26
Swimming & Diving	30	1	31
Tennis	8	2	10
Track & Field/Cross Country	34	15	49
Volleyball	16	0	16
Subtotal	179	39	218

Grand Total	417	139	556
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NOTE: Scholarship student-athletes include all students receiving athletic aid awards, including post-eligible and medical awards.

2022-23 ANNUAL REPORT
Department of Intercollegiate Athletics

University of Missouri - Columbia

**Academic Progress Rate by Sport and
Respective Sport Ranking within the Southeastern Conference**

Men's Sports (indicate if not applicable--n/a)	APR Score	Ranking*
Baseball	977	
Basketball	968	
Cross Country	989	
Football	989	
Golf	983	
Outdoor Track & Field	991	
Swimming & Diving	987	
Wrestling	987	

Women's Sports (indicate if not applicable--n/a)	APR Score	Ranking*
Basketball	1000	
Cross Country	1000	
Golf	1000	
Gymnastics	995	
Outdoor Track & Field	996	
Soccer	996	
Softball	1000	
Swimming & Diving	994	
Tennis	1000	
Volleyball	1000	

APR Score based upon multi-year rate including the 2018-19, 2019-20, 2020-21, 2021-22 academic years.

*APR Data for 2019-20 and 2020-21 is not publicly released in response to the COVID-19 pandemic and its impact on intercollegiate athletics.

2022-2023 ANNUAL REPORT
Department of Intercollegiate Athletics
University of Missouri - Columbia
Grade Point Averages by Semester

	2010-2011		2011-2012		2012-2013		2013-2014		2014-2015		2015-2016		2016-2017		2017-2018		2018-2019		2019-2020		2020-2021		2021-2022		2022-2023	
Men's Sports	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Baseball	2.99	2.87	3.08	3.06	3.05	2.94	2.96	2.76	2.47	2.62	2.86	2.56	2.90	2.52	2.98	2.94	3.13	2.95	3.03	3.36	3.14	3.03	3.11	3.06	3.33	3.12
Basketball	2.55	2.42	2.74	2.47	3.06	2.45	2.46	2.30	2.31	2.37	2.29	2.20	2.61	2.70	2.50	2.46	2.69	2.73	2.62	2.89	2.63	2.49	2.99	2.52	3.47	3.00
Football	2.48	2.64	2.65	2.64	2.62	2.59	2.41	2.57	2.58	2.55	2.69	2.52	2.48	2.34	2.48	2.62	2.90	2.87	2.97	3.12	2.79	2.91	2.83	2.94	2.95	3.08
Golf	3.41	3.53	3.48	3.42	3.32	3.23	3.46	3.43	3.08	3.31	3.38	3.07	3.47	3.40	3.41	3.26	3.38	3.38	3.45	3.64	2.89	3.01	3.15	3.16	3.56	3.48
Swimming & Diving	2.91	2.94	2.74	2.93	2.93	2.89	2.84	2.97	2.95	3.14	3.24	3.09	3.18	3.18	3.21	3.05	3.19	3.20	3.22	3.64	3.40	3.32	3.25	3.07	3.24	3.29
Track & Field/Cross Country																										
Cross Country	3.29	3.27	3.33	3.38	2.93	3.05	3.01	2.93	3.07	3.07	3.09	3.27	3.43	3.34	2.92	3.27	3.02	3.05	2.83	3.60	3.22	3.38	3.19	2.95	3.18	3.45
Track	3.06	3.12	3.27	3.27	2.97	3.04	2.84	2.88	2.81	2.89	2.99	3.18	3.11	3.16	2.81	2.80	2.90	2.91	2.84	3.33	3.08	3.05	3.11	2.95	3.23	3.41
Wrestling	2.81	2.95	2.91	2.60	3.02	2.91	2.79	2.64	2.68	2.63	2.80	2.78	2.67	2.62	2.89	2.87	2.89	2.79	2.80	3.16	3.14	3.17	3.03	3.14	3.11	2.98
Subtotal	2.94	2.97	3.03	2.97	2.99	2.89	2.85	2.81	2.74	2.82	2.92	2.83	2.98	2.91	2.90	2.91	3.01	2.99	2.97	3.34	2.99	3.01	3.01	2.99	3.14	3.16

	2010-2011		2011-2012		2012-2013		2013-2014		2014-2015		2015-2016		2016-2017		2017-2018		2018-2019		2019-2020		2020-2021		2021-2022		2022-2023	
Women's Sports	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Basketball	3.00	2.91	3.03	3.01	3.13	3.04	2.99	3.12	2.89	2.86	3.17	3.31	3.29	3.28	3.34	3.40	3.14	3.11	3.05	3.39	2.90	3.10	3.26	3.16	3.51	3.53
Golf	3.29	3.30	3.27	3.46	3.21	3.40	3.08	3.26	3.48	3.55	3.44	3.22	3.36	3.20	3.53	3.33	3.35	3.38	3.34	3.61	3.45	3.53	3.57	3.65	3.72	3.57
Gymnastics	3.41	3.63	3.41	3.19	3.32	3.38	3.35	3.39	3.34	3.43	3.34	3.42	2.94	3.18	3.30	3.40	3.20	3.24	3.28	3.76	3.45	3.45	3.37	3.49	3.48	3.55
Soccer	3.08	2.79	2.89	3.12	3.20	3.30	3.27	3.24	3.11	3.29	3.40	3.21	2.93	3.29	3.14	3.26	3.13	3.29	3.44	3.61	3.39	3.46	3.44	3.55	3.65	3.79
Softball	3.35	3.22	3.31	3.18	3.10	3.05	2.89	2.98	3.22	3.03	3.14	3.17	3.22	3.08	3.02	3.19	3.14	3.14	3.19	3.52	3.21	3.38	3.41	3.46	3.57	3.59
Swimming and Diving	3.12	3.23	3.12	3.14	3.38	3.22	3.29	3.37	3.26	3.35	3.57	3.52	3.43	3.49	3.40	3.38	3.53	3.47	3.50	3.73	3.63	3.52	3.60	3.72	3.68	3.71
Tennis	3.27	3.44	3.29	3.47	3.16	3.32	3.08	3.18	3.32	3.33	3.46	3.27	3.31	3.32	3.54	3.42	3.39	3.52	3.77	3.92	3.66	3.73	3.52	3.65	3.51	3.71
Track & Field/Cross Country																										
Cross Country	3.17	3.33	3.57	3.59	3.26	3.55	3.68	3.52	3.32	3.35	3.44	3.33	3.35	3.37	3.50	3.33	3.39	3.47	3.60	3.82	3.44	3.57	3.71	3.43	3.52	3.66
Track	3.41	3.40	3.47	3.43	3.40	3.53	3.50	3.39	3.28	3.32	3.18	3.34	3.32	3.34	3.37	3.35	3.42	3.41	3.49	3.73	3.50	3.60	3.64	3.42	3.51	3.52
Volleyball	2.86	3.03	3.12	3.22	3.26	3.26	3.40	3.38	3.44	3.55	3.55	3.57	3.55	3.50	3.53	3.56	3.30	3.57	3.38	3.74	3.53	3.39	3.35	3.16	3.42	3.21
Subtotal	3.20	3.23	3.25	3.28	3.24	3.31	3.43	3.43	3.27	3.31	3.37	3.34	3.27	3.31	3.37	3.36	3.30	3.36	3.40	3.68	3.43	3.48	3.49	3.49	3.57	3.61

Grand Total	3.07	3.10	3.14	3.13	3.11	3.10	3.14	3.12	3.00	3.06	3.14	3.08	3.13	3.11	3.13	3.14	3.16	3.17	3.19	3.51	3.18	3.21	3.22	3.20	3.32	3.35
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2022-23 ANNUAL REPORT
Department of Intercollegiate Athletics
University of Missouri - Columbia

STUDENT-ATHLETE GRADUATION RATES (Freshman cohort)

Four-year average (Federal IPEDS Rate)	All Students	Student-Athletes
2023 (16-17, 15-16, 14-15, 13-14 freshman cohort)	73%	65%
2022 (15-16, 14-15, 13-14, 12-13 freshman cohort)	71%	63%
2021 (14-15, 13-14, 12-13, 11-12 freshman cohort)	73%	61%
2020 (13-14, 12-13, 11-12, 10-11 freshman cohort)	69%	64%

Four-year average (Graduation Success Rate)	Student-Athletes	
2023 (16-17, 15-16, 14-15, 13-14 freshman cohort)	N/A	87%
2022 (15-16, 14-15, 13-14, 12-13 freshman cohort)	N/A	86%
2021 (14-15, 13-14, 12-13, 11-12 freshman cohort)	N/A	85%
2020 (13-14, 12-13, 11-12, 10-11 freshman cohort)	N/A	89%

Men's Sports (2013-2016 Cohorts)	GSR Score
Baseball	72
Basketball	88
Cross Country	77
Football	74
Golf	83
Outdoor Track & Field	77
Swimming & Diving	89
Wrestling	81
Women's Sports (2013-2016 Cohorts)	GSR Score
Basketball	100
Cross Country	97
Golf	100
Gymnastics	100
Outdoor Track & Field	97
Soccer	96
Softball	94
Swimming & Diving	96
Tennis	100
Volleyball	90

2022-23 ANNUAL REPORT
Department of Intercollegiate Athletics
University of Missouri - Columbia
Admission Exceptions

	Summer 2022	Fall 2022	Spring 2023
Student-Athlete Admission Exceptions (# of individual exceptions)	0	0	0
All Student Admission Exceptions (# of individual exceptions)	0	0	0
Percent of Admissions Exceptions who are Student-Athletes	0.00%	0.00%	0.00%

MU does not currently admit students (student-athlete or otherwise) on probation for the following reasons and thus, has no exceptions to report for the 2022-2023 academic year.

All test-optional applicants are reviewed for admission under a comprehensive and holistic process taking into account successful completion of minimum core curriculum, high school performance, accelerated high school coursework, a writing sample and academic competitiveness of the high school. Pursuant action taken by Undergraduate Deans in September 2020 effective for the 2021-2022 academic year and thereafter, a student who would have been normally admitted conditionally may now be admitted fully without being placed on academic probation to begin their academic career at MU.

Appendix B

Missouri University of Science and Technology

1. List of Sports
 - a. Accomplishments
2. Budget
3. Student Data
 - a. Participation
 - b. Academic Progress
 - c. GPA
 - d. Graduation Rates
 - e. Admission Exceptions

2022/2023 ANNUAL REPORT
Department of Intercollegiate Athletics
Missouri S&T
List of Sponsored Sports

Men's Sports

- ☒ Baseball
- ☒ Basketball
- ☒ Cross Country
- ☒ Football
- ☒ Golf
- ☒ Indoor Track & Field
- ☒ Outdoor Track & Field
- ☐ Rifle
- ☒ Soccer
- ☒ Swimming & Diving - SWIMMING ONLY
- ☒ Volleyball
- ☐ Wrestling

Women's Sports

- ☒ Basketball
- ☒ Cross Country
- ☐ Golf
- ☐ Gymnastics
- ☒ Indoor Track & Field
- ☒ Outdoor Track & Field
- ☐ Rifle
- ☒ Soccer
- ☒ Softball
- ☐ Swimming & Diving
- ☐ Tennis
- ☒ Volleyball

2022-23 Accomplishments

Athletic Department Awards	Criteria for Award
Dr. Joseph J. McGowan Visionary Award (GLVC HONOR)	S&T (Award presented to the GLVC institution that displays vision and exemplary programming to promote and advance the student-athlete experience)
James R. Spalding Sportsmanship Award (GLVC HONOR)	S&T (GLVC award given to the institution that demonstrates good sportsmanship throughout the entire year)

Academic Accomplishments	Number of Student-Athletes
GLVC Academic All-Conference (GPA 3.3+)	269
GLVC Brother Gaffney Distinguished Scholar Award (4.0 Yearly GPA)	72
GLVC COP Academic Excellence Award (Exhaust Eligibility with a GPA 3.5+)	48
GLVC Academic Team Award (Team GPA 3.3+)	13
GLVC Scholar-Athletes of the Year	2
Academic All-District Selections	38
CoSIDA Academic All-Americans	5
Athletic Department Overall GPA	3.53

Athletic Accomplishments	Number of Student-Athletes
GLVC All-Conference Student-Athletes	72
GLVC Player of the Week honorees	23
GLVC Player of the Year (Sport Specific)	4
GLVC Individual Champion Student-Athletes	12
GLVC Freshman of the Year honorees	3
GLVC Overall Team Sportsmanship Award	6
Individual NCAA Championship Appearances	18
NCAA All-America Honors	16
GLVC Team Championships (Men's Indoor & Outdoor Track and Field)	2
GLVC Coach of the Year awards	3
Daniel Murphy, Swimming; Shaun Meinecke, Indoor and Outdoor Track & Field	

Sport Specific Athletic Highlights (not an all-inclusive list, only highlights)
Baseball (24-24)
Qualified for the GLVC championship tournament for the 10th time in school history
Cole Hampton was selected first team All-GLVC, second team All-Midwest Region, first team D2CCA All-Midwest Region honors, and first team ABCA/Rawlings All-Midwest Regions honors.
Men's Basketball (16-12)
First winning record since 1996-97
Kaden Froebe was the GLVC All-Defensive honoree
Julien Smith, Idenna Okeke, and Lovell Williams were second team All-GLVC selections
Andrew Young was the GLVC Freshman of the Year honoree
Three student-athletes received NABC All-academic honors
Two student-athletes received All-District academic honors
Men's Cross Country
Matched their highest-ever team finish with a third place finish at the GLVC Championships
Three student-athletes were All-GLVC selections
Football (3-7)
Landed three of the major end of season All-GLVC awards
Defensive Player of the Year
Freshman of the Year
Special Teams Player of the Year
Four first team, seven second team, and four honorable mention All-GLVC selections
Ben Straatman named to D2CCA All-Super Region team
Men's Golf
Finished 8th at the NCAA Championships
Miners lead the nation after day 1 of the NCAA Championships
Team qualified for the NCAA Championships for the first time since 1969
Finished second out of 20 teams at NCAA Regionals
Team recorded a top 25 ranking for the first time in program history
During the regular season, the team won four invitationals & finished second in two
Two student-athletes were All-GLVC selections
Carl Miltun and Gustav Liljedahl were named to PING Division II All-America team
Carl Miltun was named GLVC Scholar Athlete of the Year
Carl Miltun qualified for the U.S. Amateur Golf Championships
Men's Soccer (5-7-5)
Qualified for the GLVC Conference Tournament for the first time since 2017
Jason Jorgensen was GLVC Offensive Player of the Year, a first time All-GLVC & D2CCA Midwest Region team selection
Two student-athletes were All-GLVC selections (first & third team)
Swimming
Earned 12 All-America awards at the NCAA II Championships
Finished 19th at the NCAA II Championships
Nine student-athletes qualified for the NCAA II Championships
200 medley relay finishes 10th at the NCAA II Championships
Connor Bichsel is selected as GLVC Freshman of the Year
Danny Murphy is selected as GLVC Coach of the Year in his first season at S&T
Men's Track & Field
Qualified two student-athletes for NCAA Championships
Won the GLVC Championship in both Indoor & Outdoor Track & Field
Nathan Swadley places fifth in the shot put at the NCAA Championship and earns fourth career All-America award
Jacob Luebbert breaks hammer throw school record
Nathan Swadley is GLVC Scholar Athlete of the Year & CSC Academic All-America of the Year
Shaun Meinecke, is named GLVC Head Coach of the Year in both indoor and outdoor track & field

Sport Specific Athletic Highlights Continued (not an all-inclusive list, only highlights)
Men's Volleyball (12-9)
Recorded a winning record in its inaugural season and won nine of their last 10 matches
Team earns IVA Team Academic Award
Nate Meyer earns second team All-IVA honors & is a Freshman All-America team selection
Women's Basketball
GLVC post-season tournament qualifier and finished with their first winning season since 2012-13
Four student-athletes received CSC Academic All-District honors
Ranked 20th on the WBCA Academic Top 25 list
Alex Kerr is All-GLVC first team selection & Laura Rodriguez is second team All-GLVC
Alex Kerr breaks the all-time scoring record at S&T
Women's Cross Country
Finished 6th at the GLVC championships
Team won both the Border War Classic & Prairie Fire Pepper races
Team received USTFCCCA All-Academic awards & was third among the nine GLVC schools receiving the award
Softball (20-28)
Beat nationally ranked 6th UINDY and beat Lewis and UIS during the season both qualifying for the NCAA tournament
Charlye Rowland was a second team All-GLVC selection and Hannah Antzoulatos was third team All-GLVC
Three student-athletes were CSC Academic All-District selections
Women's Soccer (3-8-4)
Jane Grimley is in her first season as the head coach
Team ends with a tie to 16th ranked McKendree
Closes the season on a high note with a win over UINDY
Women's Track & Field
Improved to a fifth place finish in the GLVC Outdoor Championships
Places 6th at GLVC Indoor Championships, the best finish since 2019
Maya Wright is named GLVC Freshman of the Year in Outdoor Track & Field
Five student-athletes are Academic All-District selections
Women's Volleyball (16-9)
Reached the GLVC tournament for the fourth straight season
Shelby Ply lands both GLVC Offensive Player of the Week and GLVC Defensive Player of the Week which has only occurred three other times in the GLVC (2017, 2016, 2012)
Shelby Ply is a first team All-GLVC & D2CCA All-Midwest Region team selection
Jordan Burton and Hannah Merjil are name All-GLVC second team honorees

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Budget

Revenues:	Football	Men's Basketball	Women's Basketball	Other Sports	Non-Program Specific	Operating Total	Capital Projects	Total
Broadcast, Television, Radio, and Internet Rights						-		-
Contributions	83,725	40,481	11,035	153,236	30,144	318,621		318,621
Direct Institutional Support	1,618,739	378,480	326,301	2,356,191	1,072,296	5,752,007		5,752,007
Endowment and Investment Income	49,184	30,839	21,614	106,282	39,515	247,434		247,434
Guarantees	18,000	5,000	1,500	0	0	24,500		24,500
Indirect Facilities and Administrative Support						-		-
NCAA/Conference Distributions incl. All Tournament Revenues				20,237	17,160	37,397		37,397
Other Revenues	8,013	0	6,231	43,973	34,256	92,473		92,473
Program Sales, Concessions, Novelty Sales, and Parking					41,121	41,121		41,121
Royalties, Advertisements, and Sponsorships					16,243	16,243		16,243
Sports Camp Revenues	6,795	8,030	2,030	50,791	2,845	70,491		70,491
Student Activity Fee	158,544	138,106	178,856	566,030	74,948	1,116,484		1,116,484
Ticket Sales	0	0	0	0	20,853	20,853		20,853
Total Revenues	1,943,000	600,936	547,567	3,296,740	1,349,381	7,737,624		7,737,624

Expenses:	Football	Men's Basketball	Women's Basketball	Other Sports	Non-Program Specific	Operating Total	Capital Projects	Total
Athletic Facilities Debt Service, Leases and Rental Fee			(120)	(6,500)	(1,271)	(7,891)		(7,891)
Athletics Student Aid	(1,316,560)	(338,455)	(296,425)	(1,880,948)	(31,897)	(3,864,285)		(3,864,285)
Coaching Salaries, Benefits, & Bonuses Paid by the University	(373,427)	(153,340)	(143,962)	(782,588)	0	(1,453,317)		(1,453,317)
Direct Overhead and Administrative Expenses	(5,033)	(1,380)	(710)	(9,063)	(69,387)	(85,573)		(85,573)
Equipment, Uniforms, and Supplies	(56,516)	(10,345)	(11,751)	(152,586)	(213,595)	(444,793)		(444,793)
Fundraising, Marketing, and Promotion	(1,528)	(336)	(2,159)	(1,387)	(26,253)	(31,663)		(31,663)
Game Expenses	(17,818)	(15,199)	(13,952)	(92,683)	(6,919)	(146,571)		(146,571)
Guarantees		(4,817)	(2,214)	(1,188)		(8,219)		(8,219)
Indirect Facilities and Administrative Support		0				-		-
Medical Expense and Medical Insurance	(3,715)	0	0	(30)	(159,443)	(163,188)		(163,188)
Membership and Dues	(2,387)	(665)	(675)	(5,876)	(27,162)	(36,765)		(36,765)
Other Operating Expenses	(6,372)	(13,037)	(10,854)	(18,701)	(148,032)	(196,996)		(196,996)
Recruiting	(8,945)	(9,554)	(14,498)	(24,827)	0	(57,824)		(57,824)
Spirit Groups	0	0						-
Sports Camp Expense	(778)	(1,604)	(564)	(19,426)	(1,325)	(23,697)		(23,697)
Student-Athlete Meals (non-travel)	(33,218)	(7,408)	(5,214)	(13,935)	0	(59,775)		(59,775)
Support Salaries Paid by the University	0		0	(3,749)	(655,198)	(658,947)		(658,947)
Team Travel	(89,554)	(54,948)	(71,846)	(480,988)	0	(697,336)		(697,336)
Total Expenses	(1,915,851)	(611,088)	(574,944)	(3,494,475)	(1,340,482)	(7,936,840)		(7,936,840)

Excess (Deficiency of Revenues over Expenses) 27,149 (10,152) (27,377) (197,735) 8,899 (199,216) - (199,216) covered by beginning balances

Net Assets

Unrestricted

Restricted Expendable

Restricted Non-expendable

	30-Jun-22	30-Jun-23
Unrestricted	576,967	352,790
Restricted Expendable	541,277	673,260
Restricted Non-expendable	7,016,216	7,284,352
TOTAL	8,134,460	8,310,402

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Athletic Participation by Student Athletes

Men's Sports (indicate if not applicable--n/a)	Scholarship	Walk-On	Total
Baseball	36	4	40
Basketball	10	6	16
Football	105	17	122
Golf	7	4	11
Rifle	NA	NA	0
Soccer	22	18	40
Swimming	20	1	21
Track & Field/Cross Country	23	45	68
Volleyball	13	5	18
Wrestling	NA	NA	0
Subtotal	236	100	336

Women's Sports (indicate if not applicable--n/a)	Scholarship	Walk-On	Total
Basketball	13	1	14
Gymnastics	NA	NA	0
Golf	NA	NA	0
Rifle	NA	NA	0
Soccer	26	4	30
Softball	20	1	21
Swimming & Diving	NA	NA	0
Tennis	NA	NA	0
Track & Field/Cross Country	15	16	31
Volleyball	18	0	18
Subtotal	92	22	114

NOTE: Scholarship student-athletes include all students receiving athletic aid awards, including post-eligible and medical awards.

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Academic Success Rate

22/23 for the 2016 cohort		78%	72%
Men's Sports (indicate if not applicable--n/a)		ASR score	Fed Rate
Baseball		84	73
Basketball		47	63
Cross Country/Track		77	75
Football		60	54
Golf		100	100
Indoor Track & Field		NA	NA
Outdoor Track & Field		NA	NA
Rifle		NA	NA
Soccer		88	83
Swimming & Diving		80	70
Wrestling		NA	NA

Women's Sports (indicate if not applicable--n/a)		ASR Score	Fed Rate
Basketball		81	78
Cross Country/Track		100	95
Golf		NA	NA
Gymnastics		NA	NA
Indoor Track & Field		NA	NA
Outdoor Track & Field		NA	NA
Rifle		NA	NA
Soccer		94	93
Softball		91	89
Swimming & Diving		NA	NA
Tennis		NA	NA
Volleyball		100	94

[Division II's Academic Success Rate is similar to the Division I GSR, except it measures the academic success of all student-athletes, not just those who receive financial aid.](#)

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Grade Point Averages by Semester

	2018-2019		2019-2020		2020-2021		2021-2022		2022-2023	
Men's Sports	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Baseball	3.361	3.29	3.332	3.612	3.431	3.467	3.302	3.34	3.428	3.497
Basketball	3.083	3.038	2.845	3.047	2.772	2.987	3.146	2.971	3.316	3.383
Football	2.599	2.825	2.754	3.407	2.97	2.96	3.033	3.186	3.159	3.167
Golf	3.452	3.378	3.489	3.745	3.531	3.603	3.395	3.034	3.686	3.584
Soccer	3.381	3.333	3.342	3.785	3.179	3.412	3.289	3.076	3.395	3.367
Swimming & Diving	3.276	3.186	3.315	3.642	3.264	3.561	3.709	3.507	3.341	3.287
Track & Field/Cross Country										
Cross Country	3.073	3.326	3.267	3.713	3.325	3.249	3.544	3.567	3.697	3.302
Indoor Track	3.264	3.311	3.243	3.709	3.359	3.241	3.529	3.385	3.570	3.305
Outdoor Track	3.264	3.311	3.243	3.709	3.359	3.241	3.533	3.395	3.563	3.162
Volleyball									3.465	3.302
Subtotal	3.195	3.222	3.203	3.597	3.243	3.302	3.408	3.333	3.462	3.339

	2018-2019		2019-2020		2020-2021		2021-2022		2022-2023	
Women's Sports	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Basketball	3.165	3.242	3.278	3.546	3.242	3.28	3.706	3.625	3.689	3.651
Golf	3.446	3.311	3.51	3.892	3.84	3.548				
Soccer	3.279	3.389	3.085	3.587	3.416	3.372	3.326	3.427	3.51	3.463
Softball	3.174	3.397	3.232	3.793	3.354	3.398	3.222	3.301	3.508	3.471
Track & Field/Cross Country										
Cross Country	3.23	3.228	3.41	3.826	3.477	3.592	3.709	3.599	3.778	3.925
Indoor Track	3.224	3.324	3.356	3.711	3.516	3.673	3.67	3.697	3.693	3.736
Outdoor Track	3.224	3.324	3.356	3.711	3.516	3.673	3.67	3.697	3.693	3.736
Volleyball	3.25	3.314	3.358	3.786	3.56	3.415	3.438	3.625	3.668	3.661
Subtotal	3.249	3.316	3.323	3.732	3.490	3.494	3.534	3.567	3.648	3.663

Grand Total	3.222	3.269	3.263	3.664	3.367	3.398	3.471	3.450	3.555	3.501
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STUDENT-ATHLETE GRADUATION RATES (Freshman cohort)

Four-year average (Federal IPEDS Rate)	All Students	Student Athletes	ASR
2023 (16-17 freshman cohort)	65%	72%	78%
2022 (15-16 freshman cohort)	65%	74%	79%
2021 (14-15 freshman cohort)	65%	76%	80%
2020 (13-14 freshman cohort)	67%	77%	81%
2019 (12-13 freshman cohort)	65%	75%	81%

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Admission Exceptions

	Summer 2022	Fall 2022	Winter 2023	Total
Student-Athlete Admission Exceptions (<i># of individual exceptions</i>)	0	6	0	6
All Student Admission Exceptions (<i># of individual exceptions</i>)	0	165	0	165
Percent of Admissions Exceptions who are Student-Athletes	0.00%	3.64%	0.00%	3.64%

Appendix C

University of Missouri-Kansas City

1. List of Sports
2. Budget
3. Student Data
 - a. Participation
 - b. Academic Progress
 - c. GPA
 - d. Graduation Rates
 - e. Admission Exceptions

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Men's Sports

	Baseball
X	Basketball
X	Cross Country
	Football
X	Golf
X	Indoor Track & Field
X	Outdoor Track & Field
	Rifle
X	Soccer
	Tennis
	Swimming & Diving
	Wrestling

Women's Sports

X	Basketball
X	Cross Country
	Golf
	Gymnastics
X	Indoor Track & Field
X	Outdoor Track & Field
	Rifle
X	Soccer
X	Softball
	Swimming & Diving
X	Tennis
X	Volleyball

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Actuals

Revenues:	Men's Basketball	Women's Basketball	Other Sports	Non-Program Specific	Operating Total	Capital Projects	Total
Student fees (Athletic Fee)				\$ 3,539,728	\$3,539,728		\$3,539,728
Ticket Sales	\$73,595	\$25,860	\$29,115	\$2,396	\$130,966		\$130,966
Guarantees	\$370,000	\$22,000	\$8,200		\$400,200		\$400,200
Contributions	\$66,151	\$980	\$11,990	\$665,777	\$744,898		\$744,898
Direct Institutional Support - Transfers	\$1,719,472	\$1,719,709	\$3,102,466	-\$409,743	\$6,131,904		\$6,131,904
Direct Institutional Support - Tuition Waivers	\$298,802	\$210,439	\$1,990,759	\$386,207	\$2,886,207		\$2,886,207
Indirect Facilities and Administrative Support				\$429,522	\$429,522		\$429,522
NCAA/Conference Distributions incl. All Tournament Revenues				\$680,419	\$680,419		\$680,419
Broadcast, Television, Radio, and Internet Rights					\$0		\$0
Program Sales, Concessions, Novelty Sales, and Parking				\$40,981	\$40,981		\$40,981
Royalties, Advertisements, and Sponsorships				\$532,737	\$532,737		\$532,737
Endowment and Investment Income				\$12,118	\$12,118		\$12,118
Camp Revenue	\$14,681	\$2,216	\$84,118		\$101,015		\$101,015
Other Revenues	\$4,899	\$0	\$1,407	\$40,612	\$46,918		\$46,918
Total Revenues	\$2,547,599	\$1,981,204	\$5,228,055	\$5,920,753	\$15,677,612	\$0	\$15,677,612

Expenses:	Men's Basketball	Women's Basketball	Other Sports	Non-Program Specific	Operating Total	Capital Projects	Total
Athletics Student Aid - R&B, Fees, Books, ect	\$371,356	\$288,994	\$720,510	\$223,938	\$1,604,798		\$1,604,798
Athletics Student Aid - Tuition Waivers	\$306,332	\$215,742	\$2,040,928	\$323,205	\$2,886,207		\$2,886,207
Guarantees	\$19,000	\$3,500	\$7,300		\$29,800		\$29,800
Coaching Salaries, Benefits, & Bonuses Paid by the University	\$950,952	\$810,455	\$1,362,047		\$3,123,454		\$3,123,454
Support Salaries Paid by the University	\$84,819	\$67,663	\$0	\$1,718,969	\$1,871,451		\$1,871,451
Severance			\$0		\$0		\$0
Recruiting	\$69,294	\$66,948	\$70,538	\$0	\$206,779		\$206,779
Team Travel	\$480,725	\$239,121	\$739,870	\$49,074	\$1,508,789		\$1,508,789
Equipment, Uniforms, and Supplies	\$86,537	\$52,946	\$208,025	\$338,587	\$686,095		\$686,095
Game Expenses	\$94,300	\$65,945	\$73,871	\$122,606	\$356,722		\$356,722
Fundraising, Marketing, and Promotion	\$8,617	\$3,139	\$1,266	\$199,757	\$212,778		\$212,778
Direct Facilities, Maintenance, and Rental	\$14,312	\$4,111	\$40,730	\$76,575	\$135,728		\$135,728
Spirit Groups				\$73,182	\$73,182		\$73,182
Indirect Facilities and Administrative Support				\$429,522	\$429,522		\$429,522
Medical Expense and Medical Insurance	\$3,712	\$0	\$0	\$669,826	\$673,537		\$673,537
Membership and Dues	\$2,641	\$0	\$3,266	\$49,334	\$55,241		\$55,241
Camp Expenses	\$5,622	\$3,386	\$28,744		\$37,753		\$37,753
Student Athlete Meals - Non Travel	\$99,914	\$23,042	\$49,726	\$0	\$172,681		\$172,681
Other Operating Expenses	\$226,477	\$70,353	\$103,455	\$760,266	\$1,160,552		\$1,160,552
Total Expenses	\$2,824,611	\$1,915,345	\$5,450,272	\$5,034,840	\$15,225,069	\$0	\$15,225,069
Excess (Deficiency of Revenues over Expenses)	-\$277,012	\$65,859	-\$222,217	\$885,913	\$452,543	\$0	\$452,543

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Athletic Participation by Student Athletes

Men's Sports	Scholarship	Walk-On	Total
Basketball	13	5	18
Golf	10	1	11
Soccer	30	3	33
Track & Field/Cross Country	31	2	33
Tennis	0	0	0
Subtotal	84	11	95

Women's Sports	Scholarship	Walk-On	Total
Basketball	15	0	15
Golf	0	0	0
Soccer	29	1	30
Softball	23	2	25
Tennis	8	2	10
Track & Field/Cross Country	27	2	29
Volleyball	13	4	17
Subtotal	115	11	126

Grand Total	199	22	221
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NOTE: Scholarship student-athletes include all students receiving athletic aid awards, including post-eligible and medical awards.

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Academic Progress Rate by Sport

Men's Sports (indicate if not applicable--n/a)	APR Score
Basketball	938
Cross Country	954
Golf	963
Indoor Track & Field	Suspended
Outdoor Track & Field	Suspended
Soccer	977
Tennis	Eliminated

Women's Sports (indicate if not applicable--n/a)	
Basketball	985
Cross Country	992
Golf	Eliminated
Indoor Track & Field	Suspended
Outdoor Track & Field	Suspended
Soccer	995
Softball	977
Tennis	991
Volleyball	985

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Grade Point Averages by Semester

	2019-20		2020-21		2021-22		2022-23		4-Year	4-Year
Men's Sports	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Average	Change
Basketball	2.780	2.260	3.200	3.120	3.05	3.04	3.01	2.69	2.894	0.330
Golf	3.360	2.860	3.590	3.650	3.54	3.66	3.58	3.62	3.483	0.490
Soccer	3.440	3.440	3.360	3.340	3.09	3.10	3.45	3.44	3.333	0.005
Tennis	3.280	3.320	N/A	N/A	N/A	N/A	N/A	N/A	3.300	
Cross Country	3.440	3.350	3.530	3.480	2.71	3.14	3.27	3.25	3.271	-0.135
Indoor Track	3.010	3.210	3.190	3.060	2.82	3.23	3.17	3.13	3.103	0.040
Outdoor Track	3.010	3.210	3.190	3.060	2.82	3.23	3.17	3.13	3.103	0.040
Average	3.189	3.093	3.343	3.285	3.005	3.233	3.275	3.210	3.212	0.128

	2019-20		2020-21		2021-22		2022-23		4-Year	4-Year
Women's Sports	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Average	Change
Basketball	3.270	3.360	3.210	3.290	3.240	3.280	3.220	2.450	3.165	-0.480
Golf	3.670	3.700	N/A	N/A	N/A	N/A	N/A	N/A	3.685	
Soccer	3.630	3.620	3.640	3.650	3.490	3.640	3.620	3.680	3.621	0.025
Softball	3.510	3.380	3.370	3.300	3.190	3.090	3.330	3.440	3.326	-0.060
Tennis	3.530	3.590	3.590	3.680	3.560	3.770	3.790	3.620	3.641	0.145
Cross Country	3.580	3.610	3.880	3.470	3.160	3.390	3.440	3.510	3.505	-0.120
Indoor Track	3.210	3.210	3.420	3.170	3.190	3.390	3.250	3.340	3.273	0.085
Outdoor Track	3.210	3.210	3.240	3.170	3.190	3.390	3.250	3.340	3.250	0.085
Volleyball	3.460	3.540	3.410	3.470	3.410	3.690	3.620	3.600	3.525	0.110
Average	3.452	3.469	3.470	3.400	3.304	3.455	3.440	3.373	3.443	-0.026

Overall Average	3.337	3.304	3.416	3.351	3.176	3.360	3.369	3.303	3.342	0.040
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NOTE: Scholarship student-athletes include all students receiving athletic aid awards, including post-eligible and medical awards.

2022-2023 ANNUAL REPORT
Department of Intercollegiate Athletics
UMKC

STUDENT-ATHLETE GRADUATION RATES (Freshman cohort)

Six-year average (federal IPEDS rate)	All Students	Student Athletes
2013-2016 cohort	55%	69%
2012-15 cohort	50%	66%
2011-14 cohort	51%	69%
2010-13 cohort	47%	66%
2009-12 cohort	48%	62%

Six-year average (graduation success rate)	All Students	Student Athletes
2013-2016 cohort		95%
2012-15 cohort		94%
2011-14 cohort		95%
2010-13 cohort		95%
2009-12 cohort		92%

2022-2023 ANNUAL REPORT
Department of Intercollegiate Athletics

UMKC

Admission Exceptions

	Summer 2023	Fall 2022	Spring 2023	Total
Student-Athlete Admission Exceptions (<i># of individual exceptions</i>)	5	7	2	14
All Student Admission Exceptions (<i># of individual exceptions</i>)	15	620	44	679
Percent of Admissions Exceptions who are Student-Athletes	33.33%	1.13%	4.55%	2.06%

UNIVERSITY OF
MISSOURI-ST. LOUIS

UMSL ATHLETICS ANNUAL REPORT

LORI FLANAGAN
ATHLETIC DIRECTOR
NOVEMBER 16, 2023



UMSL Athletics Varsity Teams

Women's Sports

- Basketball
- Cross Country
- Golf
- Soccer
- Softball
- Swimming
- Tennis
- Volleyball
- Track & Field

Men's Sports

- Baseball
- Basketball
- Cross Country
- Golf
- Soccer
- Swimming
- Tennis
- Track & Field

OPEN -- ASARED -- INFO -- 1-50





285

STUDENT-ATHLETES

115

NEW
STUDENT-ATHLETES

92

ARE FIRST-TIME
FRESHMEN

30

INTERNATIONAL
STUDENT-ATHLETES

11

COUNTRIES
REPRESENTED

31

STATES
REPRESENTED

UMSL Athletics Year in Review

- 1 GLVC and Regional Coach of the Year
- 1 Paragon Award Winner
- 2 GLVC Scholar-Athletes of the Year
- 2 Midwest Regional Championships
- 3 GLVC Player of the Year
- 3 GLVC Freshmen of the Year
- 4 Academic All-Americans
- 6 Individual qualifiers for NCAA Championships
- 9 NCAA Tournament Appearances
- 10 All-Americans
- 11 All-GLVC Honorees

WOMEN'S VOLLEYBALL, FINAL 4 FINISH



MEN'S BASKETBALL, ELITE 8 FINISH



UMSL Athletics Year in Review

3.4 Overall Grade Point Average
(21st consecutive semester above a 3.0)

51 Straight A's

82% Academic Success Rate

174 Academic All-GLVC Student Athletes



Major Accomplishments

FINAL 4

WOMEN'S VOLLEYBALL
ACHIEVED FINAL FOUR FINISH
FOR THE 1ST TIME IN
PROGRAM HISTORY

ELITE 8

MEN'S BASKETBALL ACHIEVED
ELITE EIGHT FINISH FOR THE
1ST TIME SINCE 1971-1972

RANKED 50th

IN LEARFIELD CUP STANDINGS
OUT OF 300 DIVISION II
SCHOOLS



HOSTED NCAA DIVISION II
NATIONAL CHAMPIONSHIPS
FOR WOMEN'S GOLF

412 - 248 - 11

OVERALL DEPARTMENT RECORD
(.622 WINNING PERCENTAGE)

3.0

FIRST TIME ALL 19 TEAMS
ACHIEVED A CUMULATIVE
GPA OF 3.0 OR ABOVE

Student-Athlete Programming & Training

- Financial Literacy Education
- Team Culture Index Surveys
- Vulnerable Leadership Workshops
- Profession Development Workshops
- Sexual Violence Awareness
- CPR/AED Training
- Etiquette Dinner for Graduating Seniors

Student-Athlete Advisory Committee

- Toys for Tots Toy Drive
- Campus Trunk or Treat
- Chili Cook-off for Make-A-Wish



OPEN -- ASARED -- INFO -- 1-55

SAAC CHILI
COOK-OFF

November 16, 2023

Currently...

- Exploring Name, Image, Likeness Partnerships for entire department
- Opportunity to bid for the first Regional Championship to be hosted on campus for Women's Volleyball
- Charlotte Richards named Top 30 nominee for NCAA Woman of the Year
- Women's Volleyball Team is ranked No. 3 in the country

A photograph of two young tennis players, a woman and a man, standing in a gymnasium with red bleachers in the background. The woman is in the foreground, smiling, holding a tennis racket. The man is standing behind her, looking towards the camera. They are both wearing dark athletic shirts. A red and yellow graphic overlay is on the right side of the image.

THANK YOU UMSL

University of Missouri Board of Curators

Executive Summary

New Degree Program: BS in Engineering Technology University of Missouri-Columbia

The proposed four-year Bachelor of Science in Engineering Technology (BSET) program at University of Missouri-Columbia will provide students with a solid foundation in engineering principles and technology, as well as the hands-on experience they need to succeed in the workforce. The initial emphasis of the BSET is on manufacturing engineering technology, and additional emphasis areas will be developed based on enrollment trends.

The BSET degree will meet the workforce needs of regional employers who employ engineers in manufacturing engineering roles. It will provide pathways for high school students and students from community colleges and universities that offer two-year associate degrees in engineering technology and/or pre-engineering program, and it will provide pathways into engineering jobs for non-traditional adult students.

The program reflects the mission of the College of Engineering to develop education and outreach programs that enhance economic competitiveness regionally, nationally and globally. It also aligns with the College's mission to educate engineers, create leaders, advance technology, and develop entrepreneurs within an inclusive, research and interdisciplinary environment; resulting in well-informed citizens, economic development, job creation, and an improved standard of living for Missouri and beyond.

Many leading universities across the nation offer a Bachelor of Science in Engineering Technology. According to National Academy of Engineering publication, approximately 38 universities award at least 100 BSET degrees each year. Over 10,700 BSET degrees per year are conferred by the 50 top programs.

According to a review by the Engineering Technology National Forum, ET programs provide a more viable avenue to the skilled technical workforce for veterans, non-traditional adult students, community college students, and adults seeking to change professions than traditional engineering programs. It is critical that our university is prepared to meet this demand and is equipped to train and retain graduates including populations traditionally underrepresented in STEM.

No. 1

Recommended Action – BS in Engineering Technology

University of Missouri-Columbia

It was recommended by the University of Missouri System Office of Academic Affairs, endorsed by President of the University of Missouri Mun Y. Choi, recommended by the Academic, Student Affairs and Research & Economic Development Committee, moved by Curator_____, seconded by Curator_____ that the following action be approved:

that the University of Missouri-Columbia be authorized to submit the attached proposal for a BS in Engineering Technology to the Coordinating Board for Higher Education for approval.

Roll call vote of the Committee:

YES

NO

Curator Blitz

Curator Graves

Curator Layman

Curator Sinquefield

The motion _____.

Roll call vote of Board:

YES

NO

Curator Blitz

Curator Brncic

Curator Fry

Curator Graves

Curator Holloway

Curator Layman

Curator Sinquefield

Curator Wenneker

Curator Williams

The motion_____.

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Executive Summary

The MU College of Engineering proposes a new four-year Bachelor of Science in Engineering Technology (BSET) degree program. This new BSET will develop innovative educational experiences to our students that are relevant to existing and emerging careers in engineering technology. The initial emphasis of this BSET is on manufacturing engineering technology, and additional emphasis area will be developed based on enrollment trends.

This new degree program will provide students with a solid foundation in engineering principles and technology, as well as the hands-on experience they need to succeed in the workforce. The BSET degree will meet the workforce needs of regional employers who employ engineers in manufacturing engineering roles, will provide pathways for high school students and students from community colleges and universities that offer two-year associate degrees in engineering technology and/or pre-engineering program, and will provide pathways into these engineering jobs for non-traditional adult students.

The proposed BSET program reflects the mission of the College of Engineering to develop education and outreach programs that enhance economic competitiveness regionally, nationally and globally. The BSET program is also aligned with the College of Engineering's mission to educate engineers, create leaders, advance technology, and develop entrepreneurs within an inclusive, research and interdisciplinary environment; resulting in well-informed citizens, economic development, job creation, and an improved standard of living for Missouri and beyond, as outlined in its most recent strategic plan.

Many leading universities across the nation offer a Bachelor of Science in Engineering Technology. According to National Academy of Engineering publication, approximately 38 universities award at least 100 BSET degrees each year. These institutions include Purdue, Texas A&M, Columbia Southern, Southern Illinois, Rochester Institute of Technology, Michigan State, and Arizona State University Polytechnic. Most recently, the Ohio State University launched their BSET degree program with focus on manufacturing engineering technology as an initial emphasis area. Over 10,700 BSET degrees per year are conferred by the 50 top programs.

According to American Society for Engineering Education (ASEE), Engineering Technology (ET) programs are inclusive options that provide access to underrepresented groups by providing “weaving- in” opportunities to students

instead of “weeding-out”, which is a large contributor to the lack of diversity in engineering programs. According to a review by the Engineering Technology National Forum, ET programs provide a more viable avenue to the skilled technical workforce for veterans, non-traditional adult students, community college students, and adults seeking to change professions than traditional engineering programs. According to the U.S. Bureau of Labor and Statistics, Science, Technology, Engineering and Mathematics (STEM) occupations are projected to grow by 10.8% from 2021 to 2031. It is critical that our university is prepared to meet this new workforce demand and is equipped to train and retain graduates including populations traditionally underrepresented in STEM. In a statement to the National Science Foundation (NSF), President Biden stated “to compete on the world stage, we must train and develop the absolute best technical workforce.” In addition, the Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act continues to drive the addition of manufacturing jobs and provide opportunities for STEM education and good-paying skilled jobs in existing and emerging industries built on the technologies of the future.

This new BSET degree program is designed to meet growing demand for graduates who possess engineering technology skills that integrate business and leadership principles with engineering processes and technical knowledge. The new BSET is designed to meet the workforce needs for regional employers who employ engineers in manufacturing design roles. The program will also provide pathways into these engineering jobs for non-traditional students.

The new BSET with an emphasis area in manufacturing prepares graduates with technical and leadership skills necessary for manufacturing competitiveness to analyze, synthesize and control manufacturing operations to design and build solutions to real-world problems and model, simulate and analyze manufacturing production processes for both small- and large-scale industries.

1. Introduction

Academic Components and Career Paths

Students completing the BSET curriculum be required to take the Fundamentals of Engineering Exam to prepare them for the professional engineering exam in the state in which they would practice if they chose to. Graduates of the BSET program will be prepared for entry-level technologist career opportunities in general engineering technology and in manufacturing engineering technology industries. Some of the career opportunities include general and operations manager, sales representative, product manager, management analyst, engineering analyst, industrial production manager, manufacturing engineer, quality engineer, engineering

technologists, product engineer, process engineer, and more.

Evolution of Concept

The degree is developed in response to the growing needs of regional and state industry for highly skilled college graduates who possess broad training in engineering technology and are prepared for the workplace. No such BSET degree program exist in the UM system. Initially, the focus of this new degree is on Manufacturing Engineering Technology, and additional emphasis areas within the degree program will be developed based on enrollment and graduation trends.

Preliminary Steps

The new BSET degree was developed based on analysis of the market and trends nationwide. No minor or certificate was offered prior to proposing this degree program. The potential for the Engineering Technology (ET) degree was based the current success of the current Information Technology degree program, which appeals to students interested in hands-on type of computer science careers.

A general ET program that would appeal to students interested in engineering, other than computer science, is expected to be an ideal fit for such students who are interested more in application than theoretical preparation.

2. University Mission and Other Academic Programs

2.A. Alignment with Mission

One of the primary goals of the proposed BSET program is to strengthen the relationship between the University of Missouri-Columbia and community colleges throughout the state. The curriculum for the BSET was designed with this goal in mind. Discussions with some feeder community colleges already started, and support from two state community colleges was obtained.

Alignment with Campus Strategic Plan

The proposed BS in Engineering Technology is closely aligned with the MU strategic plan goals of “Create new degree programs and revise existing programs based on student demand, workforce needs and emerging opportunities” and “Develop new and revise existing interdisciplinary undergraduate and graduate degree programs to magnify departmental strengths.” Also, core to the Strategic plan, this new program will increase undergraduate enrollment by attracting additional students to MU including non-traditional adult students, students from underrepresented backgrounds, and transfer students from community colleges around the state. All is in alignment with MU’s strategic goals to “Increase enrollment of transfer

students” and “Cultivate a stronger transfer- friendly environment.” Also, the proposed BSET degree will improve students’ success, retention, and graduation rates by creating weaving-in opportunities instead of weeding-out of students who tend to flourish in practice-oriented application of engineering science and design, focusing on hands-on educational experience.

The establishment of the BSET program is mission critical for recruiting and retaining students in an era where our college of engineering intends to grow enrollment by 1,500 students. This program will provide incoming and current students with a broad range of engineering options that contribute significantly to job creation and economic development for the State of Missouri. The College of Engineering Dean is committed to the success of this program and will vigorously support the investments that must be made to guarantee our success.

2.B. Duplication & Collaboration within State, Outside System

Duplication Within State

At the state level, Missouri Western State University (MWSU) offers an ABET (Accreditation Board for Engineering and Technology) accredited ET program with emphasis in Manufacturing Engineering Technology. In addition, Southeast Missouri State University (SEMO) offers an ABET accredited ET program with emphasis on Mechanical and Manufacturing Systems. Both programs are similar to the program requested in this proposal.

Rationale

Both MWSU and SEMO serve a more local population, whereas MU has the capacity to serve the entire state, including those from metropolitan areas and surrounding states. In addition, career opportunities requiring engineering technology knowledge and skills are rapidly growing, and workforce needs are on the rise. MU is well positioned to provide students with a broad-based education in engineering principles and technology and prepare graduates to meet these industry demands.

Based on Lightcast’s Q1 2023 data, currently there are 716 completions regionally (MO+8 surrounding states) from baccalaureate level engineering technology programs (CIP 15.0000 and 15.0613) compared to 60,149 annual openings with a median annual salary of \$67,100/year and 12.6% projected growth.

Collaboration and Feasibility Within the State

While there are currently no collaborations within the state, collaborations with state community colleges (CCs) that offer pre-engineering and/or 2-year degree programs in engineering have been initiated. Support letters from Saint Louis Community College and Moberly Area Community College have been obtained.

This collaboration will build on existing collaborations and articulations agreement between state CCs and college of engineering. The new ET degree program will advance such collaborations and develop seamless college pathways.

3. Business-Related Criteria & Justification

3.A. Market Analysis

3.A.1. Rationale and Workforce Demand

The program will prepare students to be competitive for jobs in Engineering Technology in Missouri, regionally, and nationally through strong connections to the industry. According to a review by the Engineering Technology National Forum, ET programs provide a more viable avenue to the skilled technical workforce for veterans, non-traditional adult students, community college students, and adults seeking to change professions than traditional engineering programs. According to the U.S. Bureau of Labor and Statistics, STEM occupations are projected to grow by 10.8% from 2021 to 2031. It is critical that our university is prepared to meet this new workforce demand and is equipped to train and retain graduates including populations traditionally underrepresented in STEM.

The demand for engineering technology professionals is expected to continue to grow in the coming years, as technology advances and the need for highly skilled workers increases. According to analysis of Lightcast data, which includes data sources such as the Missouri Economic Research and Information Center (MERIC), engineering technology and manufacturing engineering technology employments are projected to grow 3.4% and 11.3% in Missouri and surrounding state from 2021 to 2032, respectively. This growth is expected to be driven by several factors, including the increasing complexity of technology and the need for businesses to stay competitive in a global economy. Overall, a degree in engineering technology can open a wide range of career opportunities and is a solid investment for those looking to enter a dynamic and growing field. In terms of salary, engineering technologists can expect to earn a competitive income. According to Lightcast, the median annual wage for engineering technology and manufacturing engineering technology occupations are \$57,600 and \$67,700 in Missouri and surrounding state, respectively.

3.A.2. Student Demand for Program

There is currently no pathway at MU for students interested in pursuing a degree program in Engineering Technology. BSET will create opportunities for students who are interested in practice-oriented applications of engineering science and design. On average 67 students left the College of Engineering and

MU from FS2017- FS2021. The BSET degree program will create possible career pathways for such students including pre-engineering students who are not admitted into existing engineering program. It is estimated that 10 students per year will be transfers from within MU into BSET.

Table 1a. Student Enrollment Projections

Year	1	2	3	4	5
Full-time	20	38	66	89	107
Part-time	0	0	0	0	0
Total	20	38	66	89	107

Engineering technologists help close the gap between engineers and technicians. According to National Society of Professional Engineers (NSPE), many of ET students transfer from engineering programs, which is attributed mostly to the appeal of the applied hands-on education. ET programs capture students who might leave engineering or the university seeking other ET programs. For example, at Texas A&M, about 80% of ET students transferred from traditional engineering programs.

According ASEE's 2021 report, of the top 50 universities, Arizona State University had the largest ET enrollment of 5,001 students and Drexel University had the lowest enrollment of 161 students. According to the same report, 10,723 BSET degrees were awarded, of which 930 were in general ET and 1280 were in manufacturing engineering technology. Other relevant enrollment and graduation data are given in table below for specific institutions. Enrollment of underrepresented minorities (URM) and women was 23.6% and 17.4%, respectively, and the degrees awarded to URM were 20% and 15.5% to women.

Table 1b. New Student Enrollment Projections

Year	1	2	3	4	5
Total	10	10	20	25	30

Enrollment projections are for new students joining the program as FTC students and CC transfer students. New students joining the program as FTC and transfer students will grow steadily from 10 students in year 1 to 40 students in year 5. It is expected that 10 students will transfer from current engineering, and their tuition was not included in the revenue calculations in the attached Pro Forma spreadsheet.

Table 1c. Projected Number of Degrees/Certificates Awarded

Year	1	2	3	4	5	6	7	8	9	10
Completions	0	0	0	9	18	18	27	31	36	36

3.B. Financial Projections

3.B.1. Additional Resources Needed

The hiring of a full-time non-tenure/tenure track (NTT) faculty member is planned for year 1 and a second in year 2. The hiring of additional NTT faculty is planned for years 3 and 4, for a total of 4 NTTs to support the development of the program during the first 5 years. Depending on enrollment trends and creation of additional emphasis areas within the degree program, additional NTTs could be hired. The Dean has committed \$300,000 in equipment funding and space to establish the new laboratory needs for the program. In addition, the Dean has committed to hiring the first NTT and to the additional cost for new laboratories. The program will require an academic advisor who will be hired during year 3. Additional resources are outlined below:

- 1) Four non-tenure/tenure track (NTT) faculty in first five years
- 2) Additional NTT faculty if emphasis areas are added
- 3) An academic advisor

The ET program will utilize existing college resources, such as library, laboratory facilities, etc. Program costs include new equipment, faculty and staff salaries/benefits; course development; and miscellaneous expenses.

Sources of Revenue

The sources of revenue include tuition and fees for new students. No financial support is being provided by the university. The EIT department currently graduates 90 Bachelor of Science in Information Technology (BSIT) students per year. By establishing the BS in Engineering Technology within the department, the college intends, long term, to grow the number of graduates from the EIT department to 300 students per year. To support this growth, the college is committed to adding new faculty and increasing the annual budget from \$1.3M to \$3.8M. This increase in faculty and budget will be added slowly as the student body grows.

In addition to building adequate teaching support for the program, the college is committed to providing world class laboratories that will support excellence in learning. The initial focus disciplines of the BSET program will be on manufacturing. The College of Engineering is currently investing \$1M in an upgraded manufacturing lab and have been awarded another \$1M on a MoExcels Grant from the State of Missouri to augment this lab with an

advanced manufacturing facility. These investments will also benefit existing programs in the college, such as industrial engineering and mechanical engineering. The total amount of space that has been dedicated for this laboratory upgrade is 3,370 SF on the first floor of Lafferre Hall. Additional equipment funds will be sought through the FY25 MoExcels program to support the establishment of state-of-the art facilities and experiential learning laboratories for the new BSET degree program.

3.B.2. Revenue

Based on the enrollment projection presented above, the total revenue in year one using Tier 3 Block Tuition will be \$239,304; and increasing to \$1,385,814 in year five. Detailed revenue and expense projections are provided in Appendix 2.

3.B.3. Net Revenue

The program will generate net revenue in all years, with the exception of Year 2, due to \$300,000 one-time laboratory development expenses. The cumulative direct margin will be positive for the program in all years. Under a 50% enrollment scenario, the direct margin will be positive beginning in Year 3 and the cumulative direct margin will become positive in Year 6. The program will leverage existing resources and will require additional funding to be successful.

The college of engineering is currently investing \$1M in an upgraded manufacturing lab and have been awarded another \$1M on a MoExcels Grant from the State of Missouri to augment this lab with an advanced manufacturing facility.

In addition, the college of engineering is committed to support the development of the new program, including the recruitment of new NTT faculty and the appointment of peer learning assistants and an academic advisor to support the program. The college of engineering has excellent lab infrastructure to support lab courses.

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

	Year 1	Year 2	Year 3	Year 4	Year 5
1. Expenses per year					
A. One-time					
<i>New/Renovated Space</i>	0	0	0	0	0
<i>Equipment</i>	0	300,000*	5,000	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
Total one-time	0	300,000	0	0	0

B. Recurring	Year 1	Year 2	Year 3	Year 4	Year 5
<i>Faculty</i>	65,000	132,600	198,900	265,200	270,504
<i>Staff</i>	0	0	45,000	45,900	46,818
<i>Benefits</i>	30,277	54,356	95,782	119,719	121,935
<i>Equipment</i>	0	0	0	0	0
<i>Library</i>	0	0	0	0	0
<i>Other**</i>	50,600	51,212	56,836	57,473	58,122
Total recurring	145,877	238,168	396,518	488,292	497,380
Total expenses (A+B)	145,877	538,168	401,518	488,292	497,380
2. Revenue per year					
<i>Tuition/Fees</i>	239,304	463,772	821,608	1,130,085	1,385,814
<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
Total revenue	239,304	463,772	821,608	1,130,085	1,385,814
3. Net revenue (loss) per year	\$93,427	(\$74,397)	\$420,090	\$641,793	\$888,434
4. Cumulative revenue (loss)	105,259***	\$30,863	\$450,952	\$1,092,745	\$1,981,179

Notes:

*\$300,000 has already been committed by the Dean and were added to the EIT department budget for FY24.

**Peer Learning Assistants and marketing and recruitment.

***\$11,832 net margin was added from Year 0 (implementation year).

3.B.4. Financial and Academic Viability

Table 3. Enrollment for Academic and Financial Viability

Enrollment	Minimum for Financial Viability	Minimum for Academic Viability
Full-time	60	40
Part-time	0	0
Total	60	40

The program will rely on existing courses offered in the EIT department and across campus. Twenty-one specialized ET courses are proposed, which will be developed and taught mostly by new NTT faculty who will be hired for the ET program over the next 4-5 years. Dr. Salim will also contribute towards the teaching needs for the program by teaching 2-3 of the new proposed courses in the mechanics and materials subjects.

The new NTT faculty will be required to have at least an MS degree in ET or related engineering fields, and a PhD degree will be preferred. At least 3 years industrial experience will be recommended for all new hires. If needed, adjunct faculty will be hired initially while trying to fill fulltime NTT positions. NTT faculty hired in the program will be on a 70% teaching and 30% service workload. Therefore, each NTT faculty will be responsible for teaching 7 courses per year. Therefore, at steady state, the program faculty will be able to teach 30-35 courses per year, which is expected to meet the needs of the program.

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

3.C.1. Marketing Plan & Strategy

The Engineering Technology degree program will be integrated into recruitment activities currently managed by the College of Engineering, as well as general MU admissions and recruitment activities (e.g., campus tours, college fairs, Meet Mizzou Days, high school visits, and community college visits). There are additional, discipline-specific opportunities to recruit through existing MU events aimed at K-12 and early career undergraduate students, such as Project Lead the Way; Columbia STEM Alliance; and KC STEM Fest.

Targeted recruitment to state community colleges (CCs) and high schools will also be conducted to develop pathways for transfer students and first-time freshmen. The initial recruitment plan will focus on working directly with CCs. Site visits to these CCs and holding day-long recruitment events will be key to introducing the new degree program.

Prospective MU students will also be able to find ample information about the new degree program and potential employment opportunities. Advertisements and flyers will be sent to feeder high schools in the state. In addition, the program will be introduced to undecided first-year engineering students for retention in MU and will target veterans and non-traditional adult students. In addition to recruitment, BSET will improve retention by providing an alternative path to an engineering career at MU.

The college of engineering recruitment and communication teams will work directly with the EIT department chair. Cassandra Siela, Director of Recruitment and Retention, College of Engineering and Danene Brooks, Director of Strategic Communications, College of Engineering, will be responsible for marketing the program.

Projected Program Growth

We project, at steady state, 30 new students to enroll in the new BSET degree program each Fall. BSET program will be marketed utilizing existing College of Engineering and MU campus marketing programs. In addition, the new BSET program will be advertised to community colleges and pre-engineering programs around the state for pathway development.

Marketing Costs

\$30,000 per year is the estimated cost for marketing and recruitment efforts with a 2% estimated increase per year.

3.C.2. Student Success Plan

The College of Engineering has long-standing programs in advising, tutoring, MU Connect early alert and intervention and other student services to support student retention. BSET students will be integrated into the college of engineering's First Year Engineering program including the Peer Mentor program. In addition, students will be encouraged to participate in existing student teams.

Achieving Enrollment Outcomes

The EIT department plans to pursue ABET accreditation in the fifth year of the BSET program, which will enhance visibility and advance enrollment. Enrollment will be continuously monitored to develop action plans to address issues and improve outcomes. Enrollment outcomes will also be tracked using existing programs in the college.

3.C.3. Transition Plan

Professor Hani Salim, the interim Chair of EIT department is primarily responsible for the BSET degree program. Once the program is launched, an advisory faculty committee will be formed. The committee will work directly with the Dean of the college of engineering at an advisory capacity to ensure a seamless transition in the event the department chair can no longer fulfill the necessary duties for managing the program's day-to-day needs.

3.C.4. Exit Strategy

The college of engineering and the department will periodically evaluate enrollment, retention, graduation, and placement data of the new BSET program. The college and the department project that the new program will achieve its goals within five years of opening, and such period is sufficient to make decisions moving forward.

The following criteria will be considered for making decisions regarding discontinuing the program: at least an average of 5 new students per year joining the program, a freshman retention rate of at least 75%, at least an average of 10 graduates over three years; and at least 80% of graduates of the program finding successful career outcomes within six months of graduation. In addition, the program will work closely with the Dean and the Provost office to adjust these thresholds to meet the College's and the University's metrics for advancing our student outcomes and success.

If the situation arises that the program is underperforming expectations and financial viability is compromised, the advisory faculty committee will be charged with providing a plan of action to improve enrollments and/or decrease expenditures. A three-year window will be allowed following the implementation of the action plan. The department commits discontinuation if enrollment (either new or total) falls below the three year number that has been projected.

4. Institutional Capacity

The college of engineering has established lab facilities that will support many of the educational needs of the new BSET degree program. Additional equipment will be acquired to support the program, for which the Dean has already committed \$300,000, and the space needs has already been identified. In addition, 21 new courses will be developed to support the educational objectives of the program. These courses will be developed by newly hired NTT faculty as part of their assignments. Minimum resources will be needed

to support the development of these courses. The Dean is fully committed to support the established of this program and will incrementally increase the budget of the EIT department to allow for the addition of new NTT faculty as enrollment grows. Support letter from Dean is attached.

5. Program Characteristics

5.A. Program Outcomes

Engineering technology has become an increasingly important field in recent years, as more and more industries rely on advanced technology to design, build, and maintain complex systems. A degree in engineering technology will provide students with the skills and knowledge they need to succeed in this dynamic field. The goal of the BSET is to provide innovative educational experiences to our students that are relevant to existing and emerging careers in engineering technology. The new program will provide students with a solid foundation in engineering principles and technology, as well as the hands-on experience they need to succeed in the workforce. The BSET degree will:

- Meet the workforce needs of regional employers who employ engineers in general engineering technology roles and manufacturing engineering roles.
- Provide pathways for high school students and students from community colleges and universities that offer two-year associate degrees in engineering technology and/or pre-engineering program
- Provide a pathway into these engineering jobs for non-traditional adult students.

Learning Objectives

The learning objectives (called Program Educational Objectives by ABET) of the new program are consisted with the Engineering Technology Accreditation Commission of ABET. A draft learning objectives are summarized below, which will continuously be developed in consultation with our Industrial Advisory Board:

- PEO1: Produce graduates that process the technical and professional skills to have successful careers in regional and national industries.
- PEO2: Apply engineering knowledge and tools to solve technical problems, design products, and improve processes that strive to meet the ethical, cultural and environmental needs of society.
- PEO3: Be effective team members who can lead, collaborate and communicate effectively.
- PEO4: Become successful professionals in their fields.
- PEO5: Pursue professional development through continuing education and industry-specific certifications.

Table 4. Student Learning Objectives

1	To apply basic knowledge of mathematics, science and engineering principles to solve technical problems.
2	To identify, formulate and solve technical problems.
3	To design systems, components, or processes meeting specified needs for broadly defined engineering problems appropriate to the discipline.
4	To apply written, oral, and graphical communication in broadly defined technical and non-technical environments; and an ability to identify and use appropriate technical literature.
5	To conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes.
6	To function effectively as a member as well as a leader on technical teams.

5.B. Program Design and Content

Curriculum Design

Achievement and attainment of the Program Educational Objectives (PEOs) are assessed by the following Student Outcomes (SOs). Note these SOs are defined by ABET and are required for future accreditation. The SOs are mapped to the PEOs below.

- SO1: The ability to apply basic knowledge of mathematics, science and engineering principles to solve technical problems. Mapped to PEO1 and PEO2.
- SO2: The ability to identify, formulate and solve technical problems. Mapped to PEO1 and PEO2
- SO3: The ability to design systems, components, or processes meeting specified needs for broadly defined engineering problems appropriate to the discipline. Mapped to PEO2 and PEO4.
- SO4: The ability to apply written, oral, and graphical communication in broadly defined technical and non-technical environments; and an ability to identify and use appropriate technical literature. Mapped to PEO1, PEO3, and PEO5.
- SO5: The ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes. Mapped to PEO1 and PEO2.
- SO6: The ability to function effectively as a member as well as a leader on technical teams. Mapped to PEO3, PEO4, and PEO5.

5.C. Program Structure

General Description

The proposed engineering technology degree program will consist of a combination of classroom instruction and project-based, teamwork-oriented, and hands-on laboratory experiences. Students will take courses in subjects such as mathematics, physics, and chemistry, as well as specialized courses in areas in engineering. The program will also include internships and other experiential learning opportunities to give students real-world experience. The Bachelor of Science in Engineering Technology (BSET) trains students to use a systems approach to integrate knowledge and skills to support emerging technical needs in engineering industry. The technology curricula allow for a variety of exciting opportunities in the areas of Engineering Technology.

Program Requirements

The BS in Engineering Technology requires a total of 120 credit hours for completion. The students are required to complete all University general education, University undergraduate requirements, degree, and major requirements, including selected foundational courses, which may fulfill some University general education requirements. These include 15 credits of general education requirements, 27 credits of technical core requirements, 63 credits of required core courses, and 15 credits of technical electives.

General Education Requirements (15 credits)

- ENGLISH 1000 (3)
- American History/Government (Social and Behavioral Science-SBS) (3)
- COMMUN 1200: Public Speaking (HUM) (3)
- PHIL 1100/1200: Ethics/Logic (HUM) (3)
- HUM/FA 2000+ level (3)

Technical Support Core Requirements (27 credits)

- ECONOM 1014: Principles of Microeconomics (3)
(meets SBS and cultural competency requirements)
- Math 1400: Calculus for Science Majors (3)
- PHYSCS 1210: College Physics I (4)
- PHYSCS 1220: College Physics II (4)
- CHEM 1100: Atoms and Molecules with Lab (4)
- STAT 2500: Intro Probability & Statistics I (3)

- IMSE 2710: Engineering Economic Decision-Making (meets SBS requirement) (3)
- MANGMT 3000: Principles of Management (3)

Required Core Courses (63 credits)

• **Engineering Technology Core Courses (28 credits)**

- ENGINR 1000: Introduction to Engineering (1)
- INFOTC 1040: Computer Programming (3)
- MAE 1100: Introduction to Computer Aided Design (3)
- ENGTC 1250: Statics for Technology with lab-New (3)
- ENGTC 2150: Electronics Fundamentals with lab-New (3)
- ENGTC 2250: Mechanics for Technology with lab-New (3)
- ENGTC 2350: Materials, Processes, and Testing with lab-New (3)
- ENGTC 3350: Machine Tool Technology-New (3)
- ENGTC 3450: Fluid Mechanics for Technology with Lab-New (3)
- ENGTC 4800: Industrial Safety and Risk Assessment-New (3)

Manufacturing Engineering Technology Core Courses (35 credits)

- MFGET 1500: Intro Manufacturing Eng Tech Applications-New (2)
- IMSE 2030: Fund of Sys Design & Analysis (3)
- MFGET 2500: Manufacturing Methods I-New (3)
- MFGET 2600: Computer Aided Manufacturing I-New (3)
- MFGET 3200: Intro Robotics-New (3)
- MFGET 3400: Manufacturing Process Improvement-New (3)
- MFGET 3700: Industrial Automation I-New (3)
- MFGET 3800: Smart Manufacturing Technology-New (3)
- MFGET 4700: Industrial Automation II-New (3)
- MFGET 4950: Industrial Internship/Cooperative Education-New (3-6)
- MFGET 4970W: Capstone Design I- New (3)
- MFGET 4980W: Capstone Design II-New (3)

Technical Electives – select 5 courses from list (15 credits)

- INFOTC 2810: Fundamentals of Network Technology (3)
- INFOTC 2910: Cyber Security (3)
- INFOTC 3650: Project and Team Management (3)
- ENGTC 3100: Microprocessors Systems with lab-New (3)
- INFOTC 3810: Computer Network Security (3)

- ENGTC 4100: Instrumentation & Process Control-New (3)
- MFGET 4600: Introduction to Adaptive (Additive) Manufacturing-New (3)

Table 5. Engineering Technology Suggested Plan of Study

First Semester		hr	Second Semester		hr
ENGINR 1000: Intro to Engineering	1		MAE 1100: Intro CAD		3
Math 1400: Calculus for Sciences	3		MFGET 1500: Intro to Manufacturing (New)		2
PHYSCS 1210: College Physics I	4		PHYSCS 1220: College Physics II		4
ENGLISH 1000	3		CHEM 1100: Atoms and Molecules with Lab		4
American History/Government (SBS)	3		ECONOM 1014 (SBS & Cultural Competency)		3
TOTAL	14		TOTAL		16
Third Semester			Fourth Semester		
INFOTC 1040: Computer Programming	3		IMSE 2030: Fund of Sys Design & Analysis		3
ENGTC 1250: Statics for Tech w/ lab (New)	3		ENGTC 2250: Mechanics for Tech w/ lab (New)		3
STAT 2500: Intro Probability & Statistics I	3		MFGET 2500: Manufacturing Methods I (New)		3
ENGTC 2150: Electronic Fund w/ lab (New)	3		ENGTC 3450: Fluid Mech Tech w/ Lab-(New)		3
COMMUN 1200: Public Speaking (HUM)	3		PHIL 1100/1200: Ethics/Logic (HUM)		3
TOTAL	15		TOTAL		15
Fifth Semester			Sixth Semester		
MFGET 2600: Computer Aided Mfg I (New)	3		MFGET 3400: Mfg Process Improvement (new)		3
ENGTC 2350: Materials w/ lab (New)	3		MFGET 3700: Industrial Automation I (New)		3
ENGTC 3200: Intro Robotics (New)	3		ENGTC 3350: Machine Tool Technology (New)		3
IMSE 2710: Engrg Econ Decision-Making (SBS)	3		MANGMT 3000: Principles of Management		3
HUM/FA 2000+ level	3		Technical Elective 1		3
TOTAL	15		TOTAL		15
Seventh Semester			Eighth Semester		
MFGET 3800: Smart Mfg Technology (New)	3		Technical Elective 3		3
MFGET 4950: Internship (New)	3		Technical Elective 4		3
ENGTC 4800: Ind Safety & Risk Assessment-New	3		Technical Elective 5		3
Technical Elective 2	3		MFGET 4700: Industrial Automation II (New)		3
MFGET 4970W: Capstone Design I (New)	3		MFGET 4980W: Capstone Design II (New)		3
TOTAL	15		TOTAL		15

Note: Grey shading indicates New course.

Residency Requirements

There are no residency requirements for the BSET.

Internship, Thesis or Other Capstone

All senior students are required to take an industrial internship class (3-6 hours) and two capstone design classes for a total of 9-12 credit hours.

Unique Features

Some of the required and technical elective courses are taught by faculty in the IT program and faculty in the College of Arts & Science and the Trulaske College of Business.

Admission Requirements

FTC students that meet the minimum admission requirements set by MU will be eligible to be admitted into the new BSET program. FTC students admitted into the BSET program will be part of the first-year engineering program to provide them with critical academic and career advice.

Transfer applicants will also be admitted into the program following MU's policies and requirements. Community college students will be able to benefit from college pathways specifically designed for transfer students in collaboration with state community colleges and institutions that offer 2-year associate degree programs.

5.D. Program Goals & Assessment

Assessment Learning Outcomes

The student outcomes (SOs) are mapped to the PEOs, which will be reviewed every semester during the first three years and then every two years. The SOs are mapped to required courses (see attached BS Engineering Technology-Full proposal document). The mapping of the SOs to required courses and assessment tools will be reviewed every semester.

SOs are assessed in the courses listed in the table in section 5.B. Assessment instruments and performance indicators (PIs) will be defined during the design of each of the core courses used for the assessment. Data will be collected from the instructor of each course. Depending on the course, this data could be performance on a project, an exam question, a presentation, or a homework assignment. This performance indicators data is provided to the program coordinator using a pre-defined cycle. The target for achievement in all courses is that at least 70% of the students score 75% or higher on the PI for the student activity relating to a particular SO. The Chair will be responsible for program oversight.

In addition to regular department assessment, the BSIT program will undergo routine accreditation through the Engineering Technology Accreditation Commission (ETC) of ABET alongside other currently accredited programs. ABET meetings within the department are currently ongoing for the current IT program and ABET is a standing agenda item at all EIT faculty meetings.

The ET program will initiate ET specific ABET meetings once the program is launched. To obtain and sustain ABET accreditation requirements and maintaining programmatic continuous improvement, all EIT faculty, including new ET faculty, will be involved in ABET accreditation measures, including course assessment, student work collection, PEO reviews, student survey reviews, and frequent interaction with industrial advisory council. The new BSET program will follow an assessment plan and structure very similar to those of the current engineering programs.

Retention and Graduation Rate Goals

The ET program will build on the success of the IT program which is part of the EIT department. For 2021-2022, the 2-year first-year- college (FTC) retention of the IT students was 92%, and the 4-year and 6-year graduation rates were 50% and 78.9% respectively. The ET program success will be measured with similar performance outcomes currently observed for the IT programs and college of engineering.

5.E. Student Preparation

FTC students who meet the minimum admission requirements set by MU will be eligible to be admitted into the new BSET program. FTC students admitted into the BSET program will be part of the first-year engineering program to provide them with critical academic and career advice.

Transfer applicants will also be admitted into the program following MU's policies and requirements. Community college students will be able to benefit from college pathways specifically designed for transfer students in collaboration with state community colleges and institutions that offer 2-year associate degree programs.

5.F. Faculty and Administration

Dr. Hani Salim, Interim Chair of the Engineering and Information Technology Department will serve as the program director for the new BSET program. His role initially is 35% administration which will increase at the ET program enrollment and faculty grows.

Instructional Needs

The program will rely on existing courses offered in the EIT department and across campus. Twenty-one specialized ET courses are proposed, which will be developed and taught mostly by new NTT faculty who will be hired for the ET

program over the next 4-5 years. Dr. Salim will also contribute towards the teaching needs for the program by teaching 2-3 of the new proposed courses in the mechanics and materials subjects.

NTT faculty hired in the program will be on a 70% teaching and 30% service workload. Therefore, each NTT faculty will be responsible for teaching 7 courses per year. Therefore, at steady state, the program faculty will be able to teach 30-35 courses per year, which is expected to meet the needs of the program. 55% of the program's credit hours will be taught by full-time faculty.

Students will meet with the advisor on a regular basis and faculty will be required to dedicate times during the week for open-hour advising of student to ensure successful progression through the program.

Credentials for Teaching Assignment

The new NTT faculty will be required to have at least an MS degree in ET or related engineering fields, and a PhD degree will be preferred. At least 3 years industrial experience will be recommended for all new hires. If needed, adjunct faculty will be hired initially while trying to fill fulltime NTT positions.

Faculty Involvement

All faculty will be expected to become active members of state and national professional associations, which in turn provides opportunities for students to be involved in leadership within the profession. A Professional student advisor will be hired for the program starting on year 3, but faculty will have an active role in student advising, mentoring, and career development.

5.G. Alumni and Employer Survey

Alumni Survey

In alignment with ABET accreditation standards, ET program plans to complete senior exit surveys, just as is done in all other accredited programs in the college. Currently, all graduating seniors in the college programs are required to fill out a senior exit survey through Qualtrics. The survey asks about SOs, student academic and career advising experience, job placement, and career goals. In addition to the survey, all graduating seniors will have a face-to-face senior exit interview with the department chair before graduating. This interview allows the students to elaborate on their responses to the survey questions as well as give other feedback from their experience in the program.

In addition, once per year a survey will be sent to employers. The survey will ask about PEOs and SOs. Alumni surveys will also be done after the first cohort of

graduates and will continue to be conducted once per year. The planned alumni survey will ask about the PEOs and SOs, whether they have an engineering job, whether they have a graduate degree, and whether they plan to or have become licensed.

Employer Survey

EIT department currently has an industrial advisor council (IAC) which advises the department on assessment and accreditation requirements of the IT program. The IAC will be expanded to include members from the ET industry to support the new BSET program. The advisory council members will represent employers of the program. The advisory board members are involved in maintaining a strong program. The IAC meets once a semester and participates in evaluating the capstone projects.

5.H. Accreditation

Accreditation efforts will initiate during the first year of the program start. An industrial advisory board will be formed to continuously review and improve the learning objectives and student outcomes to meet the workforce demands. Data needed for the Accreditation Board for Engineering and Technology (ABET) will be collected and assessed each semester during the first five years of the program. We plan to apply for initial accreditation during 2028.

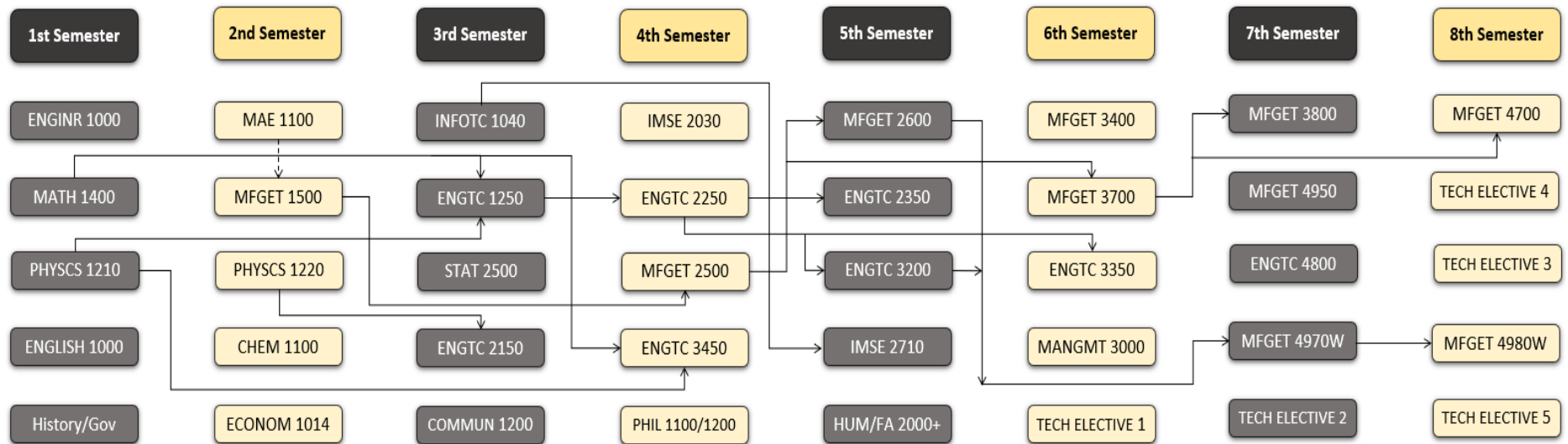
6. Appendices

- Appendix 1: Course Map (page 24)
- Appendix 2: Pro Forma (page 25)
- Appendix 3: Letters of Support (page 26)

Appendix 1

Course Map

BS in Engineering Technology Flowchart



Appendix 2

Pro Forma

New Degree Program Pro Forma

Records

Proposed program: **Bachelor of Science in Engineering Technology**

University: **University of Missouri-Columbia**

College: **College of Engineering**

Submitted: **29-May-23**

Preparer: **Hani Salim**

Reviewed by College Fiscal Officer: **6/2/2023**

Fiscal Officer Name: **Melissa Amos-Landgraf**

Reviewed by University-Level Fiscal Officer: **6/2/2023**

Fiscal Officer Name: **Todd Mackley**

PROGRAM:	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
Enrollment Projections								
Head Count Students - <i>new incoming or transfer to BSET</i>	4	18	36	63	99	144	144	144
Non-Resident - est 10%		2	4	7	11	16	16	16
Tuition Rate/YR	16,600	16,932	17,271	17,616	17,968	18,328	18,694	19,068
Tuition Non-Resident - est 10%	36,800	37,536	38,287	39,052	39,834	40,630	41,443	42,272
Tuition Discount Rate (%)	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
Scholarship Allowances (\$)								
Revenue Projections	*****CALCULATED CELLS*****							
Tuition	66,400	379,848	774,890	1,383,179	2,217,038	3,289,278	3,355,063	3,422,164
Supplemental & Other Fees	-							
Scholarship Allowances	(24,568)	(140,544)	(286,709)	(511,776)	(820,304)	(1,217,033)	(1,241,373)	(1,266,201)
Net Tuition and Fees	41,832	239,304	488,181	871,402	1,396,734	2,072,245	2,113,690	2,155,964
Other Income								
TOTAL PROGRAM REVENUE	\$41,832	\$239,304	\$488,181	\$871,402	\$1,396,734	\$2,072,245	\$2,113,690	\$2,155,964
Recurring State Support								
TOTAL REVENUE	\$41,832	\$239,304	\$488,181	\$871,402	\$1,396,734	\$2,072,245	\$2,113,690	\$2,155,964
Expenditure Projections								
Faculty Salaries								
NTTs (1 yr1, 2 yr2, 3 yr3, 4 yr4 onward)	\$ -	\$ 65,000	\$ 132,600	\$ 198,900	\$ 265,200	270,504	275,914	281,432
Technical Salaries								
Peer Learning Assistants @\$15/hr	\$ -	\$ 20,000	\$ 20,000	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000
Support Salaries								
Academic Advisor	\$ -	\$ -	\$ -	\$ 45,000	\$ 45,900	46,818	47,754	48,709
Total Salaries	-	85,000	152,600	268,900	336,100	342,322	348,668	355,142
Benefits	-	30,277	54,356	95,782	119,719	121,935	124,196	126,502
Subtotal Salaries and Benefits	-	\$115,277	\$206,956	\$364,682	\$455,819	\$464,257	\$472,864	\$481,643
Operating Expense								
Computing Expenses								
NonCapital Maintenance & Repair								
Noncapital Equipment								
Supplies								
Professional & Consulting								
Travel & Training								
Misc. Expenses, marketing and recruitment	30,000	30,600	31,212	31,836	32,473	33,122	33,785	34,461
Subtotal Operating Expense	30,000	\$30,600	\$31,212	\$31,836	\$32,473	\$33,122	\$33,785	\$34,461
One-time Expenditures (Startup Costs)								
Lab Equipment yr2; office equipment for advisor yr3			\$ 300,000	\$ 5,000				
Additional Space Costs								
Subtotal One-time Expense	\$ -	\$0	\$300,000	\$5,000	\$0	\$0	\$0	\$0
TOTAL EXPENDITURES	\$30,000	\$145,877	\$538,168	\$401,518	\$488,292	\$497,380	\$506,649	\$516,104
DIRECT MARGIN	\$11,832	\$93,427	(\$49,987)	\$469,884	\$908,442	\$1,574,865	\$1,607,041	\$1,639,860
CUMULATIVE DIRECT MARGIN	\$11,832	\$105,259	\$55,272	\$525,156	\$1,433,598	\$3,008,463	\$4,615,504	\$6,255,363
Subtract:								
Revenue from Transfers within Campus	\$ -	\$ 169,320	\$ 172,706	\$ 176,161	\$ 179,684	\$ 183,277	\$ 186,943	\$ 190,682
NET MARGIN TO THE CAMPUS	\$11,832	(\$75,893)	(\$222,694)	\$293,724	\$728,758	\$1,391,588	\$1,420,098	\$1,449,178
CUMULATIVE NET MARGIN TO THE CAMPUS	\$11,832	(\$64,061)	(\$286,755)	\$6,969	\$735,727	\$2,127,315	\$3,547,413	\$4,996,591
Campus Overhead Allocation - 10%	\$ 4,183	\$ 23,930	\$ 48,818	\$ 87,140	\$ 139,673	\$ 207,224	\$ 211,369	\$ 215,596
MARGIN AFTER CAMPUS OVERHEAD	\$7,649	(\$99,823)	(\$271,512)	\$206,583	\$589,085	\$1,184,363	\$1,208,729	\$1,233,581
CUMULATIVE MARGIN AFTER CAMPUS OVERHEAD	\$7,649	(\$92,174)	(\$363,686)	(\$157,103)	\$431,982	\$1,616,345	\$2,825,074	\$4,058,655

Appendix 3

Letters of Support



May 25, 2023

Moberly Area Community College

Mechatronics Advisory Committee

Spring 2023 General Meeting

To Whom It May Concern,

The Moberly Area Community College Mechatronics Advisory Committee fully supports the University of Missouri College of Engineering's creation of a Bachelor of Science in Engineering Technology (BSET) program.

We look forward to the collaboration of the BSET program with the MACC Mechatronics program, and understand that this partnership will allow our Mechatronic students additional pathways for the continuation of their education should they choose to do so. Additionally, we feel the program will provide a conduit for continuing education for many of our non-traditional students.

By aligning itself with community colleges, the program's aim to streamline technical education and build continuing educational bridges, while efficiently utilizing resources and minimizing associated costs, is an efficient use of taxpayer dollars and student fees. We actively support this degree program.

Mechatronics Advisory Committee

Consent By Unanimous Vote, 5/25/2023

- Jennifer Barret, Columbia Safety & Supply
- April Knight, Columbia Safety & Supply
- Alex Anderson, 3M
- Bill Marshall, 3M
- Ray Stewart, Everlast Worldwide, Inc.
- Bernie Valdez, Dana Inc.
- Kirubel Hailemichael, Dana Inc.
- Bernie Andrews, Columbia REDI
- Vernon Robertson, Walsworth Publishing
- John Davidson, Walsworth Publishing
- Roberta Carson, Heart of Missouri RPDC
- Gayla Neumeyer, University of Missouri MURR
- Ryan Fessler, University of Missouri MURR
- Suzanne McGarvey, MACC
- Brandi Glover, MACC

Approved,

Mike Klote

Director, MACC Mechatronics Program

May 31, 2023

Associate Provost Alexandra Socarides
Office of the Provost
114 Jesse Hall
University of Missouri
Columbia, MO 65211

Re: Support Letter for the BS in Engineering Technology ...

Dear Associate Provost Socarides:

I would like to indicate my support for the new Engineering Technology program (ET) to be offered in our department of Engineering and Information Technology.

The BS in Engineering Technology is strategic for retaining students that would otherwise discontinue their studies in our more traditional engineering programs. The program will also attract new students, including transfer students from community colleges.

A curriculum for the BSET has already been designed and approved by our faculty at our department and college levels. We have invested over \$800k in new manufacturing equipment to support the curriculum in the ET program. This equipment and laboratory development will also support courses in Mechanical Engineering and Industrial Engineering. A MoExcels Grant is also soon to be awarded in support of developing an advanced manufacturing systems laboratory. In our budgeting process I have set aside \$300k for the purchase of electronic and hydraulic trainers in FY24. Ample office space exist in the EIT department. Today, we have made our first offer to an Associate Teaching Professor from Moberly Area Community College, and we fully expect him to accept this offer. Over the upcoming years I am committed to adding additional faculty members to the EIT department in support of this program. These faculty members will be added as the student enrollment grows. Communications were made between the Deans of Engineering at Missouri S&T and UMKC to engage them in the process. Both Deans expressed the need for such degree program in the UM system and indicated no objection to MU offering a new BS degree in Engineering Technology.

Let me know if you have any questions concerning my support for this program.

Sincerely,

A handwritten signature in black ink, reading "Noah Manring". The signature is fluid and cursive, with the first name "Noah" and last name "Manring" clearly distinguishable.

Noah Manring
Dean and Ketcham Professor
College of Engineering

xc. L. Ramchand, H. Salim



May 31, 2023

To Whom it May Concern:

I am writing in enthusiastic support of the proposal to develop a new Bachelor of Science in Engineering Technology (BSET) degree program in the College of Engineering, University of Missouri-Columbia (MU).

MU and Moberly Area Community College (MACC) are collaborating on this well-rounded curricular opportunity that is designed to develop hard and soft skills that will prepare students for the workplace. As part of our commitment to shape students into engaged citizens and citizen leaders, we are fully supportive of this new degree program. We are eager to see this program further both MU and MACC's curricular goals through innovative pedagogies that connect undergraduate academics to the many career opportunities beyond the higher education platform. In addition, MACC and MU are collaborating on the development of an NSF-Advanced Technological Education which aims at supporting partnerships between community college institutions, industry, and four-year institutions to develop educational and career pathways to improve engineering technology education.

We believe this new BSET degree program will enable graduates to meet the workforce needs of regional employers and will provide pathways for MACC students to transition into MU from a variety of programs including the AA General Studies, AS Engineering, and AAS Mechatronics degrees. This new degree will provide opportunities for non-traditional adult students to enter into engineering careers. This type of engineering degree prepares students to enter the workforce as professional engineers with skills that are applicable to a wide variety of industry disciplines including computer, electrical, mechanical and industrial engineering. With this degree, they will have the ability to respond to real-world situations in all industries. This program will develop their critical and analytical thinking to identify complex problems, evaluate options and implement solutions. Because of the continuing need for skilled workers in these fields, engineering technology is expected to be a rapidly growing field in the decade to come.

Our students will be well-served by this opportunity as part of their educational pathway, and we fully support the development of the Bachelor of Science in Engineering Technology degree program in the College of Engineering at Mizzou.

Sincerely,

Dr. Todd Martin
Vice President for Instruction

Suzi McGarvey
Dean of Workforce Development & Technical Education



St. Louis Community College
Expanding Minds. Changing Lives.

31 May 2023

To Whom it May Concern:

I am writing to support the proposed new Bachelor of Science in Engineering Technology (BSET) degree program in the College of Engineering at the University of Missouri-Columbia (MU). Saint Louis Community College (STLCC) is committed to innovative workforce development programs and college pathways to serve the students of our state and surrounding states.

I strongly support this new BSET degree program. We are eager to see this program further both MU's and STLCC's educational goals to develop seamless pathways that lead to many career opportunities for our graduates. MU Engineering and STLCC continue to collaborate on developing academic programs and curricula designed to prepare our graduates for the continually advancing workplace. MU and STLCC-Florissant Valley are collaborating on the development of an NSF-Advanced Technological Education which aims at supporting partnerships between community college institutions, industry, and four-year institutions to develop educational and career pathways to improve engineering technology education.

We believe this new BSET degree program will provide pathways for our community college students to transition into MU to support the workforce needs of regional employers. Because of the continued need for skilled workers, engineering technology is expected to be a rapidly growing field in the decade to come. The collaboration between MU and STLCC through this new BSET degree will prepare graduates to enter engineering workforce careers, such as computer, electrical, mechanical and industrial engineering. STLCC-Florissant Valley students will greatly benefit from this opportunity as part of their college and career pathways. We fully support this new Bachelor of Science in Engineering Technology degree program in the College of Engineering at MU.

Sincerely,

A handwritten signature in dark ink, appearing to read 'Thomas A. McGovern', with a long horizontal flourish extending to the right.

Thomas A. McGovern

Division Dean, STEM

St. Louis Community College-Florissant Valley

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St. Louis Community College
Expanding Minds. Changing Lives.

Executive Summary

New Degree Program: BS in Environmental Engineering University of Missouri-Columbia

This proposal describes a new BS in Environmental Engineering to be offered in the Department of Civil and Environmental Engineering (CEE). The proposed program will offer three optional track areas: public health, data analytics and bio/agricultural engineering.

The recent growth in Environmental area faculty due to recent hires through the Mizzou Forward program resulted in an increase in teaching and research capacity that can now support a separate degree program targeted to students interested in the sustainability and environmental aspects of engineering.

This program is in line with campus priorities. First, it will provide Missourians with new learning and research opportunities in Environmental and Water Resources Engineering to support sustainable economic development in the state. Second, it supports the campus strategic plan's call to "magnify department strengths" by fostering collaboration with the recently formed Missouri Water Center, an interdisciplinary research center at MU. The Environmental Engineering teaching faculty are core members of the Missouri Water Center and will synergistically blend the research activities into the classroom.

The proposed program requires minimal investment (three teaching assistants to support hands-on learning and laboratories, and one adjunct instructor), and brings together currently available resources (tenure-track faculty and top-tier lab facilities) to deliver a world-class environmental engineering degree program for Missourians.

Program graduates will become licensed environmental engineers or/and continue to graduate programs in environmental or related fields. Environmental engineers can work in industrial facilities, consulting firms, research laboratories and in the public sector, mostly in government/regulatory agencies or municipal facilities.

There is currently a need for environmental engineering professionals and the demand for new graduates in this area will increase by 12.5% over the next decade, fueled by unprecedented federal and state funding that is being allocated to infrastructure and environmental projects.

No. 2

Recommended Action – BS in Environmental Engineering

University of Missouri-Columbia

It was recommended by the University of Missouri System Office of Academic Affairs, endorsed by President of the University of Missouri Mun Y. Choi, recommended by the Academic, Student Affairs and Research & Economic Development Committee, moved by Curator_____, seconded by Curator_____ that the following action be approved:

that the University of Missouri-Columbia be authorized to submit the attached proposal for a BS in Environmental Engineering to the Coordinating Board for Higher Education for approval.

Roll call vote of the Committee:

YES

NO

Curator Blitz

Curator Graves

Curator Layman

Curator Sinquefield

The motion _____.

Roll call vote of Board:

YES

NO

Curator Blitz

Curator Brncic

Curator Fry

Curator Graves

Curator Holloway

Curator Layman

Curator Sinquefield

Curator Wenneker

Curator Williams

The motion_____.

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Executive Summary

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There is currently a need for environmental engineering professionals and the demand for new graduates in this area will increase by 12.5% over the next decade, fueled by unprecedented federal and state funding that is being allocated to infrastructure and environmental projects.

1. Introduction

Academic Components and Career Paths

The environmental engineering BS program combines a solid background in science and engineering (chemistry, math, physics, thermodynamics) with core classes (water quality and treatment, air pollution, solid and hazardous waste management) and discipline-specific and interdisciplinary elective courses.

Program graduates will become licensed environmental engineers or/and continue to graduate programs in environmental or related fields. Environmental engineers can work in industrial facilities, consulting firms, research laboratories and in the public sector, mostly in government/regulatory agencies or municipal facilities.

Some of the activities that environmental engineers do are: “design, build and operate projects that lead to environmental protection, such as water reclamation facilities or air pollution control systems; prepare, review, and update environmental investigation reports; obtain, update, and maintain plans, permits, and standard operating procedures; inspect industrial and municipal facilities and programs in order to ensure compliance with environmental regulations; and advise corporations and government agencies about procedures for cleaning up contaminated sites”, as identified by the U.S. Bureau of Labor Statistics.

Evolution of Concept

The program is being proposed due to the convergence of several factors: growth of the environmental area faculty at MU, merger of two campus-wide research centers to form the Missouri Water Center and the resulting increase in visibility and research activity, and the increased demand of professionals driven by the unprecedented federal and state investments in infrastructure and sustainability.

Preliminary Steps

The Department of Civil and Environmental Engineering currently offers an Environmental and Water Resources track for Civil Engineers, as well as a minor in Engineering Sustainability. The courses in the new BS Environmental Engineering curriculum already exist as part of one or both of these programs. The current Environmental Engineering Teaching laboratory used by Civil Engineering students will also serve as a teaching lab for the new program.

No changes are proposed for the existing areas in Civil Engineering (Environmental Engineering/Water Resources). The Civil Engineering degree requires a fundamental course in environmental and water resources engineering; required

courses for the BS in Environmental Engineering will be offered as electives for Civil Engineering students. No additional courses are needed in order to continue the Environmental Engineering/Water Resources emphasis area in Civil Engineering. Civil Engineering students are generally interested in enrolling in electives from more than one emphasis area to have a broader education that is appealing to future employers.

2. University Mission & Program Analysis

2.A. Alignment with University Mission & Goals

The proposed program aligns with the University of Missouri land grant mission as it provides Missouri students the benefits of learning and conducting research with internationally recognized scholars in Environmental and Water Resources Engineering. MU also offers students an excellent combination of laboratory infrastructure and scholarly research environment through the recently established Missouri Water Center, a partnership between the College of Engineering and the College of Food, Agriculture, and Natural Resources.

Alignment with Campus Strategic Plan

The proposed BS in Environmental Engineering is closely aligned with the MU strategic plan goals of “Create new degree programs and revise existing programs based on student demand, workforce needs and emerging opportunities” and “Develop new and revise existing interdisciplinary undergraduate and graduate degree programs to magnify departmental strengths.” Also, core to the Strategic plan, this new program will increase undergraduate enrollment by attracting additional students to MU.

Finally, one of the areas identified in Mizzou Forward under the priority research area, New Frontiers in Science, Engineering and Technologies is “Energy, Environment & Earth Sciences”. The Department of Civil and Environmental Engineering has recently hired two new tenure-track faculty through Mizzou Forward in the Environmental area.

Program Priority

The development of the environmental area has been a focus of the department, college and campus for the past several years. A campus wide Engineering Sustainability minor is housed in the Civil & Environmental Engineering department (started in 2019); two world-renowned Mizzou Forward faculty members with strong Environmental research programs joined the department in the past year, significantly increasing the research and teaching capabilities in Environmental Engineering.

The new Missouri Water Center is the result of a merger of two long standing

water related research and outreach centers at MU with the objective of creating a more streamlined research infrastructure and collaboration opportunities for faculty from various colleges, Extension, and public and private sector partners. The Center is expected to build capacity, drive workforce training, accelerate collaboration, and generate new resources to meet today's and tomorrow's water resource needs for the state of Missouri.

2.B. Duplication & Collaboration

Within UM System

The Missouri University of Science and Technology (MS&T) offers a BS in Environmental Engineering. Due to accreditation requirements, Environmental Engineering degree programs across different universities will have some similarities in the core curriculum. However, MU's proposed degree distinguishes itself in a few ways.

First, students can choose from three tracks - Public Health, Data Analytics, and Biological/Agricultural Engineering. Courses in these tracks are already offered as part of other degree programs at MU. Thus, students will have opportunities to benefit from MU's land-grant and flagship mission to offer courses in a breadth of area that are not available at other engineering schools.

Second, students in the proposed MU degree program will have unique opportunities for undergraduate research not only in the Civil and Environmental Engineering department but also in Public Health, Agriculture and Natural Resources, and Basic Sciences. Again, this is a unique advantage students will have at MU due to our charge to conduct world-class research to maintain our status as an AAU Tier 1 Research University.

Third, MU's recent investment in growing the size of Environmental faculty allows for the development of a broad variety of technical elective courses in the discipline, as well as increased research opportunities for undergraduate students. Research facilities such as the MU Materials Science and Engineering Institute and the Roy Blunt NextGen Precision Health building are examples of excellent infrastructure available on campus to support the teaching and research activities.

We expect little to no impact on MS&T's enrollment in their existing degree program. MU and MS&T have had BS in Civil Engineering degrees for over 100 years and continue to have steady enrollment in both programs. The enrollment is mainly driven by the industry need for Environmental Engineers due to the unprecedented infrastructure spending in water treatment, wastewater treatment, pollution prevention and mitigation, and other Environmental areas of national importance. MU's proposed program will grow the size of

Environmental Engineering students in the state that can be gainfully employed by the public and private sector. In addition, MU's program will be appealing to students that are interested in an interdisciplinary experience between Environmental Engineering, Public Health, Biological and Agriculture, and Natural Sciences.

The National Academy of Engineering (NAE) published a consensus report in 2019 on the future of Environmental Engineering. The report highlights that the core competencies of the traditional environmental engineering curriculum will not be enough to address current and future challenges, where more interdisciplinary approaches and non-traditional competencies will be key to developing the solutions for in the future challenges. The MU campus provides these unique opportunities for collaboration across disciplines to address this expansion of the traditional scope of the environmental engineering competencies.

The US Bureau of Labor Statistics projects a 4% increase in the employment of environmental engineers (2021-2031), mainly in the area of air and water quality. Increased public awareness is expected to contribute to further growth, in addition to the expansion of the competencies for the profession as envisioned by the NAE report.

Rationale

The BS in Environmental Engineering provides a degree option for students that are interested in the environmental aspects of civil engineering. The timing of this program is also ideal as our society faces unprecedented challenges in providing clean drinking water and preserving our environment. The National Academies has identified five grand challenges that environmental engineers will be tasked to address in the next decade. These are: 1) sustainably supply food, water, and energy, 2) curb climate change and adapt to its impacts, 3) design a future without pollution and waste, 4) create efficient, healthy, and resilient cities, and 5) foster informed decisions and actions.

The \$1.2 trillion Infrastructure Investment and Jobs Act (IIJA) passed in 2021 will make significant investments in improving the civil infrastructure in our country. A sizeable portion of the funding will be devoted to upgrading our water treatment facilities, dams, levees, and flood control.

MU's Civil and Environmental Engineering department added Environmental Engineering to the department name 24 years ago in 1998 to reflect the research and education efforts conducted by the department faculty. Due to the recent growth in the department size, MU now boasts the largest group of Environmental Engineering faculty in the state (eight tenure-track faculty).

Two of the three Mizzou Forward hires in 2022 are in Environmental Engineering.

This size and diversity of research and teaching expertise makes it timely to launch this new degree program in Environmental Engineering that will attract both in-state and out-of-state students.

MU has excellent infrastructure to support lab-based instruction in Environmental Engineering. The teaching labs in the College of Engineering are top-notch with significant upgrades made in the past decade. Labs are equipped with all the necessary equipment to offer undergraduate courses in Environmental Engineering.

The proposed degree program will also benefit significantly from other existing programs on MU's flagship campus. For example, students choosing the Public Health track will take classes from the College of Health Science's Public Health program. Similarly, students interested in the Data Analytics and Big Data track will take classes from the College of Arts and Science's Department of Statistics.

The department faculty and Civil & Environmental Engineering alumni have strong relationships with both industry (e.g., Black and Veatch, Burns and McDonnell) and public sector agencies (e.g., Missouri Department of Natural Resources, US Geological Survey, EPA, US Army Corps of Engineers) which will help with student career readiness and placement outcomes.

In summary, this degree program will produce workforce to address a great societal need. The Civil and Environmental Engineering department has built up the necessary faculty expertise through strategic investments including the Mizzou Forward initiative. The department is well-positioned to take advantage of existing resources on campus to launch this new degree program with minimal additional cost.

Within the state of Missouri

Washington University in St Louis recently launched (2018-19) a BS in Environmental Engineering.

Rationale

There is an increase in demand of Environmental Engineers in the workforce and in student demand for the degree, shown by the enrollment and graduation data from Missouri S&T and testimony from employers (private and public sector) in their letters support of a new program at Mizzou.

MU offers a significant cost advantage with respect to Washington University and particularly for Missouri residents, with annual tuition and fees of \$ 17,800 (resident)/ \$ 38,000 (non-resident) versus \$ 63,000 at WashU.

Collaboration

The new degree program is offered at the undergraduate level, and the department believes it is in the best interest of students and instructional quality for all coursework to be offered in-person and on-campus. Any partnership with S&T in delivering the program would require students to enroll in online courses, which was not deemed desirable by faculty (and students post-COVID).

Feasibility

The faculty in the Department of Civil and Environmental Engineering at Mizzou and MS&T have a long history of collaborations, both in teaching and research. For example, the environmental faculty from both departments participate and organize the Annual Mid America Environmental Engineering Conference (MAEEC), a two-day conference for graduate students in civil and environmental engineering from six regional universities (Southern Illinois University Edwardsville, Washington University in St. Louis, Missouri University of Science and Technology, University of Missouri Columbia, Southern Illinois University Carbondale and Saint Louis University) to share educational experiences and research updates. Hosting responsibilities rotate between the first four participating universities. Other attendees include faculty members, postdoctoral researchers, and keynote speakers. The conference has been held continuously for over 25 years. It is expected that the new program will enhance current collaboration and expand possibilities for the mutual benefit of both programs.

3. Business-Related Criteria & Justification

3.A. Market Analysis

3.A.1. Rationale and Workforce Demand

There is a workforce shortage and dire need for more graduates from Missouri universities. This shortfall is expected to grow because of the investments in infrastructure coming to Missouri through the Infrastructure Investment and Jobs Act (IIJA). The new degree will prepare students to be competitive for jobs in Environmental Engineering in Missouri, regionally, nationally, and internationally through strong connections to the industry, and it will meet market, societal and student demands. In addition, the proposal has received support from government agencies, federal research laboratories, municipal water treatment facilities and industry.

The BS Environmental Engineering program offered at Missouri S&T graduated 28 students in 2021, which constitutes a 33% YOY increase, and a 115% increase with respect to 2012. Historically, the MS&T program has been the only one in the state to produce graduates; Washington University launched a BS Environmental Engineering program in 2018-2019.

The current demand for Environmental Engineers in Missouri and neighboring states (Arkansas, Illinois, Iowa, Kansas, Kentucky, Nebraska, Oklahoma, Tennessee) is slightly below the national average (184 postings per month vs. 224 jobs postings national average in 2021). However, the predicted percentage growth of jobs in Missouri in the next decade exceeds the national average by more than 2 percentage points. Jobs in the Environmental Engineering sector are projected to grow 12.5 % in Missouri by 2032. Five institutions graduated Environmental Engineers in the surrounding nine state region in 2021; (Because Washington University in St Louis and Iowa State launched their programs recently, they had not produced graduates by 2021). The number of graduates (completions) showed a 115% growth for the 2017-2021 period. At the state level, MS&T saw an increase in 33% completions in the year 2021.

The current and forecasted demand do not consider the significant federal and state investments in infrastructure (e.g., renewal of aging water treatment plants), addressing Forever Chemicals, and climate change mitigation. These investments are expected to further increase the need for trained Environmental Engineers in Missouri and the region in the next decade.

According to Bureau of Labor Statistics Occupational Outlook Handbook, there are currently 44,000 Environmental Engineer jobs in the US and the field is expected to grow at 4% over the next decade. The letters of support from public and private sector further reinforce the workforce shortage and need for more environmental engineering graduates in Missouri.

3.A.2. Student Demand for Program

There is currently no pathway at MU for students interested in pursuing a degree program in Environmental Engineering. Engineering students take Environmental electives offered in the Civil & Environmental Engineering department and some enroll in the Engineering Sustainability minor. Over the past several years, Civil & Environmental Engineering students have requested the department add more elective courses in the Environmental area. Some of these courses draw students from other Engineering degree programs (e.g., Chemical Engineering, Biological Engineering), thus showing a sustained interest among current students.

The Bureau of Labor Statistics projects a 4% increase in employment (1,800 additional jobs) for environmental engineers between 2021 and 2031. To fill these jobs, many students will be seeking educational opportunities such as the BS in Environmental Engineering, to prepare them. These jobs are attractive to potential students not only due to the exciting subject matter but also by the median pay reported by the Bureau of Labor Statistics, which is \$96,820 per year. The 2021 national median salary for Environmental Engineers is about \$9,000 higher than the pay of Civil Engineers. Most Jobs are found in the Architectural, Engineering, and Related Services.

Table 1a. Student Enrollment Projections:

Year	1	2	3	4	5
Full-time	15	35	55	80	90
Part-time	0	0	0	0	0
Total	15	35	55	80	90

These projections are based on student demand, market demand, enrollment at other regional universities, and enrollment in related engineering degree programs at MU. MU undergraduate students are primarily enrolled in classes as full-time students, thus we do not anticipate any part time enrollment in the new degree program.

Table 1b. New Student Enrollment Projections:

Year	1	2	3	4	5
Full-time	15	20	20	25	25
Part-time	0	0	0	0	0
Total	15	20	20	25	25

Under steady state, we expect to have 25-30 new students enroll in the degree program each Fall.

Table 1c. Projected Number of Degrees/Certificates Awarded:

Year	1	2	3	4	5	6	7	8	9	10
Completions	0	0	4	13	18	22	25	25	25	25

3.B. Financial Projections

3.B.1. Additional Resources Needed

The new program will leverage existing resources and does not require significant additional funding to be successful. There are sufficient number of full-time faculty in the Environmental Engineering area to teach the required and elective courses listed in the degree program. The department has excellent lab infrastructure to support lab courses.

The program will be delivered using the current teaching capacity in the department; no new full time faculty hires are required. Three additional Graduate Teaching Assistants are requested due to the projected increase in enrollment in courses with laboratory sections as well as additional capacity in the advising/student support office at the College of Engineering.

Salary for one instructor (adjunct) is included in the estimated expenses to offer courses when full-time faculty are released from teaching assignments, in case of research leave, extraordinary service appointments, involvement in large research proposals or projects, or emergencies. Salary for advising/student support staff is included, at a rate of 1/3 person to support the additional enrollment projected at steady state (90 students). A 4% annual increase in salaries is considered for the analysis. The overall expense is estimated to be \$175,000 per year. Additional resources, outlined below, are low and will be offset by new revenues.

- 1) Three teaching assistants (0.25 for CV ENG 3200, 0.5 for CV ENG 3700, 0.25 for CV ENG 3702, and 0.5 for CV ENG 4980)
- 2) Adjunct instructor for two courses
- 3) Additional capacity in the advising/student support office at the College of Engineering

3.B.2. Revenue

The source of revenue for this program is exclusively student tuition. Based on the enrollment projection presented above, the total revenue in year one using in-state tuition and fees will be \$420,646; and increasing to \$1,115,974 in year five. At the steady state, the total revenue from the BS in Environmental Engineering will be \$1,161,059 per year. These estimates are new revenues to MU due to the creation of the program (not students switching from other degree programs).

In addition to revenue generated from new students, the expansion of Environmental Engineering courses that support the new degree program will also likely lead to students from other degree programs enroll in those courses. Elective courses that support the online MS program in Civil Engineering (Environmental emphasis) are also available for students from other UM campuses.

3.B.3. Net Revenue

According to the Financial Projections Spreadsheet, revenues will exceed expenses for this program from year 1, including under a 50% enrollment scenario. No new faculty lines or increase in technical personnel are requested. The program will benefit from all services and resources currently available to engineering programs at MU. These include computer services, library, marketing campaigns, etc. No additional space is requested; practical learning will use space and equipment

currently used for the Environmental Teaching lab in the Civil and Environmental Engineering department.

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

	Year 1	Year 2	Year 3	Year 4	Year 5
1. Expenses per year					
A. One-time					
<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
Total one-time	0	0	0	0	0
B. Recurring					
<i>Faculty</i>	0	0	0	0	0
<i>Staff (teaching support)</i>	178,500	182,070	185,711	189,426	193,214
<i>Advising staff</i>	17,000	17,340	17,687	18,041	18,401
<i>Benefits</i>	62335	62335	62335	62335	62335
<i>Equipment</i>	0	0	0	0	0
<i>Library</i>	0	0	0	0	0
<i>Other (teaching lab supplies)</i>	5000	5000	5000	5000	5000
Total recurring	\$270,137	\$275,440	\$280,849	\$286,366	\$291,993
Total expenses (A+B)	\$270,137	\$275,440	\$280,849	\$286,366	\$291,993
2. Revenue per year					
<i>Tuition/Fees</i>	667,692	1,026,459	1,526,442	1,736,654	1,771,387
<i>Institutional Resources</i>	(247,046)	(379,790)	(564,783)	(642,562)	(655,413)
<i>State Aid -- CBHE</i>					
<i>State Aid -- Other</i>					
Total revenue	\$420,646	\$646,669	\$961,658	\$1,094,092	\$1,115,974
3. Net revenue (loss) per year	\$150,509	\$371,229	\$680,810	\$807,727	\$823,981
4. Cumulative revenue (loss)	\$348,747	\$719,976	\$1,400,786	\$2,208,512	\$3,032,493

3.B.4. Academic and Financial Viability

Based on the assumptions and estimates in the Financial Projections Spreadsheet, the cumulative direct margin becomes negative if total student enrollment does not reach 18 by Year 5. We estimate a minimum of 5 new students yearly for program viability. The program will be put on a hiatus if the total enrollment does not reach 20 students by the end of the initial 5- year period.

Table 3. Enrollment for Academic and Financial Viability

Enrollment	Minimum for Financial Viability	Minimum for Academic Viability
Full-time	18	40
Part-time	0	0
Total	18	40

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

Strategies

3.C.1. Marketing Plan & Strategy

The College of Engineering recruitment and communications staff will work with campus communications teams to develop print, digital, and other marketing campaigns. This includes direct communications to prospective students, K-12 partners, STEM nonprofits, industry partners, and community members of the college and university.

The Marketing and Communications office will announce the new degree on social media, on their website using search engine optimization, through newsletters sent to prospective students, academic peers, alumni and supporters. They will also incorporate it into printed recruitment pieces and digital and other paid advertising. The college will produce a video to support the degree launch.

The Environmental Engineering degree will be integrated into the College's recruitment brochure and other printed pieces and paid digital advertising, as well as on the College's website, utilizing search engine optimization to make it easier for interested prospective students to find information. A social media campaign around the launch of a program will be tailored to prospective students including the diversity of Environmental faculty in the department, four women faculty (50% of the group), and LED advertising in the building will add to the campaign.

The Environmental Engineering program will be also integrated into recruitment activities currently managed by the College of Engineering, as well as general MU admissions and recruitment activities (e.g., campus tours, college fairs, Meet Mizzou Days, high school visits, and community college visits). There are additional, discipline-specific opportunities to recruit through existing MU events aimed at K-12 and early career undergraduate students, such as Project Lead the Way; Columbia STEM Alliance; and KC STEM Fest. Additional STEM outreach activities will be organized by the Civil & Environmental Engineering department's Water and Environmental Technologists (WET) student team and will advertise the program with various STEM alliances in Missouri (e.g., Kansas City, St. Louis, Columbia).

Marketing Costs

The college has an overall paid advertising campaign including billboards and various digital online campaigns totaling \$150K. While this dollar amount is not solely focused on the new program, a portion would go to announcing it. The college has allocated \$10K for printed recruiting materials which would include this program.

3.C.2. Student Success Plan

The MU College of Engineering has long-standing programs in advising, tutoring and other student services to support student retention. Early alert system through MU Connect will help advisors track student performance and initiate timely interventions. Students will also be encouraged to participate in existing student teams, such as Water and Environmental Technologists (WET) and Engineers Without Borders (EWB). Both are focused on Environmental topics and are active student teams in Engineering that would be of interest to Environmental Engineers.

Achieving Enrollment Outcomes

The Civil & Environmental Engineering department intends to pursue ABET accreditation for the new degree program, which will further enhance visibility and enrollment. The CEE department will review the enrollment each semester and take actions to address any issues that may arise. Placement outcomes will also be tracked annually as is done with other degree programs in the college.

3.C.3. Transition Plan

The Civil & Environmental Engineering Chair will be responsible for the new program, with support from the Director of Undergraduate Studies. Thus, the program responsibility is not attached to particular faculty members but instead assigned to the current department leadership. If these individuals leave the institution or assume other responsibilities, their replacements will be installed following standard procedures for Chair and Director of Undergraduate Studies

nomination in the Department/College of Engineering.

3.C.4. Exit Strategy

The department chair will meet with the Dean each year to review the enrollment, retention, and graduation data for the new degree program. The department requests a five-year period to reach steady state. We estimate total enrollment after the initial five years would reach 90 students. The program will be put on a hiatus if the total enrollment does not reach 40 students by the end of the initial 5-year period. The program will be discontinued if the total enrollment falls below 20 students after year five.

4. Institutional Capacity

The new program is expected to have minimal burden on faculty. Many of the classes that are currently taught as part of the Civil Engineering curriculum will also be offered in the new degree program. Thus, synergies between the two programs, laboratory facilities, and research opportunities for students will be fully exploited. The new program will attract students that will enrich the learning of Civil Engineering students in classes. Academic advising duties will also be overseen by staff that are familiar with other existing Engineering degree programs, thus providing a seamless advising experience for all students.

5. Program Characteristics

5.A Program Outcomes

The (BS) in Environmental Engineering will prepare students to become competitive and marketable environmental engineers licensed in the state of Missouri, nationally or internationally, and to continue to graduate programs in environmental engineering or related fields. Core courses in mathematics, chemistry, physics, biology, mass and energy balances and transport phenomena will prepare students for more advanced work in upper-level courses that include water and wastewater treatment, air pollution, hazardous management, and regulatory compliance.

Learning Objectives

The learning objectives listed below are adapted from the student outcomes and curriculum requirements proposed by American Academy of Environmental Engineers and Scientists and ABET (Accreditation Board for Engineering and Technology) as criteria for accreditation for Environmental Engineering

undergraduate programs.

Students who complete the BS in Environmental Engineering will acquire knowledge in:

- a) mathematics through differential equations, probability and statistics, calculus-based physics, chemistry (including stoichiometry, equilibrium, and kinetics), earth science, biological science, and fluid mechanics;
- b) material and energy balances, fate and transport of substances in and between phases in the environment (air-water-soil).
- c) the design of environmental engineering systems that includes considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts, and
- d) Concepts of professional practice and project management, and the roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations.

Students will develop practical and critical thinking skills through hands-on laboratory experiments and analysis and interpretation of the resulting data in more than one major environmental engineering topic, e.g., air, water, land, environmental health, as well as through completion of the capstone project.

Table 4. Student Learning Objectives:

1	To identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2	To apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3	To communicate effectively with a range of audiences.
4	To recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5	To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6	To develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7	To acquire and apply new knowledge as needed, using appropriate learning strategies.

5.B. Program Design and Content

Curriculum Design

The curriculum was initially designed by a committee formed by the Environmental faculty in the Civil & Environmental Engineering department following criteria for ABET accredited Environmental Engineering programs. The curriculum includes 16 credit hours of math, 29 credit hours of basic sciences, 26 hours of civil engineering or engineering topics, and 24 hours of electives, of which 12 should be civil engineering electives.

The designed proposal was presented to the department faculty and voted in a departmental faculty meeting. The proposal was further presented, discussed and voted at the College faculty meeting and the MU campus Undergraduate Curriculum committee meeting.

Course Sequence

The curriculum includes a sequence of courses in math (MATH 1500, MATH 1700, MATH 2300 and MATH 4100 in this order), physics (PHYSCS 2750, PHYSICS 2760), and chemistry (CHEM 1320, CHEM 1330, and CHEM 2100).

Students start the series of department courses with CV ENG 1000 Introduction to Civil Engineering, and CV ENG 1050 Foundations of Engineering, which are introductory courses part of the freshman year program in the College of Engineering designed to better prepare the incoming students for the discipline specific course sequences.

CV ENG 3010 Decision Methods in Civil Engineering is a writing intensive course that provides the student skills regarding professional registration, ethics, economics and elements of statistics. Students must pass CV ENG 3010 with a C- or better to be enrolled in CV ENG 3200 Fundamentals of Environmental Engineering. A grade of C- or better is required for the students to take the three core Environmental Engineering courses (CV ENG 4290, CV ENG 40001 Air pollution and CV ENG 4220). The C- or better requirement ensures students have a solid understanding of the fundamentals of the professional and technical aspects of environmental engineering.

A figure showing a map of how the courses are sequenced within the curriculum is attached. This is provided as merely a template for how a student might move through the curriculum. The solid lines show strict prerequisites and the dashed lines indicate co-requisite paths. Minimum grade requirements are also shown when applicable.

No new courses are proposed to be developed for this program. The core and elective courses are all existing courses (as technical electives) in the Civil

Engineering program.

The syllabi of two electives recently added to the Civil Engineering program are attached: CV ENG 4001 Data analysis/modeling in Environmental Engineering; CV ENG 4001 Air pollution control engineering. These courses have been taught for the first time as topics courses in Spring 2023 and permanent course numbers will be assigned in 2023.

5.C. Program Structure

General Description

This program requires a total of 125 credit hours for completion. The curriculum includes 16 credit hours of mathematics, 29 credit hours of basic sciences, 9 credit hours of core environmental engineering courses, 39 credit hours of civil engineering topics/electives and 9 engineering electives. A 3 credit hours course meets the capstone requirement.

Program Requirements

The BS in Environmental Engineering requires a total of 125 credit hours for completion. Students earning a Bachelor of Science in Environmental Engineering are required to complete all University general education, University undergraduate requirements, degree, and major requirements, including selected foundational courses, which may fulfill some University general education requirements.

Students are introduced to Environmental Engineering and professional engineering design practices in the CV_ENG 1000 course. Basic science and engineering courses ground the students in the fundamentals necessary for future course work: biology (BIO SCI 1500), general chemistry (CHEM 1320 and 1330), organic chemistry (CHEM 2100), physics (PHYSCS 2750 and 2760), soil science (SOIL 2100) and thermodynamics (ENG 2300).

Students are also required to complete one 3-hour cultural awareness course which is selected from an approved cultural awareness course list, created and maintained by the College of Engineering or which meets a similar Arts and Science (A&S) requirement.

Engineering topics required courses impart general engineering foundations necessary for the discipline-specific courses. Civil Engineering topics required courses in the sophomore and junior years provide students with the basic fundamentals in the areas of environmental engineering (CV ENG 3200), water resources (CV ENG 3702), data analysis and modeling (CV ENG 4001), fluid mechanics (CV ENG 3700), water (CV ENG 4290), air (CV ENG 4001) and solid waste

(CV ENG 4220) pollution and control.

Civil Engineering elective courses provide students opportunity to specialize in different aspects of environmental engineering and water resources. With the Program elective courses, students may further focus on environmental engineering or opt for one of the three tracks: public health and emerging contaminants, big data and data analysis or, biological and agricultural engineering.

Design and communication skills are integrated throughout the curriculum culminating in a capstone design project. This "final" course requires working in teams, making oral and written presentations, and completing a final design report. Oversight, interaction, and evaluation are provided by practicing engineers from industry and governmental organizations.

Major Core Requirements:

Math (16 credit hours)

MATH 1500 Analytic Geometry and Calculus I	5
MATH 1700 Calculus II	5
MATH 2300 Calculus III	3
MATH 4100 Differential Equations	3

Basic Sciences (29 credit hours)

CHEM 1320 College Chemistry I	4
CHEM 1330 College Chemistry II	4
CHEM 2100 Organic Chemistry I	3
PHYSICS 2750 University Physics I	5
PHYSICS 2760 University Physics II	5
BIO_SC 1500 Intr. to Biological Systems with Lab	5
SOIL 2100 Introduction to Soils	3

Engineering Topics – General (5 credit hours)

ENGINR 1050 Foundations of Engineering	2
ENGINR 2300 Engineering Thermodynamics	3

Civil Engineering Topics (30 credit hours)

CV_ENG 1000 Introduction to Civil Engineering	1
CV_ENG 3200 Fundamentals of Environmental Eng	4
CV_ENG 3010 Decision Methods for Civil Engineering Design	3
CV_ENG 3700 Fluid Mechanics	3
CV ENG 4001 Data Analysis and Modeling in Environmental Engineering	3
CV_ENG 3702 Fundamentals of Water Resources Engineering	4
CV ENG 4290 Water and Wastewater Treatment Engineering	3
CV ENG 4220 Hazardous Waste Management	3
CV ENG 4001 Air Pollution Control Engineering	3
CV_ENG 4980 Civil Engineering Systems Design	3

Civil Engineering Electives (12 credit hours – any four courses from the below list)

CV ENG 4270 Environmental Engineering Microbiology	3
CV ENG 4250 Environmental Regulatory Compliance	3

CV ENG 4286 Environmental Sustainability	3
CV ENG 4230 Water Quality Analysis	3
CV ENG 4700 Hydraulics of Open Channels	3
CV ENG 4730 Hydraulic Design	3
CV ENG 4990/4995 Undergraduate research	3
CV ENG 4720 Watershed Modeling Using GIS (BIOL EN 4350)	3
CV ENG 4740 Irrigation and Drainage Engineering (BIOL EN 4250)	3

Program Electives (12 credit hours - any four courses from the below list of general electives or tracks)*

BIOL EN 4001 Observing Earth from Space	3
CV_ENG 3600 Civil Engineering Materials	4
ENGINR 2100 Circuit Theory	3
ATM_SC 3600 – Climates of the World	3

Students may choose one of the following tracks; 3 courses from the student's selected track + 1 additional elective courses from the CV ENG electives or Program electives lists

Public health and emerging contaminants

P_HLTH 4350 Principles of Environmental Health for Public Health

P_HLTH 3560: Public Health and Environmental Justice

P_HLTH 4620 Climate Change and Human Health

Data analytics and big data

STAT 4710 Intro to Math Statistics

STAT 4510/4520 Applied statistical model I and II

STAT 4870 Time series analysis

Biological and agricultural engineering (**)

CV ENG 4710 Soil and Water Conservation Engineering

CV ENG 4720 Watershed Modeling Using GIS (BIOL EN 4350)

CV ENG 4740 Irrigation and Drainage Engineering (BIOL EN 4250)

(*) any of the above listed CV ENG ELECTIVES may also be chosen, but will only count towards one requirement

(**) courses in the bio/agricultural track may change based on availability of offering

SEMESTER PLAN

First Year:

FALL : 15 credit hours

MATH 1500 Analytic Geometry and Calculus I (5)

CHEM 1320 College Chemistry I (4)

BIO_SC 1500 Intr. to Biological Systems with Lab (5)

CV_ENG 1000 Introduction to Civil Engineering (3)

SPRING: 17 credit hours

MATH 1700 Calculus II (5)

Social Behavior Science or Humanities/Fine Arts Course (3)

CHEM 1330 College Chemistry II (4)

ENGLSH 1000 Writing and Rhetoric (3)

ENGINR 1050 Foundations of Engineering (2)

Second Year:

FALL: 17 credit hours

MATH 2300 Calculus III (3)
CV_ENG 3010 Decision Methods for Civil Engineering Design (3)
Social Behavior Science or Humanities/Fine Arts Course (3)
PHYSICS 2750 University Physics I (5)
CHEM 2100 Organic Chemistry I (3)

SPRING: 18 credit hours

MATH 4100 Differential Equations (3)
CV_ENG 3200 Fundamentals of Environmental Engineering (4)
PHYSICS 2760 University Physics II (5)
CV_ENG 3700 Fluid Mechanics (3)
Social Behavior Science or Humanities/Fine Arts Course (3)

Third Year:

FALL: 15 credit hours

SOIL 2100: Introduction to Soils (3)
ENGINR 2300 Engineering Thermodynamics (3)
CV ENG 4001 Data analysis/modeling in Environmental Engineering (3)
Social Behavior Science or Humanities/Fine Arts Course (3)
CV_ENG ELECTIVE (3)

SPRING: 13 credit hours

CV_ENG ELECTIVE (3)
ELECTIVE (3)
CV ENG 4290 Water and WW treat. Eng (3)
CV_ENG 3702 Fundamentals of Water Resources Engineering (4)

Fourth Year:

FALL: 15 credit hours

CV ENG 4220 Hazardous Waste Manag (3)
CV_ENG ELECTIVE (3)
ELECTIVE (6)
Social Behavior Science or Humanities/Fine Arts Course (3)

SPRING: 15 credit hours

CV_ENG 4980 Civil Engineering Systems Design (3)
CV ENG 4001 Air pollution control engineering (3)
CV_ENG ELECTIVE (3)
ELECTIVE (3)
Social Behavior Science or Humanities/Fine Arts Course (3)

Permanent course numbers for the 4000-level courses Air Pollution Control Engineering and Data Analysis and Modeling in Environmental Engineering will be sought.

LIST OF ENGINEERING ELECTIVES

ENVIRONMENTAL

CV ENG 4270 Env Engineering Microbiology	3
CV ENG 4250 Env Regulatory Compliance	3
CV ENG 4286 Environ. Sustainability	3
CV ENG 4230 Water Quality Analysis	3

WATER RESOURCES

CV ENG 4700 Hydraulics of Open Channels	3
CV ENG 4730 Hydraulic Design	3
CV ENG 4720 Watershed Modeling Using GIS (BIOL EN 4350)	3
CV ENG 4740 Irrigation and Drainage Engineering (BIOL EN 4250)	3
BIOL EN 4001 Observing Earth from Space	3
CV ENG 4990/ 4995 Undergraduate Research	3
CV_ENG 3600 Civil Engineering Materials	4
ENGINR 2100 Circuit Theory	3

Residency requirements:

MU requires that 30 of a student's last 36 credits must be MU course work. Missouri Online-Self Paced courses authored by MU faculty are acceptable as are courses offered for credit through Missouri Online. Courses from a community college can account for six of the last 36 credits.

Internship, thesis or other capstone:

A capstone project will conclude Environmental Engineering education at MU. These capstone projects provide a culminating experience for students by applying the various concepts and design procedures they have learned in their classes. Students work together in teams to study real-world challenges and offer recommendations to address them. The experience gives students the hands-on preparation they need to be successful after graduation.

Unique features:

N/A

Admission Requirements:

The Office of Admissions (Admissions) specifies the requirements for admission into the University of Missouri-Columbia (MU) and is responsible for maintaining and publishing these requirements. Admissions is also responsible for applying the published requirements to students seeking admission to the University. The published requirements can be found at <https://admissions.missouri.edu/requirements/>

In addition to campus admission requirements, freshmen entering in College of Engineering (COE) degree programs are expected to have completed 17 units of approved high school course work (in grades 9-12), including 4 units in English, 4 in mathematics and 3 in science with laboratory. Mathematics should include 2 units of algebra, 1 unit of plane and solid geometry (combination course), and 1/2 unit of trigonometry. Additional senior mathematics is recommended.

Students satisfying requirements to be admitted into the College of Engineering will be directly admitted into the Environmental Engineering Program. Detailed requirements for individual programs in the College of Engineering are available on the college website at: <http://catalog.missouri.edu/collegeofengineering/#admissions>

5.D. Program Assessment

Assessment Learning Outcomes

The process for assessing learning outcomes will use direct and indirect measurements to assess the ability of our graduates.

Direct measures include targeted course assessments every semester and the evaluation of the capstone design projects by external readers participating in the course, practitioner/client/alumni.

Indirect measurements include an exit outcome survey by graduating seniors every semester, the Fundamentals of Engineering (FE) exam result, and surveys of Alumni, Employers, and Faculty. Data for each assessment tool will be collected every semester, except for the surveys of Alumni, Employers and Faculty, that will be conducted once every three years.

Continuous improvement will be a key component of the proposed degree program. We will utilize a six-step approach which includes:

- 1) conducting student outcome assessments,
- 2) combining assessment results by outcome,
- 3) evaluating results with program constituents and stakeholders,
- 4) developing action plans and new targets,
- 5) implementing action plans, and
- 6) reviewing actions and modifying student outcome assessment approach.

This annual cycle is also critical to the ABET accreditation process that the department will seek at the end of the fifth year after program launch.

Retention and Graduation Rate Goals

The current 2-year retention rate of students in the Civil Engineering degree program is 93.8%. The initial goal for the Environmental Engineering degree program is to reach or exceed 94%. The two freshmen Engineering courses required in the program will focus on best practices and strategies to succeed in the degree program. Based on the success of Civil Engineering, which had a 4-year graduation rate of 100%, an initial goal for the 4-year graduation rate for the Environmental Engineering program will be 80%.

Another goal of the program will be to support students in acquiring licensure. While entry level Environmental Engineering jobs do not require licensure, a professional engineer license is often required for career advancement. As is the current practice for Civil Engineering students, students in the Environmental Engineering degree program will be encouraged to take the first licensure exam in their senior year. After passing the first exam, candidates must acquire five years of qualifying work experience and clear a second exam to become a licensed professional engineer.

Other Measures of Success

Other measures of success will be derived from exit interviews and outcome surveys of graduates, and alumni and employer surveys, as described in the sections below.

5.E. Student Preparation

The major will serve a broad population, and there will be no special admissions or student qualifications required that exceed regular university standards. There is no specific preparation recommended for students entering this program to ensure success. Additional opportunities for college readiness are also available.

Admitted students are invited to join the Mizzou Engineering Summer Bridge program and to get a head start on their college experience. The Summer Bridge Program is an eight-week summer session in which the students live in a residence hall, take a prerequisite course (if student did not place in MATH 1500), attend workshops and enjoy social activities to get familiar with Mizzou, the College of Engineering and Columbia. Courses offered in the Summer 2023 program include MATH 1160 Precalculus; CHEM 1320: College Chemistry; and CMP_SC 1050: Algorithm Design and Programming. This program is presented by Mizzou's Center for Academic Success & Excellence (CASE) and the College of Engineering.

5.F. Faculty and Administration

The Chair (Dr. Praveen Edara) of the Civil and Environmental Engineering department, with support from the Director of Undergraduate Studies (Dr. Sarah Orton), will be responsible for the success of this program. The CEE Chair will dedicate 25% of time to the program. Core teaching activities will be supported by eight tenured/tenure-track faculty (Table 5) and two additional instructors. In addition to the eight core Environmental faculty, elective courses taught by other Civil Engineering faculty will also be available to students. 90% of the program's credit hours will be taught by full-time faculty, who hold either a Ph.D., a professional engineer (P.E.) license or both.

Table 5: Faculty Listing

Name	Position	Percentage of Time Dedicated to Program
1) Baolin Deng, PhD	William Andrew Davidson Professor	40%
2) Maria Fidalgo, PhD	Associate Professor, Director of Graduate Studies	40%
3) Zhiqiang Hu, PhD, P.E.	William Andrew Davidson Professor	40%
4) Tim Matisziw, PhD	Professor	15%
5) Maryam Salehi, PhD	Assistant Professor	40%
6) Kathleen Trauth, PhD, P.E.	Associate Professor, IDE Fellow	40%
7) Binbin Wang, PhD	Assistant Professor	40%
8) Feng "Frank" Xiao, PhD, P.E.	Associate Professor	40%

5.G. Alumni and Employer Survey

Alumni Survey

We will conduct surveys of the graduating class, faculty, alumni and employers, following methods already established in the BS Civil Engineering program.

Each senior will be asked to fill out a survey at the end of the semester in which they graduate. Exit interviews with the Director of Undergraduate Studies will also be conducted for graduating seniors to obtain additional feedback about the program experiences and career preparedness. The results will be compiled and discussed at a faculty meeting each semester.

Employer Survey Plans

In addition to the student survey, a similar survey will be sent to faculty, alumni and employers. The survey will be administered in an approximate 2-year cycle and reviewed by the faculty after completion. Data will be collected and stored on the departmental OneDrive account for use in accreditation preparation.

5.H. Accreditation

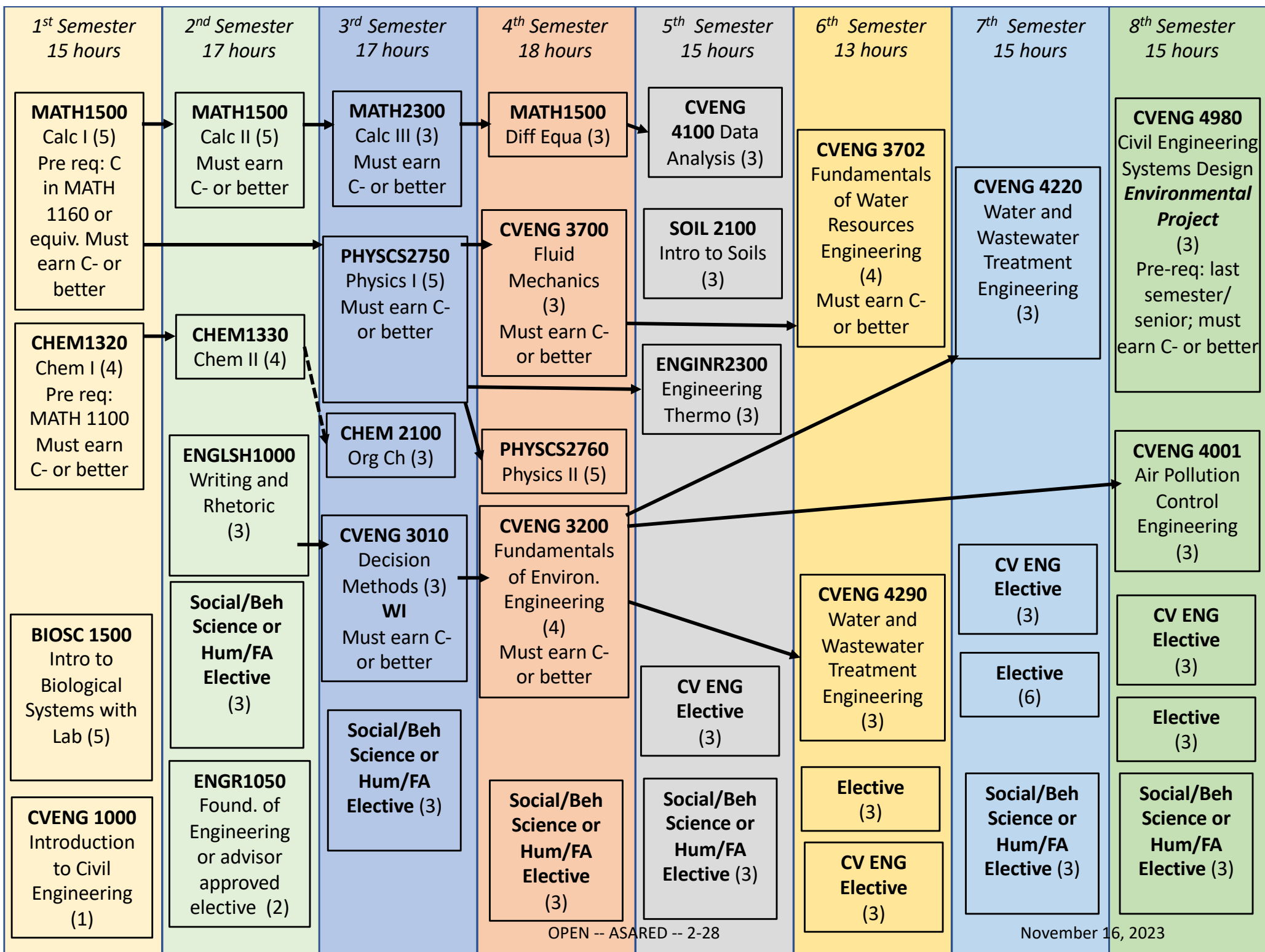
The department will seek accreditation from Accreditation Board for Engineering and Technology (ABET), the accreditation board that accredits other Engineering degree programs at MU, in the second year of the program.

6. Appendices

- Appendix 1. Course Map (page 28)
- Appendix 2. Pro Forma (page 29)
- Appendix 3. Letters of Support (page 30)

Appendix 1

Course Map



Appendix 2

Pro Forma

New Degree Program Pro Forma

Records

Proposed program: **BS Environmental Engineering**
 University: **University of Missouri Columbia**
 College: **Engineering**
 Submitted: **Jun 1st 2023**
 Preparer: **Maria Fidalgo**

Reviewed by College Fiscal Officer:
 Reviewed by University-Level Fiscal Officer

7/3/2023
 6/2/2023

Fiscal Officer Name: **Melissa Amos-Landgraf**
 Fiscal Officer Name: **Todd Mackley**

PROGRAM:	Year 0 FY24	Year 1 FY25	Year 2 FY25	Year 3 FY26	Year 4 FY27	Year 5 FY28	Year 6 FY29	Year 7 FY30
Enrollment Projections								
Head Count Students - <i>new incoming</i> or transfer to BSEE	15	35	55	80	90	90	90	90
Non-Resident	2	2	2	3	3	3	3	3
Tuition Rate/YR	16,600	16,932	17,271	17,616	17,968	18,328	18,694	19,068
Non-Resident - est 10%	36,800	37,536	38,287	39,052	39,834	40,630	41,443	42,272
Tuition Discount Rate (%)	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
Scholarship Allowances (\$)								
Revenue Projections								
Tuition	322,600	667,692	1,026,459	1,526,442	1,736,654	1,771,387	1,806,815	1,842,951
Supplemental & Other Fees								
Scholarship Allowances	(119,362)	(247,046)	(379,790)	(564,783)	(642,562)	(655,413)	(668,522)	(681,892)
Net Tuition and Fees	203,238	420,646	646,669	961,658	1,094,092	1,115,974	1,138,293	1,161,059
Other Income								
TOTAL PROGRAM REVENUE	\$203,238	\$420,646	\$646,669	\$961,658	\$1,094,092	\$1,115,974	\$1,138,293	\$1,161,059
Recurring State Support								
TOTAL REVENUE	\$203,238	\$420,646	\$646,669	\$961,658	\$1,094,092	\$1,115,974	\$1,138,293	\$1,161,059
Expenditure Projections								
Faculty Salaries								
<i>no new hires</i>								
Technical Salaries								
<i>detail</i>								
Support Salaries								
<i>Adjunct Instructor _ 3 GTA</i>		\$ 178,500	\$ 182,070	\$ 185,711	\$ 189,426	\$ 193,214	\$ 197,078	\$ 201,020
<i>Advising/student support</i>		\$ 17,000	\$ 17,340	\$ 17,687	\$ 18,041	\$ 18,401	\$ 18,769	\$ 19,145
Total Salaries	-	195,500	199,410	203,398	207,466	211,615	215,848	220,165
Benefits	-	69,637	71,030	72,450	73,899	75,377	76,885	78,423
Subtotal Salaries and Benefits	-	\$265,137	\$270,440	\$275,849	\$281,366	\$286,993	\$292,733	\$298,587
Operating Expense								
Computing Expenses								
NonCapital Maintenance & Repair								
Noncapital Equipment								
Supplies	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Professional & Consulting								
Travel & Training								
Misc. Expenses								
Subtotal Operating Expense	5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
One-time Expenditures (Startup Costs)								
Additional Space Costs								
Subtotal One-time Expense	\$ -	\$0	\$0	\$0	\$0	\$0	\$0	\$0
TOTAL EXPENDITURES	\$5,000	\$270,137	\$275,440	\$280,849	\$286,366	\$291,993	\$297,733	\$303,587
DIRECT MARGIN	\$198,238	\$150,509	\$371,229	\$680,810	\$807,727	\$823,981	\$840,561	\$857,472
CUMULATIVE DIRECT MARGIN	\$198,238	\$348,747	\$719,976	\$1,400,786	\$2,208,512	\$3,032,493	\$3,873,054	\$4,730,526
Subtract:								
Revenue from Transfers within Campus								
NET MARGIN TO THE CAMPUS	\$198,238	\$150,509	\$371,229	\$680,810	\$807,727	\$823,981	\$840,561	\$857,472
CUMULATIVE NET MARGIN TO THE CAMPUS	\$198,238	\$348,747	\$719,976	\$1,400,786	\$2,208,512	\$3,032,493	\$3,873,054	\$4,730,526
Campus Overhead Allocation - 10%	20,324	42,065	64,667	96,166	109,409	111,597	113,829	116,106
MARGIN AFTER CAMPUS OVERHEAD	\$177,914	\$108,444	\$306,562	\$584,644	\$698,317	\$712,384	\$726,731	\$741,366
CUMULATIVE MARGIN AFTER CAMPUS OVERHEAD	\$177,914	\$286,358	\$592,921	\$1,177,564	\$1,875,882	\$2,588,265	\$3,314,997	\$4,056,363

Appendix 3

Letters of Support

June 30, 2023

Roger Fales, PhD
College of Engineering
University of Missouri

Dear Dr. Fales:

As Dean of the College of Health Sciences (CHS), I am writing to confirm my strong support of the proposed BS in Environmental Engineering degree program in the College of Engineering. We are excited to be an active part of the Public Health and Emerging Contaminants track as described in the proposal. As described in the attached email communication between the Senior Associate Dean of CHS and Department Chair of the degree program, we will be willing to enroll students from the new degree program into the following three elective courses - P_HLTH 4350 Principles of Environmental Health for Public Health, P_HLTH 3560: Public Health and Environmental Justice, and P_HLTH 4620 Climate Change and Human Health.

Sincerely,

A handwritten signature in black ink, appearing to read "Kristofer J. Hagglund". The signature is fluid and cursive, with the first name "Kristofer" and last name "Hagglund" clearly distinguishable.

Kristofer J. Hagglund
Dean

May 24, 2023

To Whom It May Concern:

I am writing this letter on behalf of EFK Moen, LLC, to strongly support the University of Missouri College of Engineering's proposal to start a Bachelor of Science in Environmental Engineering degree program.

EFK Moen is a 60-person civil engineering design firm with several offices in the St. Louis region, an office in Chicago and an office in Atlanta. We provide engineering and professional land surveying services to clients in many midwestern states, primarily on highway and bridge projects.

EFK Moen, and our industry in general, is in need of more engineers with an interest in preserving and/or efficiently rehabilitating our infrastructure system. Nearly every project we work on includes environmental impact assessments and/or stormwater management systems. We also need to reassess our stormwater predictive models to adapt to changing climate conditions. As our transportation system ages, projects that will rebuild the system will need responsible civil and environmental engineers that are good stewards of our natural resources.

Many of the students we speak with are very interested in sustainability and environmental aspects of engineering. Developing this distinct curriculum may attract more students to engineering, which will greatly benefit our industry. The engineering workforce is not large enough to meet the current demands, let alone the demands of the future. Missouri's Legislature has allocated funding to add a third lane to I-70 across the state, in addition to the expanded Federal funding coming to Missouri through the Infrastructure Investment and Jobs Act (IIJA). EFK Moen alone has nine job openings and it takes longer and longer for us to fill these openings with qualified candidates.

As a civil engineering graduate of Mizzou's College of Engineering, active in Civil Engineering Alumni groups, I know the faculty well and am confident they will build and deliver a quality program for the Environmental Engineering degree. The Civil and Environmental Department has several faculty members with experience in water resources and a water resource research center that will be a strong foundation for a stand-alone Environmental Engineering degree program.

As a member and former Board Chair of the American Council of Engineering Companies of Missouri, I have seen the environmental engineering industry's rapid growth, and we are looking for qualified engineers to do the expanded volume of environmental/water resources/waste management work.

It is exciting to see that the Mizzou College of Engineering is responding to these changing needs by exploring a new separate Environmental Engineering degree, and I support the effort!

Sincerely,



Linda Moen, P.E., LEED AP BD+C, ENV SP
President



**Metropolitan
St. Louis Sewer
District**

2350 Market Street
St. Louis, MO 63103-2555
(314) 768-6200

May 24, 2023

Praveen Edara, Ph.D., P.E.
Department Chair and Professor
Civil and Environmental Engineering
E 2509 Lafferre Hall
Columbia MO 65211

Dear Professor Edara:

It is my pleasure write a letter in support of the proposal for a BS in Environmental Engineering Program at the University of Missouri.

The need for environmental engineers in the water/wastewater industry has never more crucial then today. Particularly in the St. Louis area. Since Covid we have seen limited availability of not just experienced engineers, but new graduates. An expanded program at the University of Missouri would enhance the Civil and Environmental opportunities for our local high school graduates.

In conclusion, the Metropolitan St. Louis Sewer District fully supports the efforts you are undertaking to enhance your programming. I wish you luck in your endeavor.

Sincerely,

Richard L. Unverferth, P.E.
Director of Engineering
Metropolitan St. Louis Sewer District

June 5, 2023

Baolin Deng, William A. Davidson Professor
Department of Civil & Environmental Engineering
Co-Director, Missouri Water Center
E2509 Lafferre Hall
University of Missouri, Columbia, MO 65211

Dear Mr. Deng:

The Missouri Department of Transportation (MoDOT) is in total support of the University of Missouri's proposal to start a BS in Environmental Engineering degree program.

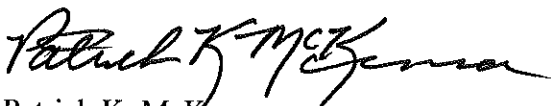
The Environmental review of our work is a critical path item for MoDOT to accomplish our Mission of providing a world-class transportation system that is safe, innovative, reliable and dedicated to a prosperous Missouri. There is an ever increasing need for our work to be environmentally friendly, sustainable and resilient.

MoDOT employs Environmental Professionals across the state and we rely on our partners having that expertise when we contract work out. Also, the resource agencies we rely on for environmental review are in need of Professionals in the environmental field.

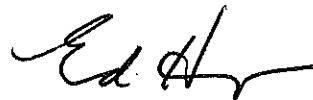
The transportation program in Missouri has grown significantly with the increase of the state gas tax, the federal Bipartisan Infrastructure Law and historic state general revenue dedicated to transportation. All of this combined will increase the demand for professionals in the environmental engineering field for years to come.

MoDOT has a great partnership with the University of Missouri System. We are an employer of your graduates; we provide internships for your students and we have a great research partnership with the Missouri Center for Transportation Innovation. This new degree program would enhance our ongoing partnership.

Sincerely,



Patrick K. McKenna
Director



Ed Hassinger, P.E.
Deputy Director/Chief Engineer



Our mission is to provide a world-class transportation system that is safe, innovative, reliable and dedicated to a prosperous Missouri.

www.modot.org

OPEN -- ASARED -- 2-33

November 16, 2023



United States Department of the Interior

U. S. GEOLOGICAL SURVEY

Columbia Environmental Research Center
4200 New Haven Road
Columbia, Missouri 65201

May 26, 2023

To whom it concerns:

I am writing this letter to express my strong support for University of Missouri's proposal to start a BS in Environmental Engineering degree program.

I am the Center Director (Acting) of the USGS Columbia Environmental Research Center (CERC). The Center is the premier research facilities within the USGS dedicated to conducting cutting-edge environmental research, particularly focused on aquatic biology and ecosystems, pollutant monitoring and toxicity assessments, and hydraulics and hydrology. CERC's expertise and contributions play a crucial role in the nation in advancing scientific understanding, informing environmental management practices, and supporting evidence-based policies to protect and preserve natural resources. Our scientists and engineers work on projects across the nation to support local, state, and federal resource agencies. We employ approximately 125 scientists and staff from Columbia. For more information about CERC you can go here: <https://www.usgs.gov/centers/columbia-environmental-research-center>

The success of USGS, more specifically CERC, relies on its ability to hire and retain a highly capable workforce in accomplishing its mission. We expect a significant increase in hiring in the next decade those with environmental engineering degrees. The BS in Environmental Engineering Program proposed by the MU College of Engineering is a timely addition for the workforce training in a field essential to the operation and growth of CERC. It builds on their well-established MS and PhD graduate programs in the Department of Civil and Environmental Engineering and open a new degree option to students who have an inspiration to addressing major environmental issues at the undergraduate level. I've reviewed their sample curriculum and believe this program will quip students with foundational knowledge, hands on experience, and critical thinking skills to address environmental challenges and support CERC's efforts in understanding and managing aquatic ecosystems.

Scientists and engineers at CERC have been collaborating with the University of Missouri for research for decades, and we co-advise students on campus and hire many MU graduates. I have been collaborating with multiple Environmental Engineering faculty members for research. I have no doubt with their expertise and experience, they will deliver a strong BS in Environmental Engineering Program.

Best regards,

Jeffery A. Steevens, Ph.D.
Supervisory Research Toxicologist and Acting Center Director



MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

Michael L. Parson
Governor

Dru Buntin
Director

May 30, 2023

To Whom It May Concern:

I am writing this letter to express strong support for University of Missouri's proposal to start a Bachelor of Science in Environmental Engineering degree program.

The Missouri Department of Natural Resources (DNR) protects our air, land, water, and mineral resources; preserves our unique natural and historic places; and provides recreational and learning opportunities; while promoting the environmentally sound and energy-efficient operations of businesses, communities, agriculture, and industry for the benefit of all Missourians.

Professional Engineers are essential members of the DNR team, and perform work of varied complexity. DNR's Professional Engineers wear many hats, including:

- Serving as a technical resource and member of project teams, which requires independence in the interpretation and broad application of engineering knowledge, relevant policies, regulations, and engineering standards;
- Managing project budgets and resources;
- Conducting inspections and establishing corrective courses of action;
- Developing moderately complex designs involving the analysis and consideration of multiple design options;
- Serving as an expert witness and a source of testimony;
- Serving as specialty representative for relevant engineering disciplines to internal and external entities; and
- Providing technical guidance to other DNR team members.

While the only constant is change, something that is nearly certain is that DNR will continue to need talented engineers. As long as there is a need to continue to serve the Department's mission of protecting and preserving Missouri's resources, there will be an enduring need for Professional Engineers.

DNR enjoys many productive partnerships with our partners at the University of Missouri and we look forward to expanding our collaborative efforts even further through this new degree program. Please feel free to contact me at 573-522-6221, with any questions or for additional information.

Sincerely,

Dru Buntin
Director

Executive Summary
New Degree Program: PhD in Bioengineering
Missouri University of Science and Technology

Bioengineering is one of the fastest-growing sectors of employment and has seen significant increases in R&D investments by governmental agencies, foundations, and industry. The proposed bioengineering PhD program at Missouri S&T aims to provide students with advanced education and research opportunities in the interdisciplinary field of bioengineering. The importance of the bioengineering PhD program extends from the university level to the state and national levels. Establishing a bioengineering PhD program at Missouri S&T will not only enhance the University's research portfolio and academic reputation but will also help in developing the workforce for bioengineering jobs, which contribute greatly to the growth and economic development of Missouri and the nation.

Evidence of employer and student demand for the program is strong. A market and demand analysis performed using Lightcast™ demonstrates the need for a sizable workforce in bioengineering and biomedical engineering at the PhD level nationally and in Missouri. There were 2,202 jobs for bioengineers and biomedical engineers in 2022, with these fields projected to grow by 15.4% over the next decade (2022-2032). Critically, the projected growth for the next 10 years is 11.1% in the states of Missouri and Illinois. In addition, there is high local student demand for a bioengineering PhD program at Missouri S&T. Out of 34 surveyed BS or MS students in our Biology and Chemical Engineering degree programs, 18 expressed interest in pursuing a bioengineering PhD degree if it were available. This was particularly the case among students with a BS in chemical engineering with biochemical engineering emphasis (10 out of 13 respondents) and students pursuing an MS in biological sciences (6 out of 9 respondents). The economic feasibility of the program is supported by the high demand for bioengineers in various industries, such as pharmaceuticals, biotechnology, and medical devices. The growth of these industries in the region and nationally will provide ample job opportunities for graduates with advanced degrees, attracting more students to the program (see letters of support).

Upon completing the bioengineering PhD program at Missouri S&T, graduates will possess a strong foundation in bioengineering principles and advanced research skills. Specifically, students will be expected to demonstrate a comprehensive understanding of core bioengineering concepts. The new bioengineering Ph.D. program is anticipated to enhance our faculty's research opportunities, particularly for NIH-sponsored programs. Given that the NIH's FY23 budget of \$48.9 billion vastly outweighs the NSF's \$10.9 billion, our program will strengthen our competitiveness for these significant resources and foster growth in the critical field of bioengineering research.

In conclusion, the proposed bioengineering PhD program at Missouri S&T is well-positioned to meet the growing demand for advanced education and research in this interdisciplinary field. The program will not only benefit the University by attracting top talent and enhancing its research capabilities but also contribute to the economic growth of the state and nation.

No. 3

Recommended Action – PhD in Bioengineering

Missouri University of Science and Technology

It was recommended by the University of Missouri System Office of Academic Affairs, endorsed by President of the University of Missouri Mun Y. Choi, recommended by the Academic, Student Affairs and Research & Economic Development Committee, moved by Curator_____, seconded by Curator_____ that the following action be approved:

that the Missouri University of Science and Technology be authorized to submit the attached proposal for a PhD in Bioengineering to the Coordinating Board for Higher Education for approval.

Roll call vote of the Committee:

YES

NO

Curator Blitz

Curator Graves

Curator Layman

Curator Sinquefield

The motion _____.

Roll call vote of Board:

YES

NO

Curator Blitz

Curator Brncic

Curator Fry

Curator Graves

Curator Holloway

Curator Layman

Curator Sinquefield

Curator Wenneker

Curator Williams

The motion_____.

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Executive Summary

Bioengineering is one of the fastest-growing sectors of employment and has seen significant increases in R&D investments by governmental agencies, foundations, and industry. The proposed bioengineering PhD program at Missouri S&T aims to provide students with advanced education and research opportunities in the interdisciplinary field of bioengineering. The importance of the bioengineering PhD program extends from the university level to the state and national levels. Establishing a bioengineering PhD program at Missouri S&T will not only enhance the University's research portfolio and academic reputation but will also help in developing the workforce for bioengineering jobs, which contribute greatly to the growth and economic development of Missouri and the nation.

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1. Introduction

Bioengineering is one of the fastest-growing employment and research sectors in the US. Inspired in part by the recent performance of pharmaceutical and healthcare biotechnology in vaccine development and manufacturing to combat the COVID-19 pandemic, increasing numbers of students have become interested in bioengineering graduate research and career pathways. Bioengineering encompasses several rapidly growing specialty areas, including biochemical engineering, biomedical engineering, and biomolecular engineering. Specific topics within the scope of bioengineering include biomaterials, biomechanics, chemistry, bioinformatics, process engineering, biology, and pharmaceutical sciences.

Academic Components and Career Paths

Our goal is to leverage the interdisciplinary nature of bioengineering by offering a multidisciplinary PhD program that can span all the relevant aspects of bioengineering, from upstream research to downstream processing and from the characterization of individual biomolecules to the design of an entire process. The intent of the program will be to break new ground to meet current and future bioengineering challenges for the benefit of society.

Graduates of this program could follow a variety of career paths in areas such as biomaterials development, biomanufacturing processes, bioseparation techniques, pharmaceutical process engineering, regenerative medicine, tissue engineering, and medical device design. The increasing demand for bioengineers and biomedical engineers in the United States, particularly in Missouri, underscores the importance and timeliness of this proposed program.

Through this degree, we will develop a workforce for advanced bioengineering jobs that will contribute to the growth and economic development of Missouri and the nation. The PhD in bioengineering will allow us to effectively combine existing expertise in chemical and biochemical engineering with several allied engineering and science departments at Missouri S&T to provide cutting-edge research and educational experiences for our students. The objectives of the proposed PhD program in bioengineering are as follows:

- (1) To grow graduate enrollment at Missouri S&T by offering a new PhD program with new courses and research opportunities that will attract a large and diverse set of students.
- (2) To build a highly skilled workforce in bioengineering to meet the current and emergent needs of industries, regulatory agencies, and NGOs.
- (3) To serve as an integrator and catalyst for faculty members at Missouri S&T to discover new ideas, develop collaborations, and increase scholarly productivity in the critically important bioengineering research domain.
- (4) To build new research and educational collaborations with industry and other external partners, including those within the UM system. This includes supporting existing focus areas at MU such as precision medicine.

Evolution of the Program Concept

The concept of this program has evolved over the years, driven by the success of our biochemical engineering emphasis area within the chemical engineering degree program and the recognition of the growing need for professionals with expertise at the intersection of engineering and medicine. The proposed bioengineering PhD program at Missouri S&T is designed to educate and train students to become leaders in the rapidly growing field of bioengineering, a discipline that combines the principles of engineering, biology, and medicine to develop innovative solutions for complex healthcare problems. This interdisciplinary program aims to develop highly skilled engineers and well-versed researchers, capable of addressing the grand challenges facing the biotechnology and pharmaceutical industries. By preparing students for successful careers in academia, industry, or government, the program will contribute to the advancement of healthcare and the overall quality of life. This interdisciplinary program is designed to allow faculty from across campus to recruit graduate students from other bioengineering or biomedical engineering programs to pursue advanced degrees in a similar discipline and in so doing, to more effectively compete for research support from agencies like the National Institutes of Health (NIH).

Integration of Existing Courses

Existing courses in related areas, such as chemical engineering, materials science and engineering, and biological sciences, will provide a strong foundation for the proposed program. The interdisciplinary nature of the program will allow students to take advantage of the wide range of expertise and resources available at Missouri S&T, fostering a culture of collaboration and innovation that is essential for breakthroughs in bioengineering. In addition, the program will develop several new courses and seminars to address emerging topics and technologies in this field.

Program Coordinator

The individual responsible for the success of the proposed bioengineering PhD program is Dr. Hu Yang, Chair of the Doshi Department of Chemical and Biochemical Engineering (ChBE). He can be reached at huyang@mst.edu or (573) 341-4854. Dr. Yang will oversee the development and implementation of the program, ensuring its alignment with the University's strategic goals and the needs of students and employers. Dr. Jee-Ching Wang, Associate Chair for Research and Program Coordinator for the chemical engineering graduate program, will serve as Program Coordinator for the proposed new PhD program. He can be reached at jcwang@mst.edu or (573) 341-6705. As the program coordinator, he will be responsible for overseeing student recruitment efforts and coordinating graduate studies to ensure a seamless and enriching experience for all students in the program. If the bioengineering PhD program experiences significant growth, we will appoint an additional faculty member to co-coordinate the program to ensure its continued success. The program will be evaluated annually to determine if additional staffing is necessary to support its growth and success.

2. University Mission & Program Analysis

2.A. Alignment with University Mission & Goals

Alignment with campus goals. The mission of Missouri S&T is to integrate education, research, and technology development to create and convey knowledge that serves our state and helps solve the world's great challenges. This mission is clearly captured within the concept of our proposed bioengineering PhD program. Our program will foster the convergence of ideas, expertise, and technologies across disciplines to stimulate innovative solutions to solving the problems facing our society. Missouri S&T's strategic vision is focused on achieving three "North Star" goals by 2030: Attain Carnegie R1 classification, grow enrollment to 12,000 students, including 4000 graduate students, and achieve a top 100 ranking among national doctoral universities. Therefore, our campus is also dedicated to forming new educational programs that are interdisciplinary in education and research to prepare more students for rapidly evolving and cutting-edge fields like those associated with bioengineering. The proposed bioengineering PhD program is an integral part of our vision and strategy. Additionally, the proposed bioengineering PhD program will maximize existing internal strengths to generate new ones, as well as lead to new collaborations both internally and externally.

Missouri S&T is embarking on a bold new undertaking to bring together and advance biologically focused research across our campus. A major focus of this "Bio-X" initiative is to position ourselves as partners in education and research in key areas that will complement ongoing efforts in the UM system such as the precision medicine initiative as well as partnerships with medical schools. Creating a PhD program in bioengineering is an important part of the Bio-X vision.

Alignment with college goals. The mission of the College of Engineering and Computing (CEC) is to (i) Provide our students with a transformative education that prepares and inspires them to shape the future, and to (ii) Lead the way in improving our world and in solving grand societal challenges through research and innovation. The overall goal and objectives of the proposed bioengineering PhD program align very well with this mission in that the program will prepare students for transformative careers in bioengineering and foster cutting-edge research which will address grand societal challenges in health and related areas. This program will allow faculty in CEC departments outside of Chemical and Biochemical Engineering to supervise students with interests in bioengineering or biomedical engineering and to more effectively compete for NIH support in related program areas.

Alignment with departmental goals. Within the Doshi Department of Chemical and Biochemical Engineering, the biochemical engineering emphasis area was established alongside the traditional chemical engineering degree more than 30 years ago. The goal has always been to grow this biochemical track into independent undergraduate and graduate degree programs. Our proposal for a PhD program in bioengineering will help us to reach this goal. The department is well-prepared to take the next step and create this new degree

program. We also anticipate growth in student enrollment and research productivity through the new PhD program. We anticipate that this program will attract additional NIH funding through its focus on mentorship and research activities. With the increased financial support from NIH, we will be able to offer a greater number of research opportunities to our students. These opportunities will allow students to participate in cutting-edge research under the guidance of seasoned researchers. Moreover, the increased funding will enable us to provide our students with enhanced facilities and resources. This includes access to the most up-to-date research tools, software, and laboratory equipment, further enriching their learning and research experience.

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

There is no similar PhD program at Missouri S&T.

While there are existing programs within the UM System that have some similarity, our proposed PhD program in bioengineering is unique in its distinct focus on the engineering applications of biochemistry, particularly in the areas of biomaterials and biomanufacturing. The University of Missouri-Columbia offers a PhD in biomedical sciences, which primarily delves into medical sciences and examines the relationship between molecular- or cellular-level changes and mammalian physiology. The University of Missouri-Kansas City (UMKC) provides an interdisciplinary PhD in biomedical and health informatics, centered on biomedical information, data, and knowledge for problem-solving and decision-making. In contrast, our bioengineering PhD program emphasizes the practical applications of biochemistry as they relate specifically to engineering themes. These include the development and utilization of biomaterials, biomanufacturing processes, bioseparations, and pharmaceutical process engineering.

The University of Missouri-Columbia (MU) also offers a PhD program in biological engineering, jointly developed by the College of Agriculture, Food and Natural Resources and the College of Engineering. This program's research areas include biological and biomedical imaging, computational approaches for environmental sustainability, neuroengineering, and regenerative medicine. While there are some potential overlaps here, our proposed bioengineering program is primarily focused on biomaterials, biomanufacturing, bioseparations, and pharmaceutical process engineering.

We believe our proposed program will complement other biologically-focused PhD programs at MU and further enhance our ability to connect with biological and medical research on the other three UM campuses. For example, NextGen Precision Health is a systemwide effort led by MU, uniting the UM system's four public research universities with a shared vision to accelerate innovations in precision health to improve health outcomes for Missourians and the world. Our new PhD program will put us in a better position to contribute to NextGen Precision Health initiatives by graduating highly skilled researchers, fostering collaborations among the four campuses, and translating new findings into clinical applications. Our program will provide engineering research that will inform medicine and drug delivery.

The bioengineering PhD program is designed to promote collaborations with existing graduate programs at Missouri S&T and across the UM System. The proposed bioengineering PhD program will bring together faculty from 13 separate academic departments (Biological Sciences, Chemical and Biochemical Engineering, Chemistry, Computer Science, Civil, Architectural and Environmental Engineering, Electrical and Computer Engineering, Engineering Management and Systems Engineering, Materials Science and Engineering, Mathematics & Statistics, Mechanical and Aerospace Engineering, Mining and Explosives Engineering, Nuclear Engineering and Radiation Science, Psychological Science) spanning three colleges at Missouri S&T (the College of Engineering and Computing, the College of Arts, Sciences, and Education, and the Kummer College of Innovation, Entrepreneurship, and Economic Development (see **Appendix 1**).

We have begun discussions about initiating the bioengineering PhD program with college leaders at both MU and UMKC. We have also explored potential collaborations among various faculty members across different campuses. Beyond these individual engagements, we have nurtured broader institutional collaborations within the UM system in this field. Our ongoing collaborations with MU are particularly noteworthy. Specifically, through our cooperation with NextGen Precision Health in the realm of precision health, and the newly established MU Materials Science & Engineering Institute (MUMSEI) in the field of materials science, we have identified biomaterials as a pivotal field of collaboration. In the spring of 2023, we successfully hosted a joint symposium between Missouri S&T and NextGen. The event saw active participation from faculty and graduate students who contributed by delivering talks and presenting posters. Furthermore, MUMSEI and Missouri S&T have established a formal and ongoing line of communication, inviting faculty to offer virtual seminars to unearth new collaborative opportunities. We believe that our joint efforts in this area will lead to significant advancements in bioengineering that can substantially impact the field of precision health.

In addition to these collaborations, Missouri S&T plays an integral role in MU's NIH R25 training grant, "Biomedical Innovation Entrepreneurial Training for Aging (BETA)." This initiative provides an excellent platform for our bioengineering doctoral students to expand their skill set and engage in entrepreneurial activities, further enriching their educational experience.

Moreover, we recently partnered with the University of Missouri–St. Louis (UMSL) on the National Science Foundation proposal entitled "NSF Engines: Type-2: Reshoring API Manufacture through Innovation." In this collaborative venture, Missouri S&T's attention is primarily directed towards innovation and workforce development for downstream pharmaceutical processes and continuous manufacturing processes. These specific areas of focus not only distinguish our bioengineering program but are also essential in facilitating the reshoring of pharmaceutical manufacturing.

No existing programs will be combined, placed on inactive status, or deleted as a result of implementing our proposed bioengineering PhD program.

3. Business-Related Criteria & Justification

3.A. Market Analysis

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

The growing biotechnology market, valued at around US\$ 417 billion in 2018, is projected to expand to over US\$ 950 billion by 2027, with a compound annual growth rate (CAGR) of more than 9.4% (Global Market Insight). Bioengineering is an interdisciplinary field, so pinpointing an exhaustive list of job titles for graduates encompassing all bioengineering-related jobs is challenging. We employed the Lightcast™ databases to assess workforce demand for bioengineers and biomedical engineers with doctoral degrees.

Although there are many opportunities in our state, we focused our market analysis on a national level due to the rapidly evolving nature and wide geographical distribution of opportunities in bioengineering and biomedical engineering. A national perspective allows us to align our program with broader trends and workforce needs, while preparing our students, who come from diverse backgrounds, for career opportunities in Missouri and elsewhere across the country. This approach helps ensure our program's competitiveness and relevance. The Lightcast™ report supports the need for a sizable workforce in bioengineering at various education levels nationally. Jobs for bioengineers and biomedical engineers in 2022 were projected to grow by 15% over the next decade (2022-2032). The top posted job titles include Engineering Managers, Project Engineers, Directors of Engineering, Chief Engineers, and Biomedical Engineers. In particular, 11.6% of these jobs require doctoral level education. This implies that out of the 18,963 bioengineering and biomedical engineering job openings in 2022, approximately 2,200 required PhD qualifications. However, the number of PhD graduates in this field in 2021 was only 1,117, indicating a significant gap between the supply and demand in the workforce. This shortage underlines the critical need for more graduates with PhD degrees in bioengineering and biomedical engineering to meet the burgeoning industry demand.

This new PhD program will help build strong connections with the pharmaceutical and biotech industries in our region, and could help in attracting more of these companies to our state. The STL 2030 Jobs Plan reveals that St. Louis City's Equitable Economic plan, the St. Louis metro is home to five strong subsectors that have the potential to drive growth. One of them is the biomedical and health service subsector, which consists of local health services, biopharmaceuticals, and medical devices. Biomedical and health service occupations in the region require educational degrees at various levels. This subsector employs over 198,500 people and represents over 10 percent of non-governmental employment in the St. Louis area. Employment in this subsector grew by 4% from 2012-2018, to which rapidly growing industries emerging within the ecosystem, most notably within biopharmaceuticals, contributed actively.

This robust market demand underlines the importance of a bioengineering PhD program to meet Missouri's academic and economic needs. We have received letters of support from

employers, community partners, and other stakeholders, which can be found in **Appendix 2**. Additionally, quotes from the letters emphasize the value of this program and its alignment with key competencies employers are seeking in graduates, further validating the proposed curriculum.

Bipin Doshi, Trustee Missouri S&T, Board Member KI Foundation, Past Chair Beacon Health System Board, South Bend, Indiana states that *“This new degree will develop a workforce for bioengineering jobs that will contribute to the growth and economic development of Missouri and the nation.”* He stresses that *“There is great demand in the Medical and Biomedical field for biomanufacturing, drug delivery, biomaterials, biomedical devices, imaging devices and technology, antiaging science, as well as preventive and regenerative medicines and technology. Early detection of cancer and other chronic diseases and reversing the onset of certain debilitating conditions will significantly improve the chances of successful treatment and recovery”*.

Jason Shenefield, President and CEO, Phelps Health, declares that *“As a leading healthcare provider in the region, we recognize the value and potential of such a program in advancing the field of bioengineering and meeting the growing demand for skilled professionals.”* Furthermore, Phelps Health expresses interest in working with us to *“explore new opportunities for educational initiatives, internships, and research activities through this program”*. He adds that *“such a program will greatly benefit our healthcare system, the university, and the broader community by fostering the growth of biomedical engineering professionals and promoting innovative healthcare solutions.”*

Justin Sperry, Vice President – Transformational Technology and Chesterfield Site Head, Pfizer, states that *“The bioengineering industry has seen rapid growth in recent years, with a rising need for skilled professionals in biomanufacturing and biomaterials. As a global leader in biopharmaceuticals, Pfizer is well aware of the increasing demand for experts who can develop innovative solutions to address complex challenges in the production and distribution of vital therapies. A new bioengineering PhD program at Missouri S&T would contribute significantly to satisfying the increasing demand for skilled talent in the workforce”*. He adds that *“The institution's track record of producing top-quality engineering graduates, combined with the expertise of the Doshi Department of Chemical and Biochemical Engineering, gives us confidence in the program's potential to produce outstanding bioengineering professionals”*.

Mart Berutti, Vice President Sales, Life Sciences of Emerson points out that *“Missouri has several large employers in addition to Emerson that could benefit from the skills of a PhD in Bioengineering. These include development labs like Pfizer in Chesterfield, Contract Development and Manufacturing Organizations like Millipore Sigma and Thermofisher Patheon in St. Louis, as well the many cell and gene therapy startups throughout the state.”* He adds that *“The Life Sciences industry is changing rapidly as the promise of personalized healthcare grows under the development of new cell, gene, and tissue therapies. NGO's like BioSTL and Continuous API are working to support the growth of large and small molecule production as well as emerging therapies in Missouri. The addition of a PhD Bioengineering program would support this initiative.”*

Charles W. Lyon, Senior Vice President and Chief Commercial Officer, FutureFuel Chemical Company, shows strong support for this new program development. FutureFuel Chemical Company is a specialty chemical company with corporate headquarters in St. Louis, MO and a world-class, fully integrated manufacturing facility sitting on 2,200 acres in Batesville, AR (north-central Arkansas, about a 3 hour drive from Rolla). He points out that *“I hope you can recognize how valuable and attractive a Bioengineering PhD program would be to a company like Futurefuel Chemical Company. We have routinely recruited chemical engineering (mechanical and electrical engineering too!) graduates from Missouri S&T, and those that have worked for us have (or had) very challenging work and perform at a very high standard. It would be excellent to also recruit engineers and scientists associated with a new program like this to support our strategy for the pharma industry. Secondly, I see opportunities for FutureFuel and the department to collaborate in joint research projects in areas such as process development and equipment design (ie. flow reactor technology). Finally, much opportunity lies ahead for us to identify additional ways the Bioengineering program could support my company’s success, and we, in turn, can support the program and department.”*

Sarah Bock, Director Capital Engineering, Curium, indicates that *“Curium, a leading global manufacturer and distributor of nuclear medicine products, stands to benefit greatly from graduates of the bioengineering doctoral program at Missouri S&T.”* She emphasizes that *“the establishment of a bioengineering PhD program at Missouri S&T will address the increasing demand for bioengineers and biomedical engineers in the St. Louis area and beyond”.*

Ralph Grant, Director of Business Development-Associate, Clark, Richardson and Biskup Consulting Engineers, Inc., substantiates workforce demand and states that *“CRB has numerous associates and senior fellows that currently have PhD’s in biochemical engineering and are considered THE subject matter experts when it comes to biochemical processes, including upstream and downstream processing. Our teams were some of the first to develop industrial scale biologics and we are deeply concerned as that workforce continues to age and retire. There is a significant gap in the market for that talent.”* He further confirms that *“We most certainly would consider the right candidates as additional team members to our staff and see a PhD in Bioengineering to be an asset”.*

Fred Kielhorn, CEO, DeNovix Inc. states that *“The creation of a bioengineering PhD program at Missouri S&T would not only cater to the expanding demand for proficient experts in the industry but also enhance the university’s stature as a premier institution in the engineering field.”* Furthermore, he is *“dedicated to supporting the new bioengineering PhD program at Missouri S&T in various ways, including providing internships and sharing my industry insights and experiences with students and faculty.”*

Brian K. Donley, P.E., bd Solutions, LLC, also echoed the need for developing a bioengineering PhD program. He says *“In my role as a research and development leader, I recruited and directed numerous chemistry and biological PhDs. As an engineer, I was disappointed in the lack of bioengineering graduate programs and bioengineering researchers. Unlike traditional fields, emerging bio-programs lack the research coupling of pure science and engineering.”* He adds that *“The Chemical and Biological Engineering department’s proposal for a Bioengineering PhD program provides a solution to this unmet need. The establishment of this*

program will expand the graduate opportunities at MS&T, enabling researchers in the bioengineering field to make new discoveries at one of the nation's premiere research institutions."

Dr. Jorge A. Ochoa, Managing Partner, Principal Engineer, Biomedical Dynamics LLC, states that *"Establishing a graduate program in biomedical engineering at Missouri S&T will provide talented students with the opportunity to engage in cutting-edge research and interdisciplinary collaboration, preparing them to make significant contributions to the healthcare industry. Graduates of the program will be well-equipped to design and develop medical devices, diagnostic tools, and therapeutic techniques that can save lives, reduce pain, and improve patient health outcomes."* He adds that *"this program will bring immense benefits to Missouri S&T and the state of Missouri. The expansion of Missouri S&T's engineering and technology education, research, and innovation capabilities will drive economic growth, job creation, and attract top talent to the region"*.

In addition to the external letters of support, there are two internal letters of support that are from: Dr. Colin Potts, Provost and Executive Vice Chancellor for Academic Affairs, and Dr. David Borrok, Vice Provost and Dean of College of Engineering and Computing.

3.A.2. Student Demand for the Program

According to the National Academy of Engineering, one of 14 grand challenges for Engineering in the 21st century is to Engineer Better Medicine. We are embracing this grand challenge by preparing the engineering workforce of the future at the intersection of engineering and medicine. According to the Lightcast™ reports, in 2021, a total of 1117 doctorate degrees in bioengineering or biomedical engineering were conferred by 118 public and private institutions in the United States. Among these degrees, 672 were awarded by public institutions and 445 by private institutions. An average of 9.5 doctorate degrees were produced by each institution. In 2021, among all doctoral degree programs, the biomedical engineering and bioengineering programs were ranked third in the US for the number of doctoral degrees awarded. The total number of degrees has risen by 9% over the last 5 years, but the growing market in the US is far from saturated with doctorates in this area. The national workforce in these occupations has not been met. In 2022, there were 2202 jobs that required a doctorate degree in bioengineering or biomedical engineering. A job growth of 15% is anticipated for biomedical engineers and bioengineers with a doctoral or professional degree for the next decade (2022-2032).

The chemical engineering BS- and MS-degree programs at Missouri S&T will be a strong source for students for the proposed bioengineering PhD program. Over the last five years (2017-2021), we have graduated on average 99 chemical engineering BS degree students and 11 MS degree students per year. Our department has a history of offering chemical engineering BS degrees with a biochemical engineering emphasis, and there is an existing biomedical engineering (BME) minor administered by the Materials Science and Engineering Department. There is a sustained interest in bioengineering on our campus, with an average of 21 students annually graduating with either a BME minor or biochemical engineering

emphasis or both between 2017 and 2021. Some fraction of our undergraduate and MS students will stay to complete the new PhD degree in bioengineering. We also expect to attract students on our campus from peripheral backgrounds like materials science and engineering, electrical engineering, chemistry, and biological sciences. An important feature of our bioengineering PhD program is that it is designed to accommodate students with a range of academic experience and interests, but with a common goal of exploring the educational and research opportunities that exist at the interface between medicine and engineering.

Table 1. S&T Student Interest in Bioengineering PhD Program

Degree Program	No. of Respondents	Interest in Bioengineering PhD	Interest in Bioengineering PhD at S&T
ChE BS	12	4	2
ChE BS with BioChE	13	12	10
Biological Sciences MS	9	6	6
Total	34	22	18

Chemical Engineering (ChE), Biochemical Engineering (BioChE)

We conducted an anonymous survey among students currently enrolled in undergraduate and master's programs in chemical and biochemical engineering and in biological sciences. According to the survey outcomes, students pursuing a BS in chemical engineering without a focus on biochemical engineering show lower interest in the program, with only 2 out of 12 respondents expressing interest in the proposed bioengineering Ph.D., which is understandable as most of them are pretty set on their career path and many have job offers already. Encouragingly, we observe that students pursuing a BS in chemical engineering with biochemical engineering emphasis (BioChE) show the highest interest among the students in the pipeline, with 12 out of 13 respondents expressing interest in bioengineering Ph.D. and 10 out of 13 in a bioengineering Ph.D. program at Missouri S&T. Students pursuing a MS in biological sciences also expressed great interest in the program, with 6 out of 9 respondents expressing interest in bioengineering Ph.D. at Missouri S&T. Overall, there is a high student demand for a bioengineering PhD program at Missouri S&T, particularly among students with a BS in chemical engineering with biochemical engineering emphasis and students with a MS in biological sciences or non-chemical engineering program.

In addition to a pipeline of local students in chemical engineering and biological sciences, our program will be attractive to other undergraduate and MS students in Missouri and the nation. One way to gauge potential interest is to consider the success of similar programs in our region. For example, from 2015 through 2019, the University of Missouri-Columbia averaged enrollments of 186 undergraduate students in their bio-engineering portfolio (biological engineering, biomedical engineering, and bioengineering). This healthy undergraduate enrollment was matched by a healthy enrollment in biomedical engineering PhDs, with average enrollments of 34 students per year over the same timeframe. Washington University in St. Louis in Missouri is another producer of doctoral degrees in biomedical engineering. It awarded 18 doctoral degrees in 2021. Nonetheless, we feel there is still ample room for an additional graduate program within the UM System and in Missouri,

one that is built on our reputation for excellence in engineering education. With the strength of our existing undergraduate degree programs and recruitment of other students nationally and internationally, we anticipate similar or larger enrollments once the program is established.

We anticipate a starting enrollment of five PhD students with an annual growth of about five to seven students such that we reach an enrollment target of 25 within five years. This includes the expectation that students in the program graduate after four years on average. Like our chemical engineering PhD program, we anticipate receiving a large number of applicants. The actual number of applicants accepted into the program will be primarily determined by the available funds available to pay for graduate research assistantships. As the program grows, we anticipate more faculty will be able to advise and fund more bioengineering PhD students. In return, this will foster a more productive research environment that will attract additional funding.

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

Year:	1	2	3	4	5
Full-time	5	10	15	20	25
Part-time	0	0	0	0	0
Total	5	10	15	20	25

We expect to admit five students per year, including both new and transfer students, during the first four years of the program. Subsequently, the enrollment is projected to increase to eight students in year five. Please note that these projections take into account students who are anticipated to graduate in the spring or summer semesters of year four, thus reflecting the net enrollment figures.

Table 1b. New Student Enrollment Projections (anticipated number of students enrolled in the program during the first five fall semesters following implementation that are new to the University.)

Fiscal Year:	1	2	3	4	5
Full-time	3	8	13	18	23
Part-time					
Total	3	8	13	18	23

We anticipate to accept internal transfer students to this new program and estimate two transfer students per year in years 1-5. Transfer students are recategorized as continuing students in their second year.

Table 1c. Projected Number of Degrees Awarded

Year:	1	2	3	4	5	6	7	8	9	10
# of Degrees Awarded	0	0	0	3	5	5	5	5	7	8

We anticipate students to finish their degrees in four or five years and expect some transfer students to graduate sooner.

3.B. Financial Projections

A completed Pro Forma for the financial projections is included as **Appendix 3**. It was reviewed and endorsed by S&T's fiscal officer.

3.B.1. Additional Resources Needed

The new bioengineering Ph.D. program has been crafted to rely primarily on existing personnel, resources, and infrastructure at Missouri S&T. The host department and college are committed to providing needed support. Existing resources and infrastructure at the institution are sufficient to support the creation of this new program until it grows to capacity. In years 3-5, we anticipate the need for a half-time staff position to coordinate program activities, oversee laboratory operations, and offer crucial support to students in our expanding bioengineering Ph.D. program. Additionally, to enable essential laboratory activities, we foresee a continuous requirement for funding to cover course-related laboratory costs throughout the program's initial five years. Given that we plan to utilize existing resources and faculty, we don't foresee an immediate need for new hires to launch the program. However, to ensure the long-term sustainability of the program, we do anticipate recruiting new faculty members in the fields of bioengineering or biomedical engineering within the next few years. We've incorporated the budget for these faculty hires into a recent degree proposal for a biomedical engineering BS degree program, which includes the appointment of one tenure-track faculty member and one non-tenure track teaching faculty member in the third year. As these positions are also designed to support the proposed bioengineering PhD program, their associated costs are not included here, as they have already been included in the overall budget for the biomedical engineering BS program, thereby ensuring a comprehensive and sustainable financial plan.

3.B.2. Revenue

We expect that this new PhD program will boost grant productivity and attract major awards from federal funding agencies such as the NIH. Students in the new bioengineering PhD program will be supported primarily with research assistantships derived from this external funding. A small number of students will be supported as graduate teaching assistants (GTAs). Within 5 years, we anticipate having at least 25 full-time students (50% FTE) enrolled in this program with 20 fully funded by external sources, primarily the NIH. The tuition paid by these students represents revenue for the program. The tuition and fees generated by these graduate students will be approximately \$292,257 in year five after reduction of GTA stipends. GTA stipends will be offset by the revenue generated in the preceding years. In addition, we anticipate patent revenue to be generated in the longer term because bioengineering research projects are highly likely to have patentable research outcomes. The Kummer Institute and Office of Research and Innovation at Missouri S&T have

the capacity to help us develop incubators for new ideas, ultimately leading to economic benefit.

We will evaluate the bioengineering PhD program annually, track costs and revenue, and recognize the effort and credit of all participating faculty and their affiliated departments. This way, any adjustments to marketing and recruiting can be made quickly. Such annual analysis will also provide a basis for the allocation of internal resources and for the justification of student support, and additional faculty and staff positions.

3.B.3. Net Revenue

Starting from the first year, annual revenue is projected to exceed annual expenses.

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

	Year 1	Year 2	Year 3	Year 4	Year 5
1. Expenses per year					
A. One-time					
<i>New/Renovated Space</i>					
<i>Equipment</i>					
<i>Library</i>					
<i>Consultants</i>					
<i>Other</i>					
Total one-time	0	0	0	0	0
B. Recurring					
<i>Faculty</i>					
<i>Staff</i>			\$20,000	\$20,600	\$21,218
<i>Benefits</i>			\$7,124	\$7,124	\$7,124
<i>Graduate Teaching Assistants</i>	0	\$52,680	\$80,601	\$109,617	\$139,762
<i>Equipment</i>					
<i>Library</i>					
<i>Other (lab needs)</i>	\$10,000	\$10,000	\$20,000	\$20,000	\$20,000
Total recurring	\$10,000	\$10,000	\$47,124	\$47,124	\$47,124
Total expenses (A+B)	\$10,000	\$62,680	\$127,725	\$157,555	\$188,538
2. Revenue per year					
<i>Tuition/Fees</i>	\$67,500	\$137,700	\$210,681	\$286,526	\$365,321
<i>Institutional Resources (Scholarship Allowance)</i>		(\$27,540)	(\$42,136)	(\$57,305)	(\$73,064)
<i>State Aid -- CBHE</i>					
<i>State Aid -- Other</i>					
Total revenue	\$67,500	\$110,160	\$168,545	\$229,221	\$292,257
3. Net revenue (loss) per year	\$57,500	\$47,480	\$40,820	\$71,666	\$103,719
4. Cumulative revenue (loss)	\$57,500	\$104,980	\$145,799	\$217,465	\$321,184

Financial projections for a 50% enrollment scenario have also been developed. In this situation, the program will request additional support from the university and reduce the budget for lab costs, staff and GTAs to reflect the reduced need for the program.

3.B.4. Academic and Financial Viability

The PhD in Bioengineering will leverage existing financial resources to enhance research activities within Missouri S&T. Minimal costs are associated with the program, which will be covered through strategic reallocation of existing resources within Missouri S&T. Consequently, there is no minimum enrollment required for financial viability. With respect to academic viability, we anticipate a minimum enrollment of 10 students to maintain a vibrant and active learning environment.

Table 3. Enrollment for Academic and Financial Viability

Viability	Minimum Enrollment
Academic	10
Financial	N/A
Overall	10

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

3.C.1. Marketing Plan

The marketing plan for our new bioengineering PhD program will involve a multi-faceted approach to reach our target audience, promote the program's unique offerings, and attract prospective students. Our marketing efforts will be primarily managed by the University's Marketing and Communications Department, with shared responsibility by the Department Chair of Chemical and Biochemical Engineering and our participating faculty members.

Key components of our marketing plan include:

Rebranding: Once the program is approved, the department will pursue authorization to rebrand as the Doshi Department of Chemical and Biomedical Engineering. This new name will underscore the coexistence of two distinct programs within the department. By effectively conveying its updated identity and vision, the department aims to cultivate robust relationships across academia, industry, and the wider community, and to become an obvious destination for students interested in bioengineering PhD careers.

Digital Marketing: We will leverage our University's website, social media platforms, and digital media to highlight the program's strengths, share news about research breakthroughs, showcase faculty expertise, and present student success stories. Digital marketing efforts will also include search engine optimization, targeted Google Ads, and social media advertising campaigns.

Recruitment Events: Our admissions team will attend regional and national college fairs, graduate school visits, and other targeted recruitment events to raise awareness about the program. We will also host open house events, virtual information sessions, webinars, and develop workshops to provide prospective students and their families with an opportunity to learn more about our program and campus.

Collaboration with Universities, Research Institutions, and External Partnerships: We will establish partnerships with universities, research institutions, national organizations, foundations, and community organizations to facilitate joint research projects, conferences, and events to increase program awareness and encourage enrollment. We will also join the campus efforts with the American Institute of Chemical Engineers, Biomedical Engineering Society, International Society of Pharmaceutical Engineers, and other relevant professional societies.

Alumni Engagement and Industry Partnerships: We will engage our alumni network and industry partners to serve as ambassadors for the program, share their experiences, and help us connect with prospective students and create opportunities for research collaborations, internships, and job placements for our graduates.

Press Releases and Announcements: When the program launches, we will prepare a press release and send out announcements to appropriate professional societies, such as the American Institute of Chemical Engineers, Biomedical Engineering Society, International Society of Pharmaceutical Engineers, American Society for Engineering Education (ASEE), and target corporations through a listserv or other forms of communication.

We will monitor enrollment trends, marketing analytics, and collect feedback from enrolled students to better understand their decision-making process, which will help us refine our marketing efforts. We will evaluate the program annually to track costs and revenue, and make adjustments to marketing and recruiting strategies as needed. By working with the University's marketing team, we don't anticipate additional costs for marketing.

3.C.2. Student Success Plan

The Doshi Department of Chemical and Biochemical Engineering at Missouri S&T is committed to fostering the success of bioengineering PhD students. We have developed a comprehensive student success plan that focuses on supporting and retaining students through graduation. The plan incorporates the following key components:

Academic Support: The department will provide academic support services such as tutoring, workshops, and study groups to assist students in mastering challenging course material. We will also provide access to research resources, such as software, laboratory equipment, and facilities, to help students excel in their research endeavors.

Faculty Mentorship: Each PhD student will have a faculty mentor/advisor who will guide them through their research and academic journey and provide graduate assistantships. Mentors will offer advice, support, and networking opportunities, as well as regular progress meetings to ensure students stay on track with their research and degree milestones.

Financial Support: We will strive to secure funding opportunities for students through research assistantships, teaching assistantships, and fellowships. These opportunities not only help students finance their education but also provide valuable professional experience.

Professional Development: The Office of Graduation Education on campus will offer professional development workshops and seminars that focus on skills such as grant writing, research presentation, job searching, and networking. These opportunities will prepare students for successful careers in academia, industry, or government sectors.

Interdisciplinary Collaboration: Students will be encouraged to collaborate with researchers from other departments and disciplines within the University. This exposure to diverse perspectives will enrich their research experience and expand their professional network.

Career Services: We will work closely with the University's Career Services to provide students with access to job listings, resume workshops, mock interviews, and job fairs. These services will help students successfully transition from the program to rewarding careers in their chosen field.

Wellness and Mental Health Support: Recognizing the importance of mental health and well-being, we will provide students with access to counseling services, stress-management workshops, and wellness resources, to help them maintain a healthy work-life balance throughout their PhD journey.

Peer Support: The department will facilitate the creation of student-led support groups, where students can share experiences, discuss challenges, and celebrate successes. These groups will foster a sense of community and belonging among students.

Regular Progress Assessment: The department will closely monitor student progress through annual evaluations, ensuring they are on track to complete their degree requirements in a timely manner. This feedback will help students identify areas of improvement and address any challenges they may face.

The student success plan is designed to support bioengineering PhD students in achieving their academic and professional goals. The department's track record of student success in other programs, such as our BS, MS and PhD degrees in chemical engineering, demonstrates our commitment to fostering a supportive and enriching learning environment. By implementing this plan, we aim to ensure that our bioengineering PhD students graduate with the skills, knowledge, and experiences necessary to excel in their careers.

3.C.3. Transition Plan

If the department chair who is primarily responsible for the program leaves the institution or assumes other responsibilities, a transition plan will be in place to ensure program continuity and quality. The plan includes the appointment of an interim department chair by the vice-provost and dean of the College of Engineering and Computing. This will be followed by a national search to identify and hire a new department chair. If the program coordinator leaves or assumes other responsibilities, the department chair will appoint a new member of the faculty as the program coordinator.

3.C.4. Exit Strategy

If the program underperforms expectations or fails to meet minimum enrollment criteria for financial viability continuously for several years after the initial period, the following exit strategy will be implemented:

1. A thorough program evaluation will be conducted by the Office of the Provost to identify any areas in need of improvement or adjustment.
2. Marketing and recruitment efforts will be re-assessed and adjusted as needed to attract more students.
3. If the program continues to underperform after implementing these changes, the University will place the program on hiatus to re-evaluate its offerings and strategies.
4. If the program must be discontinued, the department will develop a teach-out plan to ensure that currently enrolled students can complete their degree requirements in a timely manner. This may include offering necessary courses until all enrolled students graduate or assisting students in transferring to comparable programs at other institutions.

4. Institutional Capacity

Missouri S&T has a strong foundation and the necessary resources to support the implementation of the new bioengineering PhD program.

While leveraging existing assets to a maximum extent, this new program does include the development and delivery of several new courses. The Doshi Department of Chemical and Biochemical Engineering (ChBE) currently has 12 tenure track (TT)/non-tenure track (NTT) faculty members, 1 lecturer, adjunct faculty and affiliated faculty. Currently, the department is conducting a national search for a junior faculty position in bioengineering. We anticipate this junior faculty position to be filled by spring 2024. The addition of this new faculty member will be more than sufficient to initiate the PhD program. As the program goes new hires may will be added in the future.

ChBE is housed in Bertelsmeyer Hall, a recently constructed (2017) 68,500-square-foot, three-story building. The department manages state-of-art equipment and laboratories dedicated to chemical and biochemical engineering research and teaching activities. There is enough existing space in Bertelsmeyer Hall to accommodate the faculty, staff, and classes requirements anticipated for the new program. The University also has a Bio-Imaging Facility, a Bioanalytical Laboratory, a Histology Laboratory, and a small animal vivarium, which we will leverage to support the proposed program. Within the College of Engineering and Computing, faculty who will be affiliated with the bioengineering PhD program maintain facilities and equipment dedicated to creating and testing biomaterials (e.g., materials science and engineering), biosensors, signal processing, and imaging (electrical and computer engineering), bioprinting (mechanical engineering), and other engineering specialties.

The Office of Graduate Education at Missouri S&T also offers a comprehensive range of services to support current and prospective graduate students.

5. Program Characteristics

5.A. Program Outcomes

Upon completing the bioengineering PhD program at Missouri S&T, graduates will possess a strong foundation in bioengineering principles and advanced research skills. Specifically, students are expected to demonstrate a comprehensive understanding of core bioengineering concepts, such as biomaterials, drug and gene delivery, tissue engineering, cellular and molecular bioengineering. They will develop expertise in a specialized area of bioengineering through focused research and coursework, exhibit proficiency in utilizing advanced research techniques, state-of-the-art tools, and software relevant to bioengineering. Graduates will also demonstrate the ability to critically analyze, synthesize, and evaluate scientific literature and research findings in bioengineering.

Furthermore, students will exhibit effective written and oral communication skills for disseminating research findings to diverse audiences, including scientific communities, industry professionals, and the public. They will develop skills in interdisciplinary collaboration, working effectively with researchers from various fields to address complex bioengineering problems. Finally, graduates of the program will demonstrate ethical awareness and professional responsibility in conducting bioengineering research and addressing related challenges.

Graduates will be equipped to apply these skills in academic, industrial, or clinical settings. In addition to core bioengineering competencies, graduates of the program will have experience in advanced research methods, interdisciplinary collaboration, and effective communication. These skills will enable them to excel in their chosen careers and contribute significantly to the advancement of the bioengineering field.

5.B. Program Design & Content

The proposed bioengineering PhD program will be situated and managed within the Doshi Department of Chemical and Biochemical Engineering at Missouri S&T. The degree program will also involve collaboration among faculty members from 13 distinct academic departments across three colleges at Missouri S&T, including Biological Sciences, Chemical and Biochemical Engineering, Chemistry, Computer Science, Civil, Architectural and Environmental Engineering, Electrical and Computer Engineering, Engineering Management and Systems Engineering, Materials Science and Engineering, Mathematics & Statistics, Mechanical and Aerospace Engineering, Mining and Explosives Engineering, Nuclear Engineering and Radiation Science, and Psychological Science. These departments fall under the College of Engineering and Computing, the College of Arts, Sciences, and Education, and the Kummer College of Innovation, Entrepreneurship, and Economic Development.

To provide all our students with core competencies within the bioengineering PhD program, students will choose three courses from the list of five below. Three of these core courses currently exist and two new courses (labeled BIO ENG 6XXX) will be added.

Core Courses (minimum of 9 hrs required):

1. *BIO ENG 6XXX Biomanufacturing* (LEC 3.0)
2. *BIO ENG 6XXX Pharmaceutical Process Engineering* (LEC 3.0)
3. *CHEM ENG 5250 Isolation and Purification of Biologicals* (LEC 3.0)
4. *CHEM ENG 5001 Drug and Gene Delivery* (LEC 3.0)
5. *MSE 5200 Biomaterials I* (LEC 3.0)

Ethics (1 hr required)

BIO ENG 5XXX Integrity and Ethics in Bioengineering (LEC 1.0)

This course presents research and professional ethics, legal and ethical standards, and codes of ethics and integrity relevant to the profession. Students must pass one credit hour course in ethics.

CHEM ENG 6015 Lecture Series (minimum of 2 hrs required)

All students will take two semesters of the CHEM ENG 6015 graduate seminar series. One faculty member in the department will serve as seminar coordinator on a rotating basis. Graduate seminars often include written assignments (reflection reports) about seminar presentations. In the future, we plan to co-list this offering with existing seminar series in Biology, Chemistry, and Materials Science and Engineering to provide additional content options for students.

It is a common practice in academic programs that if a student entering the program has already completed a course or courses considered equivalent to the required core course(s), those core courses can be waived and substituted with elective courses (see below). Decisions regarding course equivalency will be made upon the student's request by the program coordinator, in consultation with the course instructors.

The list of elective courses below is largely based on existing courses from eight supporting departments at Missouri S&T. Those courses are organized into multiple thematic clusters as suggested below. Also, the *Core Courses* not chosen by a student for their 9 hour requirement may be used to satisfy the *Elective Courses* requirement.

Elective Courses (minimum of 18 hrs required)

Biomanufacturing and Biochemical Engineering Process Design

1. *CHEM ENG 4210 Biochemical Reactors (LEC 3.0)*
2. *CHEM ENG 4220 Biochemical Reactor Laboratory (LAB 2.0 and LEC 1.0)*
3. *CHEM ENG 5001 Drug and Gene Delivery (LEC 3.0) (LEC 3.0)*
4. *CHEM ENG 5100 Intermediate Transport Phenomena (LEC 3.0)*
5. *CHEM ENG 5120 Interfacial Phenomena in Chemical Engineering (LEC 3.0)*
6. *CHEM ENG 5150 Intermediate Process Computing (LAB 1.0 and LEC 2.0)*
7. *CHEM ENG 5161 Intermediate Molecular Engineering (LEC 3.0)*
8. *CHEM ENG 5200 Biomaterials I (LEC 3.0)*
9. *CHEM ENG 5210 Intermediate Biochemical Reactors (LEC 3.0)*
10. *CHEM ENG 5211 Intermediate Bioreactor Laboratory (LAB 2.0 and LEC 1.0)*
11. *CHEM ENG 5250 Isolation and Purification of Biologicals (LEC 3.0)*
12. *CHEM ENG 5251 Intermediate Bioseparations Laboratory (LAB 2.0 and LEC 1.0)*
13. *CHEM ENG 5220 Intermediate Engineering Thermodynamics (LEC 3.0)*

Biomaterials and Tissue Engineering

14. *CHEM ENG 5300 Principles of Engineering Materials (LEC 3.0)*
15. *CHEM ENG 5320 Introduction to Nanomaterials (LEC 3.0)*
16. *CHEM ENG 6150 Molecular Modeling and Simulation (LEC 3.0)*
17. *CHEM ENG 6300 Biomaterials II (LEC 3.0)*
18. *ELEC ENG 5810 Computational Intelligence (LEC 3.0)*
19. *ELEC ENG 6260 Integrated Microsystems Engineering (LAB 1.5 and LEC 1.5)*
20. *MECH ENG 5229 Smart Materials and Sensors (LAB 1.0 and LEC 2.0)*
21. *MS&E 5210 Tissue Engineering (LEC 3.0)*
22. *MS&E 5460 Molecular Engineering of Materials (LEC 3.0)*
23. *MS&E 6210 Advanced Tissue Engineering (LEC 3.0)*
24. *MS&E 6460 Advanced Molecular Engineering of Materials (LEC 3.0)*
25. *ENV ENG 6601 Biological Principles in Environmental Engineering Systems (LAB 1.0 and LEC 2.0)*
26. *ENV ENG 6612 Biological Operations in Environmental Engineering Systems (LEC 3.0)*

Data Analysis and Computational Modelling

- 27. *STAT 5346 Regression Analysis* (LEC 3.0)
- 28. *STAT 6344 Design And Analysis Of Experiments* (LEC 3.0)
- 29. *COMP SCI 5401 Evolutionary Computing* (LEC 3.0)
- 30. *COMP SCI 5700 Bioinformatics* (LEC 3.0)

Biochemical Interactions and Applications in Medicine and Nanotechnology

- 31. *CHEM 5001 Medicinal Chemistry* (LEC 3.0)
- 32. *CHEM 5610 Biochemistry* (LEC 3.0)
- 33. *CHEM 5620 Biochemical Metabolism* (LEC 3.0)
- 34. *CHEM 5630 Biochemical Nanotechnology* (LEC 3.0)
- 35. *BIO SCI 5533 Pharmacology* (LEC 3.0)
- 36. *BIO SCI 6413 Molecular Cell Biology* (LEC 3.0)
- 37. *BIO SCI 6523 Advanced Biomolecules* (LEC 3.0)
- 38. *BIO SCI 6666 Advanced Nanotechnology in Biomedicine* (LEC 3.0)

Students are required to select at least six courses (equivalent to 18 hours) from a mixture of both existing and newly introduced courses that are listed under the thematic clusters. In addition, students can choose any additional Core Course once they have met the category's minimum requirement of 9 credit hours. To ensure a comprehensive understanding of the themes, students are required, through advising, to engage with at least two different thematic areas. This is a requirement designed to provide structure and enhance interdisciplinary learning. While engagement with three themes is highly recommended, a minimum of two themes is mandatory.

Students, with the guidance of their advisors and committees, will devise an acceptable pathway that aligns with their research interests and, in some cases, helps prepare them for the required core courses. The CHEM ENG 4210 and 5250 courses are particularly beneficial for students entering the program without a robust background in chemical or biochemical engineering, as these courses aim to augment their foundational knowledge.

As the bioengineering PhD program evolves and expands, additional courses will be developed and added to the above list. Choices of the above courses can effectively form a specific bioengineering thematic area within the PhD program and could also earn the student a graduate certificate in designated concentration areas when such options are made available in the future. Faculty members from the participating departments will be allowed to directly advise bioengineering PhD students. More faculty members are expected to be added to the list (**Appendix 1**) as the bioengineering PhD program expands and more bioengineering-related faculty members are hired.

The proposed Ph.D. program in bioengineering will admit highly qualified students with relevant engineering and science backgrounds but the primary recruiting target will be those with BS or MS degrees in chemical engineering, biochemical engineering, biomedical engineering, biomolecular engineering, or biological engineering, as they will be able to take all the core courses directly. As explained above, well-prepared students from related

disciplines may need to take some elective courses to prepare for the core courses and in rare cases may need lower division leveling courses identified by their advisors.

5.C. Program Structure

Students who enter the program directly with a BS degree will need to complete a minimum of 72 credit hours beyond their BS degree, which includes a minimum of 30 credit hours of 4000-, 5000-, and 6000-level lecture courses. A student entering with a MS degree can receive up to 30 credit hours toward their PhD, so that they would need to complete only the remaining 42 credit hours, including a minimum of 12 credit hours of 4000-, 5000-, and 6000-level lecture courses.

In addition, students are required to pass a PhD qualifying exam before their 5th semester and a comprehensive PhD exam after completing at least 50% of the required coursework for their PhD degree. When they are ready and have obtained sufficient results from their research, students must complete a written dissertation and successfully defend the dissertation in their final examination (defense).

5.C.1. Program Structure Form

1. **Total Credits Required for Graduation:** 72
2. **Residence requirements, if any:** None
3. **General education**
 - a. Total general education credits: None
4. **Major Requirements**
 - a. Total credits specific to degree: 13 (9 hours selected from the 5 core courses; 1 hour Integrity and Ethics in Bioengineering; and 3 hours Lecture Series),

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

Course	Hrs	Course	Hrs	Course	Hrs
Biomanufacturing	3	Pharmaceutical Process Engineering	3	Isolation and Purification of Biologicals	3
Drug and Gene Delivery	3	Biomaterials I	3		
Integrity and Ethics in Bioengineering	1				
Lecture Series	3				

5. **Free elective credits**

- a. Total free elective credits: 15

Although there are no completely unrestricted electives, students are able to choose from a list of elective courses to fulfill 15 credit hours of electives.

6. **Requirement for thesis, internship or other capstone experience:**

A dissertation is an essential component of earning a bioengineering PhD. To complete the program and obtain the degree, PhD candidates must successfully submit and defend their bioengineering research in the form of a dissertation.

7. **Any unique features such as interdepartmental cooperation:**

Courses that are required for the program will be instructed by faculty members from Chemical and Biochemical Engineering, and Materials Science and Engineering. For elective courses, students may choose from a range of degree programs, such as those offered by Biological Sciences, Chemical and Biochemical Engineering, Chemistry, Computer Science, Electrical Engineering, Environmental Engineering, Mathematics, and Materials Science and Engineering.

5.D. Program Goals and Assessment

The bioengineering PhD program at Missouri S&T is committed to ensuring that students achieve the Graduate Learning Outcomes (GLOs) in knowledge, communication, integrity and ethics, scholarship independence, and critical thinking.

Knowledge: Students will demonstrate mastery of the contemporary state of knowledge within their discipline through original and substantial contributions.

Communication: Students will demonstrate mastery in communication (oral and written) in the standards of published work in their discipline.

Integrity and Ethics: Students will demonstrate the highest standards of professional behavior, integrity, and ethical conduct.

Scholarship Independence: Students will demonstrate the ability to independently identify, explain, and develop scholarship including a clear plan for addressing open research questions in their field.

Critical Thinking: Students will demonstrate the independent, self-directed, ability to evaluate arguments, assess assumptions about information and data, and synthesize knowledge.

To achieve this, the program will develop and implement a comprehensive assessment plan that evaluates students' progress in these areas. This assessment plan includes mapping course learning outcomes to departmental and campus learning outcomes, selecting appropriate assessment tools linked to specific activities or courses, and specifying the frequency of measurements for each tool. A well-defined plan for reviewing and using assessment data will be established, including setting clear criteria for meeting learning outcomes, such as requiring a certain percentage of students to achieve a specific score or level. This comprehensive approach will ensure the program's effectiveness in fostering student success and achieving its goals.

To ensure the success of the program, specific goals for student retention and graduation rates will be set based on historical data, benchmarking with peer institutions, and ongoing program improvements. These rates will be monitored and reported regularly. We anticipate 85% retention and graduation rates or higher. Furthermore, we aim for a 100% placement rate. Graduates will secure positions such as postdoctoral fellowships, or roles in academia, industry, healthcare, or government.

Additionally, the program will describe other measures of success, such as external research funding, faculty and student awards, industry partnerships, or alumni achievements. These measures will be assessed regularly to ensure that the program is achieving its goals and contributing to the advancement of the bioengineering field.

5.E. Student Preparation

The bioengineering PhD program at Missouri S&T targets highly motivated students who have completed a bachelor's or master's degree in chemical engineering, biomedical engineering, biology, chemistry, or a related field. These individuals should have a strong foundation in mathematics, biology, physics, and chemistry, as well as a background in engineering principles to ensure success in the program. Prior research experience is beneficial, but not mandatory.

Applicants may be required to submit a compelling statement of purpose outlining their research interests and goals, along with letters of recommendation from faculty or professionals in the field. The program recognizes the interdisciplinary nature of bioengineering and welcomes well-prepared students from peripheral disciplines. To accommodate diverse academic backgrounds, these students may need to take elective courses to build the necessary foundation for core courses. In rare cases, lower-division leveling courses identified by their advisors might be required, which fall outside the standard program curriculum. This inclusive approach ensures that all admitted students can strengthen their foundational knowledge and excel in the bioengineering PhD program, regardless of their specific academic background.

5.F. Faculty and Administration

Dr. Hu Yang, department chair, will be the primary point person for the program, while Dr. Jee-Ching Wang, associate chair for research and graduate coordinator, will serve as program coordinator for this new program and help track activities, students, and advising for the proposed bioengineering PhD program.

This program requires interdepartmental cooperation. A key component of the proposed PhD program is to welcome researchers, students, and ideas from all relevant backgrounds. Participating faculty members (**Appendix 1**) will offer courses listed in the curriculum or mentor students enrolled in the program. Students in the program will have the opportunity to work across disciplines and develop their own individualized plans of study. Similar opportunities are also available to participating faculty on both the research and education fronts. While the proposed curriculum includes the important element of flexibility, it also includes a powerful set of core courses, including offerings in biomanufacturing and biomaterials, which are existing strengths at Missouri S&T.

All participating faculty have relevant qualifications and experience in the field of bioengineering or related areas. PhD advisors are required to hold doctoral faculty status, and committee members must have graduate faculty status.

The curriculum will be evaluated annually using a steering committee of representatives from participating departments, together with the Chair and Graduate Coordinator of the host department. The committee will be charged with meeting annually to discuss and possibly revise curricular requirements in addition to discussing the need for adjusting research priorities, admission criteria, student-advisor assignments, and so on. The chair of the supervisory committee will be the program coordinator of the bioengineering PhD program.

5.G. Alumni and Employer Survey

We are committed to continuously gathering feedback from both alumni and employers to evaluate and improve the quality of this new program. Surveys and communication channels are utilized to collect relevant information, ensuring that the program meets the expectations and requirements of both alumni and employers. The following methods and schedules are used for collecting feedback from these key stakeholders:

Alumni Survey:

Method: Online questionnaires and mailed surveys are sent to alumni who graduated three to five years prior. The survey focuses on evaluating their satisfaction with the program and the extent to which it prepared them for their careers.

Schedule: Alumni surveys are conducted biennially, allowing for a comprehensive and up-to-date understanding of alumni perspectives.

Expected/desired satisfaction rates: The department aims to achieve a satisfaction rate of at least 80% among respondents, with the goal of continuously improving the program based on alumni feedback.

Employer Survey:

Method: Online questionnaires and surveys are distributed to employers of the program's graduates. The surveys seek to evaluate the preparedness and performance of alumni in their respective workplaces, as well as solicit suggestions for program improvements.

Schedule: Employer surveys are conducted every three years, allowing sufficient time to gather meaningful feedback while keeping the information current.

Expected/desired satisfaction rates: The department aims to achieve a satisfaction rate of at least 85% among employer respondents, using their input to adapt the program to better meet industry needs and expectations.

In addition to the scheduled surveys, the department encourages ongoing communication with alumni and employers through various channels, including departmental events, Industrial Advisory Council meetings, and direct communication with alumni and employers at on-campus career fairs. This continuous feedback loop helps to ensure that the program stays relevant and aligned with the needs of both alumni and employers.

5.H. Program Accreditation

This new bioengineering PhD degree needs no accreditation to function but will be assessed together with other graduate degrees in the chemical engineering graduate program via the Higher Learning Commission.

6. Appendices

- Appendix 1: List of Participating Faculty Members (page 30)
- Appendix 2: Letters of Support (page 31)
- Appendix 3: New Program Pro Forma_ Bioengineering PhD (page 50)
- Appendix 4: Response to External Reviews (page 51)

Appendix 1

List of Participating Faculty Members

List of Participating Faculty

Faculty Member	Title	Department/College	Area of Expertise
Al-Dahhan, Muthanna H.	Curators' Distinguished Professor	Chem. & Biochem. Engr./Engr & Computing	Multiphase and Multiscale Processes
Belfi, Amy	Assistant Professor	Psychological Sci./Arts, Sci., and Edu.	Neuropsychology, Cognitive Neuroscience
Brow, Richard	Curators' Distinguished Professor	Mater. Sci. & Engr./Engr. & Computing	Bioactive Glass, Ceramics
Castano, Carlos	Associate Professor	Nuclear Engr. & Radiation Sci./Engr & Computing	Radioactive nanoparticles, nuclear medicine
Cen, Nan	Assistant Professor	Computer Sci./Engr. & Computing	Visible-Light Networking, Internet-of-Things, Protocol Design and AI for Wireless Networks
Convertine, Anthony	Roberta and G. Robert Couch Assistant Professor	Mater. Sci. & Engr./Engr. & Computing	Biomaterials, Drug delivery, Polymeric Prodrugs
Emdadi, Arezoo	Assistant Professor	Mater. Sci. & Engr./Engr. & Computing	Computational Mechanics and Material Science
Ercal, Nuran	Professor and Richard K. Vitek/FCR Endowed Chair	Chemistry/Arts, Sci., and Edu.	Redox Biology, Bioanalytical Chemistry
Esmaeelpour, Mina	Assistant Professor	Electrical & Computer Engr/Engr. & Computing	Biomedical Devices, Biosensors, Cancer Biomarker Detection and Analysis
Forciniti, Daniel	Professor	Chem. & Biochem. Engr./Engr & Computing	Biomanufacturing, Purification of Biomacromolecules
Huang, Jie	Roy E. Wilkens Endowed Associate Professor	Electrical & Computer Engr/Engr. & Computing	Fiber Optic Sensors, Optical Biomedical Imaging and Sensing
Huang, Yue-Wern	Professor	Biol. Sci./Arts, Sci., and Edu.	Nanobiotechnology, Toxicity
Johnson, Catherine	Quenon Associate Professor	Mining & Expl. Engr./Engr. & Computing	Traumatic Brain Injury, Shock Physics
Kim, Chang-Soo	Professor	Electrical & Computer Engr/Engr. & Computing	Bioinstrumentation, Sensors, Solid-state Devices
Leu, Ming C	Bailey Professor	Mech. & Aerospace Engr./Engr. & Computing	Additive Manufacturing, 3D Printing, Smart Manufacturing
Liu, Jinling	Assistant Professor	Engr. Mgt & Sys Engr/Kummer College	Big Data Analytics, Precision Medicine, Systems Biology
Ludlow, Douglas	Professor	Chem. & Biochem. Engr./Engr & Computing	Surface Characterization of Adsorbents and Catalysts
Luks, Christi	Professor (NTT)	Chem. & Biochem. Engr./Engr & Computing	Engineering Education Pedagogies
Neogi, Parthasakha	Professor	Chem. & Biochem. Engr./Engr & Computing	Interfacial and Transport Phenomena
Okoronkwo, Monday U.	Assistant Professor	Chem. & Biochem. Engr./Engr & Computing	Materials for Sustainable Infrastructure, Energy and Environment
Olbricht, Gayla	Associate Professor	Math& Statistics/ Arts, Sci., and Edu.	Biostatistics
Park, Jonghyun	Associate Professor	Mech. & Aerospace Engr./Engr. & Computing	Nanomaterials, 3D Printing, Additive Manufacturing
Rezaei, Fateme	Doshi Associate Professor	Chem. & Biochem. Engr./Engr & Computing	Adsorption, Energy Efficient Separation Processes, Process Design
Semon, Julie A.	Associate Professor	Biol. Sci./Arts, Sci., and Edu.	Stem Cell Biology, Tissue Engineering
Smith, Joseph	Professor	Chem. & Biochem. Engr./Engr & Computing	Process Modeling, Monitoring, Control, and Operation
Thimgan, Matthew S.	Associate Professor	Biol. Sci./Arts, Sci., and Edu.	Sleep Disorders, Biomarkers
Towler, Mark	Doshi Professor	Chem. & Biochem. Engr./Engr & Computing	Biomaterials and biomedical engineering
Wang, Jee-Ching	Associate Professor	Chem. & Biochem. Engr./Engr & Computing	Molecular Modeling and Simulation, Biomolecular Transport and Adsorption
Wang, Risheng	Associate Professor	Chemistry/Arts, Sci., and Edu.	DNA-assembly for bioapplications
Westenberg, David	Professor	Biol. Sci./Arts, Sci., and Edu.	Antimicrobial Materials, Antimicrobial Treatments
Wu, Chenglin	Assistant Professor	Civil, Architectural, and Envir. Engr./Engr. & Computing	Nanomechanics and Nanomaterials, Sensing and Multifunctional Materials
Wu, Jiandong	Assistant Research Professor	Chem. & Biochem. Engr./Engr & Computing	Biopharmaceutical Analysis, Biomarkers
Yang, Hu	Doshi Endowed Department Chair, Professor	Chem. & Biochem. Engr./Engr & Computing	Drug and Gene Delivery, Pharmaceutical Engr., Nanomedicine

Appendix 2

Letters of Support



MISSOURI UNIVERSITY OF
SCIENCE AND TECHNOLOGY
— ROLLA, MISSOURI —

Office of the Provost

102 Parker Hall
300 W. 14th Street
Rolla, MO 65409
573-341-4138
provost@mst.edu
provost.mst.edu

May 16, 2023

To: UM System Office of Academic Affairs

From: Colin Potts, Provost and Executive Vice Chancellor for Academic Affairs

Subject: New Program Proposal, Ph.D. Degree in Bioengineering

I am delighted to recommend that the attached full proposal for a Ph.D. degree in Bioengineering be advanced to the UM System for their review. This new degree program will be housed in the Department of Chemical and Biochemical Engineering in the College of Engineering and Computing (CEC), and a copy of Dean Borrok's letter of support is also attached.

This degree will be an interdisciplinary degree, one that is intended to allow faculty from across the Missouri S&T campus to recruit students from a variety of disciplines to pursue common research opportunities involving bioengineering and related topics. The program will provide those faculty with greater opportunities to pursue support from agencies like the National Institute of Health, to build on, for example, current campus research efforts in biomanufacturing, biomaterials, drug design and delivery, and the development of diagnostic and therapeutic medical technologies. Such advances will occur at the intersection of medical research with more traditional engineering and science disciplines and this proposed degree program is designed to establish and nurture the resulting interdisciplinary collaborations.

This degree proposal will be accompanied by a complementary proposal for a Ph.D. in Biological Sciences, expected to be completed this summer and will be fed in part by a pipeline of undergraduate students from the new BS program in Biomedical Engineering, currently under review by the System. These bio-engineering and sciences programs are among the fastest growing undergraduate and graduate disciplines in the United States and so are not only of programmatic value to our campus but will also fit into the broader strategies of the UM System, including the NextGen Precision Health initiative.

This degree requires no additional campus resources because it is designed to give our current faculty opportunities to pursue new funding opportunities and to recruit students who are interested in bioengineering careers, including those faculty outside of a bioengineering program. If this program grows as we anticipate that it will, it could become part of a larger, more comprehensive department dedicated to biomedical and related disciplines.

Approved by:

Mohammad Dehghani, Ph.D.
Chancellor

5/18/23
Date

An equal opportunity employer

Date: May 16, 2023

To: Dr. Colin Potts, Provost and Executive Vice Chancellor for Academic Affairs

From: Dr. David Borrok, Interim Vice-Provost and Dean, College of Engineering and Computing



Subject: Support for developing a PhD in Bioengineering

Bioengineering employment is expected to grow by 10% nationally and 12.9% in Missouri over the next decade. Bioengineering has seen enormous investments in research and development funding from federal agencies as well as private companies. The College of Engineering and Computing at Missouri S&T has a critical mass of faculty expertise and student interest in bioengineering, but we currently have no degree programs in this area. Therefore, bioengineering is a crucial missing piece of our engineering portfolio.

The PhD in bioengineering will not only leverage existing expertise in Chemical and Biochemical Engineering at Missouri S&T but will bring together faculty with related bio-science and – engineering backgrounds from many different disciplines and from all three colleges at Missouri S&T. Almost 30 faculty members on our campus are lined up to support this new degree program.

A key part of the mission of our college and university is to address societal problems through the development and implementation of new technologies. One of our most important societal challenges is human health and well-being. In fact, engineering better medicine has been identified by the National Academy of Engineering as one of the 14 grand challenges for engineering in the 21st century. To fully embrace the mission of our college and university, we need to establish new degree programs in bioengineering. Doing so will allow us to (1) train the engineering workforce of the future at the intersection of engineering and medicine, (2) establish cutting-edge research in the areas of biomanufacturing and biomaterials, and (3) further contribute to the growth and economic development of Missouri and the nation.

Establishing a PhD in bioengineering is also part of our broader campus focus on growing education and research in biology-related engineering research areas. We desire to bring Missouri S&T's engineering expertise to bear on health and medicine solutions, including those identified within the UM system's NextGen Precision Health initiative.

In summary, I strongly support the creation of the Bioengineering PhD program. It fits perfectly into our mission by addressing workforce and research needs that will benefit our state and society.

BIPIN N. DOSHI
748 RIVER POINTE PLACE
MISHAWAKA, INDIANA 46544

Dr, Hu Yang
Department Chair
Chemical and Biochemical Engineering
101 Bertelsmeyer Hall
1001 N. State Street
Rolla, Missouri 65409

May 11, 2023

Dear Dr. Yang:

As I understand the Chemical and Biochemical Engineering department has received an invitation from the UM system to develop full proposals to establish Biomedical Engineering BS degree and Bioengineering PhD degree programs. I support the initiative to offer both degree programs. In this letter, I would like to emphasize my support for offering a Ph.D. program in Bioengineering.

In line with the North Star Goals of Missouri S&T, curriculum to offer doctoral programs to fulfill the demand from industry and students will attract bright students and top faculty. These programs should include Biomedical Engineering and Bioengineering curriculums. MST is well suited to develop and offer a Doctoral program in Bioengineering within the Department of Chemical and Biochemical Engineering.

This new degree will develop a workforce for bioengineering jobs that will contribute to the growth and economic development of Missouri and the nation. The PhD in bioengineering will allow us to effectively combine existing expertise in Chemical and Biochemical Engineering with several allied engineering and science departments at Missouri S&T to provide cutting-edge research and educational experiences for our students. The objectives of the proposed PhD program in Bioengineering are detailed as follows:

1. To increase graduate enrollment at Missouri S&T by offering a new PhD program with new courses that will attract a large and diverse set of students.

2. To build a highly skilled workforce in bioengineering to meet the current and emergent needs of industries, regulatory agencies, and NGOs.
3. To serve as an integrator and catalyst for faculty members at Missouri S&T to discover new ideas, develop collaborations, and increase scholarly productivity in the critically important bioengineering research domain.
4. To build new research and educational collaborations with industry and other external partners, including those within the UM system. This includes supporting existing focus areas such as precision medicine.

There is great demand in the Medical and Biomedical field for biomanufacturing, drug delivery, biomaterials, biomedical devices, imaging devices and technology, antiaging science, as well as preventive and regenerative medicines and technology. Early detection of cancer and other chronic diseases and reversing the onset of certain debilitating conditions will significantly improve the chances of successful treatment and recovery.

There are several well-known universities such as Georgia Institute of Technology, John Hopkins, Stamford University, Duke University, MIT, University of Michigan, Northwestern, University of California, Berkley in the U.S. offering such programs. MST could and would be a better option for this program because of its strong STEM offerings, lower cost, and accessibility.

Sincerely,

Bipin Doshi

Bipin Doshi

B.S. (1962) and M.S. (1963) Chem Engr.

Trustee Missouri S & T

Board Member KI Foundation

Past Chair Beacon Health System Board, South Bend, Indiana

BIPIN N. DOSHI
748 RIVER POINTE PLACE
MISHAWAKA, INDIANA 46544

May 1, 2023

Hu Yang, PhD
Department Chair and Professor
Doshi Department of Chemical and Biochemical Engineering
Missouri University of Science and Technology, Rolla, MO 65401

Subject: Letter of Support for Bioengineering PhD Program

Dear Dr. Yang,

I am writing to express our interest and support for the development of a Doctor of Philosophy (PhD) program in Bioengineering within the Doshi Department of Chemical and Biochemical Engineering at Missouri S&T. As a leading healthcare provider in the region, we recognize the value and potential of such a program in advancing the field of bioengineering and meeting the growing demand for skilled professionals.

Phelps Health has a long-standing and fruitful relationship with Missouri S&T through our strategic partnership known as Ozark Biomedical Initiative, where we have collaborated on numerous research projects, educational initiatives, and other ventures that have ultimately improved patient care and advanced healthcare innovation. The establishment of a Bioengineering PhD program at Missouri S&T will not only strengthen this relationship but also provide invaluable resources and opportunities for interdisciplinary collaboration and education between our two institutions.

Our healthcare system has witnessed an increasing demand for bioengineers who can merge engineering principles, biosciences, and medicine to develop innovative solutions for the diagnosis, treatment, and prevention of various medical conditions. The proposed Bioengineering PhD program at Missouri S&T will be instrumental in preparing graduates to meet this demand and contribute significantly to the future of healthcare.

Phelps Health looks forward to working with you to explore new opportunities for educational initiatives, internships, and research activities through this program. We also look forward to participating in advisory committees to help shape the program's curriculum and ensure that it remains aligned with the evolving needs of the healthcare industry.

We wholeheartedly support the development of a Bioengineering PhD program within the Doshi Department of Chemical and Biochemical Engineering at Missouri S&T. We believe that such a

program will greatly benefit our healthcare system, the university, and the broader community by fostering the growth of bioengineering professionals and promoting innovative healthcare solutions.

Sincerely,



Jason Shenefield
President & CEO
Phelps Health



Mart Berutti
Vice President Sales
Life Sciences

Emerson
8070 W Florissant Avenue
St. Louis, MO, 63136
United States

M +1 314 452 3386
Mart.Berutti@Emerson.com

April 26, 2023

Ref: Proposed Bioengineering PhD Program for Missouri S&T

Emerson is a leader in the automation and digitalization of the Life Sciences industry in both traditional small molecule and large molecule therapeutics discovery and production as well as the emerging cell, gene, and tissue therapy fields. Our growth and ability to create value for our customers in this market is dependent upon the engineering talent pool available to our organization. We strongly recommend that the University of Missouri approved the development of a Bioengineering PhD program for Missouri S&T.

To follow are some reasons to consider this program in support of companies like Emerson that hire STEM talent:

- As a company based in St. Louis, Missouri, Emerson provides a career path in Life Sciences for engineering and management for Missouri S&T graduates. I personally am a BS Chem E graduate of MS&T and have hired several graduate degree engineers to support the development and delivery of advanced solutions for Life Sciences.
- Emerson has targeted Life Sciences as one of our key industries for market growth and customer value creation. This was highlighted in our recent investors conference with references given by several global Life Sciences customers.
- Missouri has several large employers in addition to Emerson that could benefit from the skills of a PhD in Bioengineering. These include development labs like Pfizer in Chesterfield, Contract Development and Manufacturing Organizations like Millipore Sigma and Thermofisher Patheon in St. Louis, as well the many cell and gene therapy startups throughout the state.
- Emerson's Midwest Engineering Center with offices in St. Louis and Kansas City delivers solutions to the Life Sciences industry. These teams recently were instrumental in delivering automation, digitalization, and dynamic simulation solutions for Covid-19 therapies driven by Operation Warp Speed. This center is populated by a large number of Missouri S&T graduates currently and actively recruits from the campus, participating in annual career fairs and mentoring programs. Having an engineering center report to me in a previous role at Emerson, I can verify that we relied heavily on Missouri S&T to fill our engineering talent need.
- The Life Sciences industry is changing rapidly as the promise of personalized healthcare grows under the development of new cell, gene, and tissue therapies. NGO's like BioSTL and Continuous API are working to support the growth of large and small molecule production as well as emerging therapies in Missouri. The addition of a PhD Bioengineering program would support this initiative.



Mart Berutti
Vice President Sales
Life Sciences

Emerson
8070 W Florissant Avenue
St. Louis, MO, 63136
United States

M +1 314 452 3386
Mart.Berutti@Emerson.com

In summary, for the reasons listed above we strongly recommend that the University of Missouri approved the development of a PhD Bioengineering program for Missouri S&T. Please feel free to contact me if you have any questions or I can be of further support.

Best Regards,

A handwritten signature in black ink, appearing to read "M.B.", with a stylized flourish at the end.

Mart Berutti
Vice President Sales, Life Sciences



05-Jun-2023

Missouri University of Science and Technology

1101 N. State Street

Rolla, MO 65409

ATTN: Dr. Hu Yang- Chair, Doshi Department of Chemical and Biochemical Engineering

Reference: Non-Binding Letter of Support for the development of a new bioengineering PhD program in the Doshi Department of Chemical and Biochemical Engineering at Missouri University of Science and Technology (Missouri S&T) ("Proposal")

Dear Dr. Yang:

Thank you for contacting us on a non-confidential basis seeking a letter from us to give non-binding and general support to the Proposal.

The bioengineering industry has seen rapid growth in recent years, with a rising need for skilled professionals in biomanufacturing and biomaterials. As a global leader in biopharmaceuticals, Pfizer is well-aware of the increasing demand for experts who can develop innovative solutions to address complex challenges in the production and distribution of vital therapies. A new bioengineering PhD program at Missouri S&T would contribute significantly to satisfying the increasing demand for skilled talent in the workforce.

Moreover, the geographic location of Missouri S&T, in close proximity to various pharmaceutical and biotechnology hubs, makes it an ideal choice for the development of this PhD program. The establishment of the bioengineering program will further strengthen the relationship between Pfizer and Missouri S&T, which has already proven to be a fruitful partnership in the past. The institution's track record of producing top-quality engineering graduates, combined with the expertise of the Doshi Department of Chemical and Biochemical Engineering, gives us confidence in the program's potential to produce outstanding bioengineering professionals.

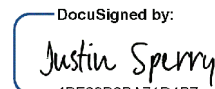
As the area of research in the Proposal may be of potential interest to Pfizer in the future, we would be interested in maintaining an open dialogue with you on a non-confidential basis (unless we agree otherwise in writing) regarding such technology and any potential related emerging needs at Pfizer. Any such potential future interest by Pfizer will be predicated on several factors, including Pfizer's strategic needs, agreement upon business terms, and Pfizer's completion of an appropriate due diligence process. However, for clarity, neither Pfizer nor you are in any way obliged to negotiate or enter into any agreement in relation to the Proposal or any research performed in relation to the Proposal or otherwise.

We wish you every success in attempting to address this important area of research through your pursuit of this new program.

Sincerely,

Justin Sperry

Vice President – Transformational Technology and Chesterfield Site Head

DocuSigned by:

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 June 5, 2023

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v.SEP302022

Breakthroughs that change patients' lives

[pfizer.com](https://www.pfizer.com)



April 27, 2023

Dr. Hu Yang
Chair, Doshi Department of Chemical and Biochemical Engineering
Missouri University of Science and Technology
1101 N. State Street
Rolla, Missouri 65409

Dear Dr. Yang:

I am very excited and honored to write this letter with my strong endorsement and support for the establishment of a PhD degree program in Bioengineering within the Doshi Department of Chemical and Biochemical Engineering at Missouri University of Science and Technology. The establishment of this program is critical to support the ever-growing need for engineering professionals to discover, innovate, and successfully execute in a variety of crucially related and important areas. The education and preparation of PhD level engineers versed in Chemical and Biochemical Engineering and allied fields will provide these professionals an extremely valuable and unique toolbox with which to attack projects. It will, most definitely, produce cutting edge science and innovations that bring great value to industry. My company, its executives and the Board of Directors are extremely interested in what lies ahead for a program like this, especially the R&D that will be conducted – and the graduates entering their professional careers – in the areas of biotechnology and pharmaceutical development and manufacturing. Under your leadership Dr. Yang, I am certain a new degree program such as this will only further solidify your department's and the university's world class standing and reputation for excellence.

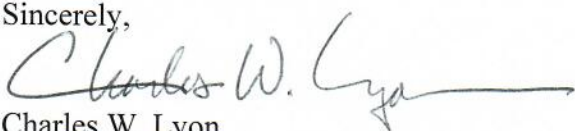
FutureFuel Chemical Company is a specialty chemical company with corporate headquarters in St. Louis, MO and a world-class, fully integrated manufacturing facility sitting on 2,200 acres in Batesville, AR (north-central Arkansas, about a 3 hour drive from Rolla). Despite its relatively recent company name, it has a long and successful history of supporting the pharmaceutical industry. As a heritage Eastman Chemical Company site (established in 1975), this specialty chemical company supplied pharmaceutical intermediates to large, well-known global pharmaceutical companies for human and veterinary API's. The company developed in-house and produced pharma intermediates requiring – and meeting – GMP compliance, as well as non-GMP. Today, the company continues to support the pharmaceutical companies and their critical strategic objective of reshoring the production of key API's, their intermediates, and regulatory starting materials. This is also a key national security focus, and FutureFuel is collaborating with multiple government-funded entities to reestablish reliable, cost-effective domestic manufacturing. In short, FutureFuel's business in the pharma intermediate market segment has been a key foundation of our business, and it is now a strategic growth focus. We have been investing – and will continue to invest – heavily in

operations equipment, people (research, analytical, engineering), laboratory facilities (instrumentation, pilot plants, kilo-labs), and infrastructure to support this initiative.

I hope you can recognize how valuable and attractive a Bioengineering PhD program would be to a company like FutureFuel Chemical Company. We have routinely recruited chemical engineering (mechanical and electrical engineering too!) graduates from Missouri S&T, and those that have worked for us have (or had) very challenging work and perform at a very high standard. It would be excellent to also recruit engineers and scientists associated with a new program like this to support our strategy for the pharma industry. Secondly, I see opportunities for FutureFuel and the department to collaborate in joint research projects in areas such as process development and equipment design (ie. flow reactor technology). Finally, much opportunity lies ahead for us to identify additional ways the Bioengineering program could support my company's success, and we, in turn, can support the program and department.

Again, I am extremely excited about the prospect of a Bioengineering PhD program. The contributions to industry, the university, and our global society will be immense. I hope you are very successful with your proposal, and I am happy to discuss this further or provide any additional affirmation of its benefit.

Sincerely,



Charles W. Lyon
Senior Vice President and Chief Commercial Officer
(636) 357-8550

Hu Yang, PhD
Department Chair and Professor
Doshi Department of Chemical and Biochemical Engineering
Missouri University of Science and Technology
Rolla, MO 65401

Dear Dr. Yang:

I am writing to express my strong support for the proposed PhD program in bioengineering at Missouri University of Science and Technology. As someone who recognizes the importance of fostering innovation in the biomedical field, I believe that this program will greatly benefit the Doshi Department of Chemical and Biochemical Engineering and contribute significantly to the growing demand for skilled professionals in St. Louis and in the state of Missouri.

The Doshi Department's commitment to high-quality education and research in chemical and biochemical engineering places it in an excellent position to lead a new bioengineering PhD program. By integrating the expertise of its faculty and resources, the department can provide a solid foundation for students seeking a career in bioengineering. Furthermore, the proposed program will enable students to specialize in areas of particular relevance to companies like Curium.

Curium, a leading global manufacturer and distributor of nuclear medicine products, stands to benefit greatly from graduates of the bioengineering doctoral program at Missouri S&T. Your program will equip students with the knowledge and skills needed to optimize production processes and develop innovative solutions for the manufacturing of radiopharmaceuticals and train students to create and test advanced materials for use in medical devices and drug delivery systems. As Curium continues to expand its operations, the availability of well-trained bioengineering professionals with doctoral degrees will be crucial to our success.


Furthermore, the establishment of a bioengineering PhD program at Missouri S&T will address the increasing demand for bioengineers and biomedical engineers in the St. Louis area and beyond. As the healthcare industry continues to grow, driven in part by an aging population and advances in medical technology, there will be a need for skilled professionals capable of developing and implementing innovative solutions to pressing medical challenges. Graduates of the proposed program will be well-prepared to meet this demand, contributing to the local economy and improving the quality of healthcare in the region.

I strongly support the development of a bioengineering PhD program at Missouri S&T, as it represents a great opportunity for the Doshi Department of Chemical and Biochemical Engineering and holds immense potential for the future of bioengineering and biomedical engineering in Missouri.

Sincerely,

Bock, Sarah

Sarah Bock, PE
Director Capital Engineering, Curium

 Digitally signed by Bock, Sarah
Date: 2023.05.09 08:20:15 -05'00'

CURIUM™
LIFE FORWARD



May 1, 2023

Dr. Hu Yang
Missouri University of Science of Technology
Linda and Bipin Doshi Department of Chemical and Biochemical Engineering
110 Bartelsmeyer Hall - 1101 N. State Street
Rolla, MO 65409-1230

RE: Support for Bioengineering PhD Degree Program

Dear Dr. Yang,

The development of Bioengineering PhD program within the Doshi Department of Chemical and Biochemical Engineering at Missouri S&T is an exciting and transformative step towards advancing healthcare technology and research in St. Louis Metropolitan area and in the state of Missouri. This initiative will not only contribute to the local economy but also help create a thriving ecosystem of innovation and collaboration in the fields of biomedical engineering and healthcare.

CRB is the pre-eminent engineering and construction firm in the United States and Europe, executing thousands of projects in the biochemical and pharmaceutical industries for the last 40 years. Our team has received numerous industry awards and play a significant role in the communities of practice, writing engineering standards for the International Society of Pharmaceutical Engineers (ISPE). CRB has significant offices in St. Louis and Kansas City with more than 500 associates, further contributing to Missouri's economic needs.

CRB has numerous associates and senior fellows that currently have PhD's in biochemical engineering and are considered THE subject matter experts when it comes to biochemical processes, including upstream and downstream processing. Our teams were some of the first to develop industrial scale biologics and we are deeply concerned as that workforce continues to age and retire. There is a significant gap in the market for that talent.

It will be critical that we have engineering resources that have a deep understanding of Bioengineering for us to be competitive in the future.

CRB fully supports and recommends that MS&T offer these skills as an extension to the degree programs. The establishment of the Bioengineering PhD program at Missouri S&T represents a pivotal milestone in fostering cutting-edge research and education, ultimately contributing to a healthier, more sustainable future for the people of Missouri and beyond. **We most certainly would consider the right candidates as additional team members to our staff and see a PhD in Bioengineering to be an asset.** In addition, we would support having our experts look at the program and make recommendations to help insure the program is relevant to industry needs.

Kindest Regards,

Clark, Richardson and Biskup Consulting Engineers, Inc.

Ralph E. Grant | Director of Business Development - Associate
701 Emerson Road, Suite 500, St. Louis, MO 63141
Ralph.grant@crbusa.com
c: 636-542-3622

May 15, 2023

Hu Yang, PhD
Department Chair and Professor
Doshi Department of Chemical and Biochemical Engineering
Missouri University of Science and Technology, Rolla, MO 65401

Dear Dr. Yang:

As the CEO of DeNovix Inc. and a proud alumnus of Missouri S&T, I am delighted to express my robust support for the proposed bioengineering PhD program at the university. The initiation of this program within the Doshi Department of Chemical and Biochemical Engineering represents a significant advancement towards addressing the escalating need for adept bioengineers in the professional sphere.

My affiliation with Missouri S&T, both during my time as a student and in the ensuing years, has remained strong, greatly owing to the dedicated faculty and the rich academic environment. My experiences at S&T have been instrumental in shaping my professional trajectory, and I firmly believe that the proposed bioengineering PhD program will equip its graduates with a solid foundation for success in the bioengineering domain.

The worldwide demand for bioengineers has seen a remarkable surge in recent times, fueled by progress in medical technology and an increasing necessity for inventive solutions in diagnostics, therapeutics, and preventative medicine. As the CEO of a firm committed to creating cutting-edge life science instrumentation, I can vouch for the critical role of a comprehensive bioengineering education for those entering this field.

The creation of a bioengineering PhD program at Missouri S&T would not only cater to the expanding demand for proficient experts in the industry but also enhance the university's stature as a premier institution in the engineering field. As an alumnus and an industry pioneer, I am excited to witness the university broaden its academic horizons to better serve its students and the bioengineering community at large.

I am dedicated to supporting the new bioengineering PhD program at Missouri S&T in various ways, including providing internships and sharing my industry insights and experiences with students and faculty. I am confident that with the right support and resources, the proposed program will flourish, producing outstanding bioengineering professionals poised to leave a lasting imprint on the field.

In conclusion, I wholeheartedly endorse the establishment of a new bioengineering PhD program at Missouri S&T and eagerly anticipate the numerous opportunities and achievements that will undoubtedly stem from this initiative.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Fred Kielhorn', with a long, sweeping horizontal stroke extending to the right.

Fred Kielhorn
CEO, DeNovix Inc.

May 8, 2023

I am writing to express my endorsement for the proposed new Bioengineering PhD program at Missouri University of Science and Technology, as presented by the Chemical and Biochemical Engineering department. As a seasoned professional in the pharmaceutical and medical device industry, I have firsthand experience of how important this program is to the bioengineering field. I am impressed with Missouri S&T's Chemical and Biological Engineering department's initiative and commitment in bringing forth this proposal.

In my role as a research and development leader, I recruited and directed numerous chemistry and biological PhDs. As an engineer, I was disappointed in the lack of bioengineering graduate programs and bioengineering researchers. Unlike traditional fields, emerging bio-programs lack the research coupling of pure science and engineering. New drug discoveries and innovative biological solutions face numerous barriers due to the lack of accompanying bioengineering innovations. Industry practitioners are faced with applying traditional technologies to innovative bio-solutions, given the lack of critical research and development in the bioengineering space.

The Chemical and Biological Engineering department's proposal for a Bioengineering PhD program provides a solution to this unmet need. The establishment of this program will expand the graduate opportunities at MS&T, enabling researchers in the bioengineering field to make new discoveries at one of the nation's premiere research institutions. These breakthroughs will accelerate the growth of the emerging bioengineering industry, producing specialized graduates who can cater to the needs of employers, regulators, and NGOs. Ultimately, the proposed program has the potential to tackle some of society's most pressing problems.

The collaborative environment between the research-driven programs at MS&T creates the partnerships necessary to make the Bioengineering PhD program successful, both within the academic community and with outside industry partners. This proposal capitalizes on the outstanding reputation of the Chemical and Biochemical Engineering department, one of MS&T's engineering pillars, and leverages MS&T's immersive and inter-disciplinary educational style to fill a critical gap in this rapidly expanding field. I am excited, and honored, to offer my wholehearted support for this new graduate program.

Sincerely

A handwritten signature in black ink, appearing to read "Brian K. Donley", written in a cursive style.

Brian K. Donley, P.E.

Background

Brian Donley is a recently retired 35-year professional, spending most of his career in the pharmaceutical and medical device industry. Mr. Donley has held multiple leadership positions in Tyco Healthcare/Covidien (now Medtronic), Mallinckrodt Pharmaceuticals, and Curium Pharmaceuticals. He has led drug/device regulatory compliance, new drug development and drug/device technical transfer teams. He has also led multiple continuous improvement (Six Sigma / Lean) deployments in the areas of drug/device development and manufacturing.

Mr. Donley has provided guidance to the Linda and Bipin Doshi Chemical and Biological Engineering Department for over 20 years. He has held positions in the department's Industrial Advisory Committee, previously serving as chair for 10 years. He is a member of MS&T's Academy of Chemical and Biological Engineers and the recipient of MS&T's Award of Professional Distinction (2016). He continues to collaborate with faculty, delivering lectures and presentations in the areas of process safety, experimental design, and engineering ethics.

Mr. Donley holds a BS in Chemical Engineering from MS&T (1987) and a Master of Business Administration from Washington University in St. Louis (2000). He is a Certified Six Sigma Master Black Belt and is a licensed professional engineer in Missouri and Illinois.

Hu Yang, Ph.D.
Department Chair, Professor; Linda and Bipin Doshi Chair
Linda and Bipin Doshi Department of Chemical and Biochemical Engineering
Missouri University of Science and Technology
110E Bertelsmeyer Hall, 1101 N. State St., Rolla, MO 65409

Dear Dr. Yang,

I am writing to express my strong support for the proposed graduate program in biomedical engineering at Missouri University of Science and Technology (Missouri S&T), offering both MS and PhD degrees. As a member of the engineering and scientific community in the life sciences industry for more than 35 years, I recognize the importance of interdisciplinary collaboration and innovation, and I believe that this program will create immense opportunities for the students, faculty, and community it serves.

The field of biomedical engineering has become increasingly important in recent years, as it has the potential to revolutionize healthcare, medical technology, and the quality of life for millions of individuals. The integration of engineering and biology for therapeutic and diagnostic medical applications requires a diverse range of skills, knowledge, and perspectives, making biomedical engineering a unique and essential discipline.

Establishing a graduate program in biomedical engineering at Missouri S&T will provide talented students with the opportunity to engage in cutting-edge research and interdisciplinary collaboration, preparing them to make significant contributions to the healthcare industry. Graduates of the program will be well-equipped to design and develop medical devices, diagnostic tools, and therapeutic techniques that can save lives, reduce pain, and improve patient health outcomes.

A graduate program in biomedical engineering at Missouri S&T addresses the current and future demands of the healthcare and life science industries in the United States and abroad. As the aging population, chronic diseases, and technology breakthroughs continue to fuel the increase in drug and device utilization and patient care expenditures, it is expected that the demand for biomedical engineers will increase dramatically in the coming years. By developing this program, Missouri

S&T will be able to help address this demand and equip the next generation of biomedical engineers to positively impact society.

Additionally, this program will bring immense benefits to Missouri S&T and the state of Missouri. The expansion of Missouri S&T's engineering and technology education, research, and innovation capabilities will drive economic growth, job creation, and attract top talent to the region. The graduates of the program will have access to a wide range of employment opportunities, both in academia and industry, and will contribute to Missouri's capacity and capabilities in biomedical engineering research and development.

The interdisciplinary nature of biomedical engineering also presents opportunities for collaboration between departments and with other institutions, fostering a culture of innovation and enhancing Missouri S&T's competitiveness in the global academic and research landscape. The university's central location in Rolla, Missouri, is ideal for interdisciplinary research and collaboration, and its proximity to St. Louis, Kansas City, and other major metropolitan areas will allow students and faculty to collaborate with top hospitals, research institutions, and business partners.

A graduate program in biomedical engineering at Missouri S&T would position the university to be a strong contender for competitive federal funding opportunities in biomedical research from the National Institutes of Health (NIH), Department of Defense (DOD), National Science Foundation (NSF), and other governmental agencies. These agencies provide significant funding for research in biomedical engineering and related fields, which would provide valuable resources to support faculty research and attract top talent to the program. The success in obtaining funding would not only advance cutting-edge research in biomedical engineering, but it would also elevate Missouri S&T's research profile and bring prestige to the institution as it aims to achieve Carnegie R1 status.

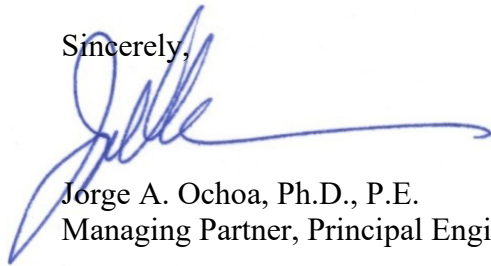
Moreover, a graduate program in biomedical engineering would complement and further the mission of the Kummer College of Innovation, Entrepreneurship, and Economic Development at Missouri S&T. The inter-disciplinary nature of biomedical engineering promotes innovation and collaboration between diverse fields and provides opportunities for entrepreneurial ventures. By offering a graduate program in biomedical engineering, the Kummer College would have access to a pipeline of highly skilled and creative individuals who are equipped to develop novel medical devices, diagnostics, and therapies that can lead to commercialization and economic growth. In addition, the program could foster interdisciplinary teams that can work together to solve complex problems and create new technologies, which aligns with the Kummer College's goals of promoting innovation and entrepreneurship. The potential for intellectual property, patents, and

startup companies arising from biomedical engineering research and development can further strengthen Kummer College's position as a leader in innovation and entrepreneurship.

In summary, the establishment of a graduate program in biomedical engineering at Missouri S&T will have significant impacts on healthcare, medical technology, economic growth, and the quality of life of millions of individuals. This program will provide talented students with the knowledge, skills, and opportunities to make a positive impact on society, and it will enhance Missouri S&T's reputation and influence as a top-tier research institution.

As someone who cares deeply about the future of engineering and Missouri S&T, I believe that establishing a graduate program in biomedical engineering has the potential to create a brighter future for all. I appreciate your consideration and time, and I look forward to the success and accomplishments that will result from this program.

Sincerely,

A handwritten signature in blue ink, appearing to read 'J. Ochoa', with a long horizontal flourish extending to the right.

Jorge A. Ochoa, Ph.D., P.E.
Managing Partner, Principal Engineer

Appendix 3

New Program Pro Forma_Bioengineering PhD

New Degree Program Pro Forma

Records

Proposed program: **Bioengineering PhD**

University: **Missouri University of Science and Technology**

College: **College of Engineering and Computing**

Submitted: **[insert date]**

Preparer: **Hu Yang**

Reviewed by College Fiscal Officer: **5/5/2023**

Fiscal Officer Name: **Latesha Zach**

Reviewed by University-Level Fiscal Officer: **[insert date]**

Fiscal Officer Name: **Lisa Cerney**

PROGRAM:	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
	FY23	FY24	FY25	FY26	FY27	FY28
Enrollment Projections						
Head Count Students - <i>new incoming</i>		3	8	13	18	23
Head Count Students - <i>transfers within campus</i>		2	2	2	2	2
Student Credit Hours		90	180	270	360	450
Tuition Rate/Credit Hour		750	765	780	796	812
Fee Rate/Credit Hour		-	-	-	-	-
Tuition Discount Rate (%)		0%	20%	20%	20%	20%
Scholarship Allowances (\$)						
Revenue Projections	*****CALCULATED CELLS*****					
Tuition	-	67,500	137,700	210,681	286,526	365,321
Supplemental & Other Fees	-	-	-	-	-	-
Scholarship Allowances	-	-	(27,540)	(42,136)	(57,305)	(73,064)
Net Tuition and Fees	-	67,500	110,160	168,545	229,221	292,257
Other Income						
TOTAL PROGRAM REVENUE	\$0	\$67,500	\$110,160	\$168,545	\$229,221	\$292,257
Recurring State Support						
TOTAL REVENUE	\$0	\$67,500	\$110,160	\$168,545	\$229,221	\$292,257
Expenditure Projections						
Faculty Salaries						
Technical Salaries				\$ 20,000	\$ 20,600	\$ 21,218
Lab Teaching Support						
Support Salaries						
Graduate Teaching Assistants			\$ 52,680	\$ 80,601	\$ 109,617	\$ 139,762
Total Salaries	-	-	52,680	100,601	130,217	160,980
Benefits	-	-	-	7,124	7,338	7,558
Subtotal Salaries and Benefits	-	\$0	\$52,680	\$107,725	\$137,555	\$168,538
Operating Expense						
Computing Expenses						
NonCapital Maintenance & Repair						
Noncapital Equipment						
Supplies		10,000	10,000	20,000	20,000	20,000
Marketing/Advertising						
Travel & Training						
Misc. Expenses						
Subtotal Operating Expense	-	\$10,000	\$10,000	\$20,000	\$20,000	\$20,000
One-time Expenditures						
Startup Costs						
Equipment						
Additional Space Costs						
Subtotal One-time Expense	\$ -	\$0	\$0	\$0	\$0	\$0
TOTAL EXPENDITURES	\$0	\$10,000	\$62,680	\$127,725	\$157,555	\$188,538
DIRECT MARGIN	\$0	\$57,500	\$47,480	\$40,820	\$71,666	\$103,719
CUMULATIVE DIRECT MARGIN	\$0	\$57,500	\$104,980	\$145,799	\$217,465	\$321,184

Subtract:						
Revenue from Transfers within Campus						

NET MARGIN TO THE CAMPUS	\$0	\$57,500	\$47,480	\$40,820	\$71,666	\$103,719
CUMULATIVE NET MARGIN TO THE CAMPUS	\$0	\$57,500	\$104,980	\$145,799	\$217,465	\$321,184

Campus Overhead Allocation						
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MARGIN AFTER CAMPUS OVERHEAD	\$0	\$57,500	\$47,480	\$40,820	\$71,666	\$103,719
CUMULATIVE MARGIN AFTER CAMPUS OVERHEAD	\$0	\$57,500	\$104,980	\$145,799	\$217,465	\$321,184

Assumptions:

Appendix 4

Response to External Reviews

Response to External Reviews

The feedback received by the three external reviewers was unanimously supportive. The reviewers agree that with the right strategies the doctoral program in bioengineering can be very successful.

Will the proposed curriculum produce high-quality graduates who can make significant contributions in the field?

According to the reviewers, the program's design is well-conceived, aiming to cater to the requirements of the biotech and biopharmaceutical sectors. They laud the course offerings but there was a suggestion for the inclusion of more biomedical-related subjects as part of a group of mandatory core courses. We did consider this option, but believe our current approach provides greater flexibility, which will be helpful for being as inclusive as possible for all bioengineering related focus areas. While still recognizing the importance of biomedical courses, essential subjects, such as tissue engineering, will be prominently featured. As our faculty expertise in specific areas grows, we'll consider introducing additional biomedical-specific coursework to reflect that growth.

Is there a sufficient market for doctoral students interested in this area to allow the program to meet the proposed enrollment projections?

The reviewers generally concur that there is a significant market for doctoral students in the field of bioengineering, indicating that the program's enrollment projections are plausible. They note the rapid growth of the BME/BioE field and the high demand in the biotech and biopharmaceutical sectors, especially in regions near Missouri. We recognize the crucial importance of offering competitive stipends and ensuring our program remains inclusive and appealing to a broad spectrum of prospective students.

Do the courses, faculty, and financial plan provide the necessary elements for doctoral education?

The consensus among the reviewers is that the courses, faculty, and financial plans presented in the proposal generally align well with the needs of a doctoral-level bioengineering program. While most reviewers agreed with the financial plan and its feasibility, one reviewer found the fiscal plan to be a bit ambitious, suggesting a more conservative approach. Although we feel our enrollment projections are attainable, the program would still be financially viable if we were a bit more conservative in our outlook so financial risk is limited.

How does this program compare with other similar programs in the country and does the program have the potential to achieve a national reputation?

The reviewers generally concur that the proposed program at Missouri S&T has strong potential to achieve a national reputation in the field of bioengineering. A distinct advantage emphasized by the reviewers is the program's unique focus on the biotech and biopharmaceutical side, particularly integrating the engineering applications of biochemistry. Drawing upon the strengths of Missouri S&T's existing engineering programs and leveraging existing collaborations with biomedical firms and institutions, the program is well-positioned for success. Dr. Yang's leadership, given his established record in biomedical engineering, is viewed as a significant asset. To help build our national reputation/visibility we plan to amplify our program's presence at national conferences and events and share our accomplishments widely in the academic

community via newsletters and postcards. We are also committed to cultivating industry partnerships and nurturing academic excellence to ensure our program not only stands out but also retains its distinctiveness.

Do you have any other comments, questions, or concerns regarding the proposed doctoral program?

There's a shared enthusiasm for the program's potential to enhance faculty research and to help Missouri S&T achieve an R1 designation. Some comments received related to recruiting students who reflect the local community and ensuring adequate support for at-risk students, noting that some federal research grants (essential for this and other PhD programs) require evidence of such efforts. The importance of strong student mentorship programming was also emphasized. As the program launches and grows, Missouri S&T will continue to evaluate these suggestions and develop initiatives consistent with state and federal laws.

Executive Summary

New Degree Program: PhD in Biological Sciences Missouri University of Science and Technology

The Missouri University of Science and Technology proposes a doctoral graduate program (Ph.D.) in Biological Sciences. As the University embarks on a bold new vision to address biomedical, environmental, and life science challenges through the interdisciplinary life science initiative, it is essential that the University expands the size and impact of Biological Sciences programs on the S&T campus.

- A doctoral program in Biological Sciences, along with other new programs, will act synergistically to enhance interdisciplinary collaborations among scientists and engineers across the S&T campus to realize the vision of the life science initiative.
- The growth of Biological Sciences on the S&T campus is essential to achieving University goals in growing research impact and breadth, physical infrastructure, faculty recruitment, external funding, enrollment, and diversity.
- Strong student demand for enhanced opportunities to study in life sciences programs on the S&T campus is indicated by exceptional numbers of applications to the Biological Sciences BS/BA and MS programs (relative to other campus programs). The Biological Sciences represents a growth opportunity for Missouri S&T at both the undergraduate and graduate levels, and data suggests biology degree programs serve a broader audience compared to other STEM degree programs.
- In recent decades, Missouri has emerged as a regional hub for biotechnology innovation and a major contributor to the bioeconomy. There is strong market demand for a talented pool of experts, innovators, and life sciences leaders to drive the biotechnology market.
- There is strong evidence that investments are needed in Missouri to increase the capacity for advanced training of the next generation of biological scientists. As the premiere public STEM campus in the University of Missouri System, Missouri S&T must play a leading role in contributing to this mission. We have received positive feedback and strong support from industry representatives and workforce development leaders in the state for a doctoral program at Missouri S&T.
- The proposed doctoral program in Biological Sciences will include three tracks: Biomedicine, Bioinnovation, and Environmental Biology. These tracks are selected to emphasize both the current strengths and future vision of life sciences research on the Missouri S&T campus. Each track will emphasize core biology, interdisciplinary training, and data analytical competencies. We propose an internship option in our doctoral program that will be vital to allow graduate students to establish industry or agency connections while completing their degree.

No. 4

Recommended Action – PhD in Biological Sciences

Missouri University of Science and Technology

It was recommended by the University of Missouri System Office of Academic Affairs, endorsed by President of the University of Missouri Mun Y. Choi, recommended by the Academic, Student Affairs and Research & Economic Development Committee, moved by Curator_____, seconded by Curator_____ that the following action be approved:

that the Missouri University of Science and Technology be authorized to submit the attached proposal for a PhD in Biological Sciences to the Coordinating Board for Higher Education for approval.

Roll call vote of the Committee:

YES

NO

Curator Blitz

Curator Graves

Curator Layman

Curator Sinquefield

The motion _____.

Roll call vote of Board:

YES

NO

Curator Blitz

Curator Brncic

Curator Fry

Curator Graves

Curator Holloway

Curator Layman

Curator Sinquefield

Curator Wenneker

Curator Williams

The motion_____.

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Executive Summary

Missouri University of Science and Technology proposes a doctoral graduate program (Ph.D.) in Biological Sciences. As the University embarks on a bold new vision to address biomedical, environmental, and life science challenges through the interdisciplinary life science initiative, it is essential that the University expands the size and impact of Biological Sciences programs on the S&T campus.

- A doctoral program in Biological Sciences, along with other new programs, will act synergistically to enhance interdisciplinary collaborations among scientists and engineers across the S&T campus to realize the vision of the life science initiative.
- The growth of Biological Sciences on the S&T campus is essential to achieving University goals in growing research impact and breadth, physical infrastructure, faculty recruitment, external funding, enrollment, and diversity.
- Strong student demand for enhanced opportunities to study in life sciences programs on the S&T campus is indicated by exceptional numbers of applications to the Biological Sciences BS/BA and MS programs (relative to other campus programs). The Biological Sciences represents a growth opportunity for Missouri S&T at both the undergraduate and graduate levels, and data suggests biology degree programs serve a broader audience compared to other STEM degree programs.
- In the past decades, Missouri has emerged as a regional hub for biotechnology innovation and a major contributor to the bioeconomy. There is strong market demand for a talented pool of experts, innovators, and life sciences leaders to drive the biotechnology market.
- There is strong evidence that investments are needed in Missouri to increase the capacity for advanced training of the next generation of biological scientists. As the premiere public STEM campus in the University of Missouri System, Missouri S&T must play a leading role in contributing to this mission. We have received positive feedback and strong support from industry representatives and workforce development leaders in the state for a doctoral program at Missouri S&T.
- The proposed doctoral program in Biological Sciences will include three tracks: Biomedicine, Bioinnovation, and Environmental Biology. These tracks are selected to emphasize both the current strengths and future vision of life sciences research on the Missouri S&T campus. Each track will emphasize core biology, interdisciplinary training, and data analytical competencies. We propose an internship option in our doctoral program that will be vital to allow graduate students to establish industry or agency connections while completing their degree.

1. Introduction

The 21st Century is the Century of Biology. Biotechnology plays a central role in developing solutions to virtually all global challenges now and into the future, including healthcare, food security, renewable energy, bioinspired materials, and management and protection of our environment, ecological resources, and biodiversity. In the past year, the U.S. Congress has budgeted \$2 billion in new investments in biotechnology and biomanufacturing, and training for the next generation of biotechnologists ([White House briefing room release, September 14, 2022](#)). The bioeconomy was valued at \$400 billion in 2016, with projections to increase by \$30 trillion in the next two decades according to the Federation of American Scientists ([Jeffery 2023](#)). The challenges of the future will be met by a workforce of highly trained scientists and experts who can develop and capitalize on emerging biotechnologies and communicate effectively to educate the public on the values of technology adoption. Big ideas and big challenges require the cooperative efforts of interdisciplinary teams of experts. At the center of interdisciplinary translational research in biotechnology are the foundational biological sciences.

The biological sciences are the foundation for existing and emerging industries that drive economic growth and development in Missouri and across our nation. As the leading public STEM university in Missouri, Missouri S&T serves a central role in technology and workforce development for our state. A market analysis, and ongoing conversations with leading employers in the biotechnology industry in Missouri, indicate that Missouri institutions do not currently have the capacity to meet the demand for highly trained senior scientists and experts in biotechnology fields. In fact, the public universities in Missouri graduate fewer Biology Ph.D.'s than the public universities in every one of our eight bordering states. The Biological Sciences department at Missouri S&T is poised to contribute to satisfying this demand through ongoing investments and the development of this proposed doctoral training program.

Missouri S&T researchers are leaders of cross-disciplinary translational technology-driven research. Our university is [undertaking a transformational reorganization to promote the life sciences](#) and to further develop leading interdisciplinary research to advance human and environmental health. Leadership will require collaborative, cross-disciplinary initiatives that capitalize on all the strengths that our university can bring to bear on these challenges. One of those strengths must be in biological sciences research and workforce development. Growth of the Biological Sciences *programs* at Missouri S&T is an essential aspect of realizing the goal of expanding bioengineering, environmental engineering, and bioscience research and training on the S&T campus, and the Biological Sciences department will not be able to meet this demand without the addition of a Ph.D. program.

We propose a new Ph.D. program in Biological Sciences at Missouri S&T in order to secure a foundation and an expansion of translational biological sciences research at our university, to enhance critically needed partnerships between scientists and engineers, and to provide students with opportunities for advanced training in interdisciplinary life sciences research.

The Ph.D. in Biological Sciences will attract and support cutting-edge science and provide a platform for training future researchers and leaders across Biological Sciences disciplines. Although this Biological Sciences Ph.D. program will serve a distinctly different niche than the recently proposed Missouri S&T Bioengineering Ph.D. program, both programs will function synergistically in promoting an interdisciplinary collaborative environment, including the expansion of related research infrastructure, for both biological scientists and engineers.

The objectives of the proposed Ph.D. program in Biological Sciences are:

- 1) To grow and diversify graduate enrollment at Missouri S&T and within the UM System by offering a new Ph.D. program built on the foundations of basic and translational biological sciences.
- 2) To develop a highly skilled workforce and leadership in translational biological sciences to meet the current and emergent needs of the bio-innovation economy, including industries, government and regulatory agencies, and non-governmental organizations. The promotion of internship opportunities with industry and agency partners outside the university is central to this objective.
- 3) To elevate the volume and impact of Missouri S&T's research enterprise by providing new and expanded opportunities for Biological Sciences faculty and our students to engage in interdisciplinary research leading to new collaborations, innovative ideas, and increased scholarly productivity in life sciences research.
- 4) To build new research and educational collaborations with external partners, including those within the UM System. This includes supporting existing institutional focus areas including precision medicine and environmental science. Opportunities for students to pursue internships with industry and agency partners is part of this proposal.

The proposed Ph.D. program in Biological Sciences will be housed and administered within the Biological Sciences Department at Missouri S&T.

2. University Mission & Program Analysis

2.A. Alignment with University Mission & Goals

Alignment with University Mission & Goals

The mission of Missouri S&T is to “integrate education, research and application to create and convey knowledge that serves our state and helps solve the world’s great challenges.” Our university’s strength is engaging in transformational research that combines science,

technology, engineering, and mathematics. Missouri S&T has the broadest range of engineering offerings among peer institutions, as well as first-rate research programs in basic sciences, including chemistry, physics, and math. The strength of Missouri S&T's research is the integration of science and technology across diverse disciplines to achieve results that address challenges and solve problems. Biological Sciences is currently the only STEM field at Missouri S&T campus that does not award a Ph.D. degree, and so this limits the ability of the University to address fundamental societal challenges associated with the life sciences and limits the opportunities for interdisciplinary collaborations in areas like biomedical engineering and environmental engineering.

With a forward-looking vision and taking advantage of its existing interdisciplinary strengths, Missouri S&T has embarked on the life sciences initiative which addresses biomedical, environmental, and life science issues at the global scale (Figure 1). The Initiative is composed of three cornerstones: biomedical science, environmental & life science, and humanities & social science. The first two cornerstones align with our intent to establish a Ph.D. degree program in the Department of Biological Sciences. The program contains education and research elements that train our students to make consequential and impactful contributions to humanity.

In the past 25 years, S&T has developed national reputations in biomedical science areas including translational medicine (e.g., targeted drug delivery, traumatic brain injuries), regenerative tissue engineering (e.g., bone and wound regeneration), and biomedical informatics using artificial intelligence and machine learning. Our nascent environmental and life science research in ecological remediation and natural resource sustainability has also gained national visibility (e.g., bioremediation of urban runoff in aquatic systems). The intersection of biomedical science and environmental and life science will continue to produce advances in biodiversity prospecting, sensor technology (e.g., disease diagnosis and treatment, environmental sensing), and environmental health (e.g., aerosol toxicity, waste removal in fragile ecosystems). With a master's degree program and a strong tradition of involving undergraduates in research, the Biological Sciences Department has, for decades, participated in or led most of these successful ventures. A Ph.D. degree in biological sciences is long overdue to realize the full potential the campus can offer in basic and applied biological research and education.

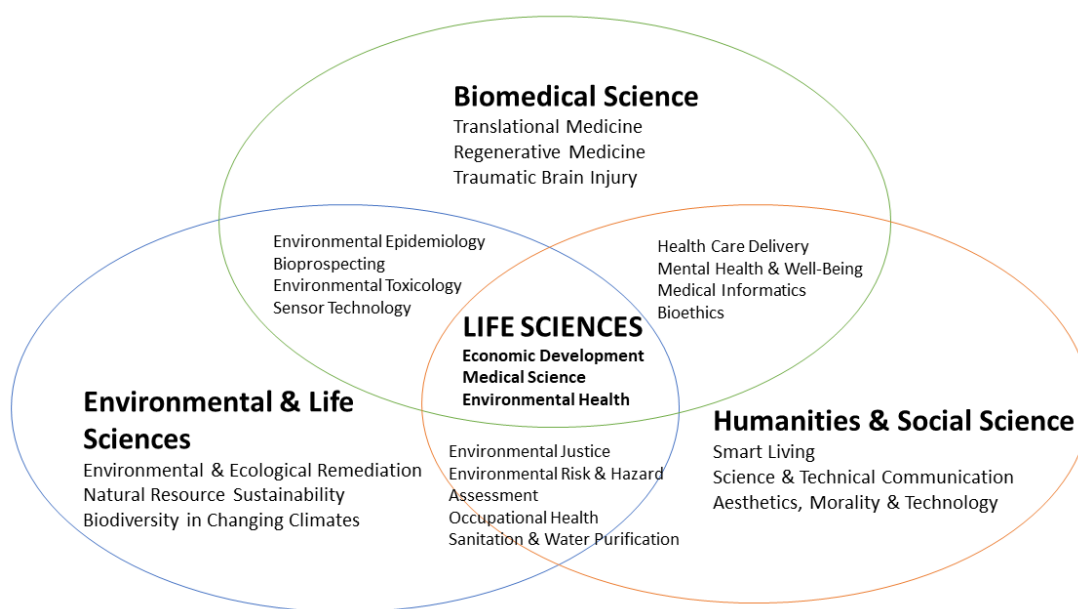


Figure 1: Missouri S&T life sciences initiative.

Synergy with Other S&T Programs

Our university has proposed a new doctoral program in Bioengineering (a separate proposal), administered in the Chemical and Biochemical Engineering Department with this new doctoral program in Biological Sciences (this proposal), administered in the Biological Sciences Department. We envision these two programs producing complementarity and synergy as well as fostering new collaborations. A strong Biological Sciences Department, with a Ph.D. degree program, will form the foundation for expansion of our current emphasis in biomedical applications. Basic science fosters new ideas in translational science. In pursuit of translational medicine, if we do not continue to advance our foundational understanding of human biology, there will no longer be new knowledge to translate.

In the past, S&T investigators in engineering programs such as Chemical and Biochemical Engineering, Materials Science and Engineering, Electrical and Computing Engineering, and Environmental Engineering have formed productive collaborations with faculty in the Biological Sciences Department. Faculty and students in these departments are frequent users of equipment and facilities in Schrenk Hall, maintained and managed by faculty in Biological Sciences, including specialty facilities managed by the interdisciplinary Center for Biomedical Research, and interdisciplinary partnerships and collaborations are numerous.

Successful collaborations between engineers and biologists have produced peer-reviewed publications, patents that have generated significant income for the university, and international recognition. However, on other occasions, these efforts have failed to find sustainable collaboration due to limited capacity in Biological Sciences at S&T. The

consequence is that promising technologies and engineering processes have not been translated to (bio)-medical use. The establishment of collaborations outside our home institution is possible but remains more difficult given the necessary additional investment in time and resources. A critical mass of S&T biologists who can translate basic science will facilitate engagement in exploratory and long-term collaborative projects. An enhanced, better equipped, and larger Biological Sciences Department is the foundation of current and future S&T strengths in applied biomedical and environmental research and education.

Missouri S&T has set an ambitious goal to become an international leader in making consequential impacts in the living world, and our three cornerstones in the life sciences initiative are interconnected via human factors (Fig. 2). Without understanding and accommodating these human factors, effort in advancing biomedical science and environmental and life science become futile. To address these needs, faculty in Psychological Science and in Technical Communications have begun the process to develop new Ph.D. degree programs in their respective areas as well. The involvement of humanities and social science disciplines in the life sciences initiative is in line with the University's goal to elevate the presence of humanities and social science on our campus and beyond, as well as the University's ultimate intent to reach R1 status by FY2030.

Support Infrastructure for Goals

Biomedical science and environmental and life sciences have been, and will continue to be, supported by S&T's immense resources in technologies and engineering processes (Fig. 2). Research in biomedical science will be supported by the Center for Biomedical Research (CBR, leading role), Material Research Center (MRC), High Performance Computing Center (HPCC), Intelligent Systems Center (ISC), and by the Technology Transfer & Economic Development Office. Environmental & life science research will be supported by the Center for Research in Energy and Environment (CREE, leading role), MRC, HPCC, Energetic Materials, Rock Characterization, and Geomechanics Center (EMERGe), Center for Infrastructure Engineering Studies (CIES), and [Center for Intelligent Infrastructure](#) (CII).

Alignment with department goals.

The Department of Biological Sciences, with our current baccalaureate and MS programs, prepares students for interdisciplinary STEM careers by emphasizing problem solving, innovation, and entrepreneurial thinking. The addition of a Ph.D. program will serve as a catalyst for department growth, expanding research capacity, enhancing existing partnerships with collaborators across disciplines, and attracting sponsored support and investments in personnel and infrastructure. Expansion of research activities will enhance opportunities for our undergraduate students and lead to enrollment growth in both our undergraduate and graduate programs. The addition of a doctoral program is viewed as essential to future department growth.

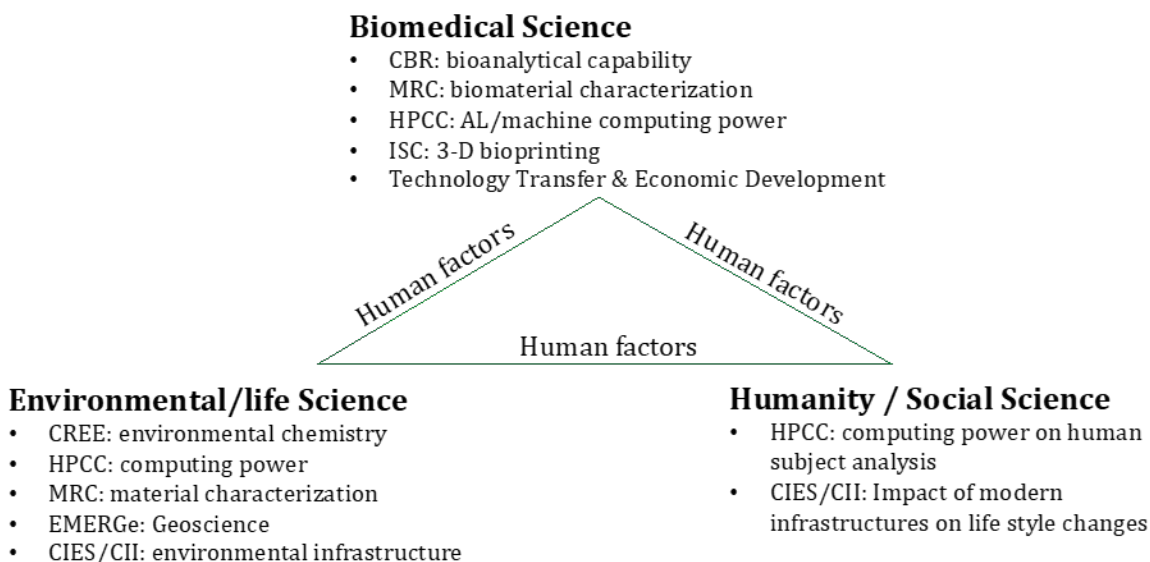


Figure 2: Research centers and research infrastructure on the Missouri S&T campus.

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

Unique features of our proposed program

Our program will be categorized under CIP code 26.0101- Biology/Biological Sciences, General, and will distinguish itself from similar programs on the other UM System campuses by capitalizing on the strengths and unique research profile of our campus. The Biological Sciences Ph.D. program at Missouri S&T will provide doctoral training opportunities that are not available on the other UM System campuses. Life science faculty members individually offer unique research foci, and doctoral programs are unlike undergraduate and non-thesis masters programs in that doctoral programs do not compete in the same way for enrollment of the same pool of potential students. Students often select programs by reputation, but also by finding scholars and faculty with interests matching their own. Furthermore, doctoral student training is synergistic with and supported by the scholarly pursuits of research faculty. Missouri S&T has a practice of establishing collaborations with companies and national labs that provide opportunities for students to work on-site and gain experience in these interdisciplinary environments. An opportunity for students to conduct internships with these partners is a key feature of this proposal. To maximize the return on scholarly efforts of our biological sciences faculty as well as our institutional investments into faculty and facilities, we need to develop this doctoral program and the students it will bring. The citizens of Missouri will benefit from the advancement of scholarship provided by our faculty and students, as well as the expanded opportunities to pursue advanced training in the scholarly fields uniquely supported by our biological sciences faculty.

Our doctoral program will emphasize interdisciplinary collaboration across the S&T campus, bringing cross-disciplinary technology applications to address fundamental and

translational applications. The integration of technologies and disciplines, and engagement with industry partners, is a strength that is a part of Missouri S&T's reputation. In a nod to our university reputation, Dr. Kristine Callis-Duehl (Dreimeyer Director of Education Research and Outreach, Danforth Center) stated as part of her support for our proposal, *"Missouri S&T is uniquely positioned to connect biological sciences with math, computer science, and engineering to produce researchers who can bring together these fields for true innovation"*, and *"a Ph.D. program that focuses on training students for industry research as opposed to academic research is unique in this area and relatively unique across the country"*. Dr. Christina Taylor (S&T chemistry alum and Computational Molecular Design Lead and Science Fellow, Bayer) compared S&T's strengths to those of her own Ph.D. alma mater, MIT (see her support letter, appendix 3), concluding *"Expanding the Biological Sciences Program to include a Ph.D. will help drive more collaborations between Biological Sciences and many of the areas in which Missouri S&T exhibits strengths"*. Similarly, Dennis Ridenour (President and CEO of BioNexus KC) stated in his support for our proposal *"A new program for doctoral-level training in biological sciences, along with a new doctoral program in bioengineering, will create a dynamic, interdisciplinary collaborative environment to enhance current and future cutting-edge research and advanced training opportunities."*

The foundations for interdisciplinary engagement of biological scientists and our students already occur in existing collaborations with researchers in departments across the S&T campus. In the past ten years, the faculty of our relatively small Biological Sciences department (average 9 tenure-track faculty over the ten-year period) have served in a co-investigator role on 86 interdisciplinary research proposals amounting to \$56 million. The principal investigators of these proposals have come from Chemical and Biochemical Engineering, Civil, Environmental and Architectural Engineering, Electrical and Computer Engineering, Materials Science and Engineering, Mechanical and Aerospace Engineering, among others. In addition, Biological Sciences faculty have served as principal investigators on an additional \$26 million in proposals that included one or more co-investigators from many of the same other departments. Two-thirds of these proposals were submitted to NIH or NSF. There is a high demand across the S&T campus for the expertise provided by Biological Sciences faculty that is essential to many of the ongoing and planned interdisciplinary research programs. The addition of a bioengineering doctoral program and the investments in new faculty that accompany that program will serve to greatly increase the opportunities for Biological Sciences faculty and student collaborators. Adding a doctoral graduate program in our department will maximize the return on investments in our discipline and future collaborations will be strengthened by the enhanced capacity of our department.

Examples of the potential of these collaborations can be seen through the success of our undergraduate students in innovation and entrepreneurship competitions. Interdisciplinary teams of undergraduate students have successfully competed locally and regionally winning several pitch competitions, often against medical students, graduate students, and practicing professionals (see section 3.C.2 for specific examples). Expanding this approach to the proposed graduate program will lead to more opportunities for entrepreneurial successes that benefit the state of Missouri such as patents and start-up companies.

Need for foundational science programs on all UM System campuses

There are four biological sciences departments in the UM System (one on each campus), and currently there are two biological sciences Ph.D. programs, at MU and UMSL. The UMKC campus also has doctoral training in biology, although it employs a different model, with a single interdisciplinary-Ph.D. (iPhD) program that serves all departments on the Kansas City campus

During the preparation of this proposal, we have engaged with department chairs and graduate program directors in biological sciences disciplines on all three of our sister campuses (MU, UMSL and UMKC). These individuals expressed support for our proposal and interest in the potential for enhancement of future collaborations. Dr. Truman (Dean, School of Science and Engineering, UMKC) provided a support letter in which he endorsed our proposal (see letter, appendix 3).

The foundational sciences of any STEM-based curriculum and research focus include biology, physics, chemistry, and math. Missouri S&T, the STEM-focused campus in our system, is the only one of the four campuses that lacks the support and opportunities provided by a doctoral program in biological sciences. This is a key missing component that is essential to the success of the life sciences initiative on our campus.

3. Business-Related Criteria & Justification

3.A. Market Analysis

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

Missouri is a Growing Hub of Biomedical, Pharmaceutical and Biotechnology Companies

In the past ten years, life sciences employment in the U.S. has doubled, representing an annual growth rate of 6.6% compared to the 1.2% annual average for total U.S. employment ([Cushman & Wakefield October 2022 report](#)). According to [Global Market Insight](#), the biotechnology market was valued at around \$497 billion in 2020 and was projected to grow to more than \$950 billion by 2027, at a compound annual growth rate (CAGR) of over 9.4%. Missouri in general, and the St. Louis region in particular, has emerged as a major biotech hub in the Midwest ([St. Louis Bioscience Labor Market Analysis](#)). Outside of St. Louis, much of the biotech industry (broadly speaking) has developed along the I-70 corridor between St. Louis and Kansas City. The top biotech employers in Missouri include large, international companies, like Bayer, Pfizer, Thermo Fisher Scientific, MilliporeSigma, and Eurofins Scientific, to name a few. Top biopharmaceutical companies in Missouri include Mallinckrodt, Genentech, AstraZeneca, GlaxoSmithKline, and Eli Lilly. Institutions like the Donald Danforth Plant Science Center, the Missouri Botanical Garden, and the Stowers Institute are internationally recognized leaders in their fields of life sciences research. In the

past two decades, the St. Louis region has been transformed into a hotbed for bio-innovation. Initiatives to attract, foster and support a vibrant innovation community include [Cortex](#), [T-REX](#), and [BIOSTL](#). St. Louis alone hosts over 1,000 small and startup biotech companies ([BIOSTL](#)). Similarly, [BioNexus KC](#) is a non-profit organization in the Kansas City area advancing life sciences resources, facilitating collaborations, and promoting workforce development.

The major elements that are essential to a successful biotech community are a talented workforce and creative, innovative leaders. At the heart of a region feeding both these elements are world class academic institutions. The leaders and innovators in biotech companies almost universally are subject experts with doctoral degrees. The largest centers of biotech innovation develop around regions with multiple academic research institutions. Missouri is moving in this direction and *with the vision established by the Kummer Institute, Missouri S&T is poised to contribute to growing the influence of Missouri in the biomedical, pharmaceutical and biotechnology industries.*

Public universities should be an important contributor of talent, leadership, and opportunity. There are four universities in Missouri where Ph.D. degrees are awarded in biological sciences. They are concentrated in St. Louis and along the I-70 corridor: Washington University-St Louis, Saint Louis University, University of Missouri-Columbia, and University of Missouri-St. Louis, setting aside UMKC's unique campus-wide interdisciplinary Ph.D. program for which discipline-specific numbers are unavailable. These programs collectively graduated 384 total Ph.D.'s in the five years between 2017 and 2021 for *an average of 77 new scientists with doctoral degrees in biological or life sciences per year in Missouri.*

It is notable that the academic landscape for Biological Sciences Ph.D. degrees in Missouri is dominated by just one university. The Division of Biology and Biomedical Sciences (DBBS) at Washington University graduated 384 PhDs in biological sciences fields in the previous five years (average 77 per year). The DBBS is responsible for almost 80% of biological sciences PhDs awarded in Missouri. The strength of the DBBS is the sheer number and diversity of participating faculty from more than 30 departments across multiple campuses of Washington University in St. Louis. By comparison, the largest public university in Missouri, University of Missouri-Columbia, graduated 53 PhDs from a single department (not including a few more graduates in biomedical disciplines) in the same five-year span (average 10 per year). Saint Louis University and University of Missouri-St. Louis each graduated 26 PhDs from their biology programs in the same time frame (average 5 per year each). Washington University is a highly selective internationally renowned private university, and it is a major driver of the biomedical, biotechnology, and pharmaceutical industries in the St. Louis region. However, as reported in a [Bioscience Labor Market Analysis](#) prepared by BioSTL in reference to graduate programs, "90% of Washington University students are from outside Missouri, 65% are from more than 500 miles away", and "a notable share of these students will not stay in the area after program completion." It is limiting for the region to rely on a single private university that holds such a dominant position for training top leadership talent in the region. Public universities also serve an important role in contributing to the talent pipeline, and while the UM campuses have excellent programs, there is room for more investment and growth. Missouri S&T can

accelerate this development by joining the other three campuses in training leadership talent in the biological sciences for Missouri.

The Job Market in Missouri for PhDs in Biological Sciences Fields

In Missouri, the most recently available six-year period 2016-2021 shows 3,617 unique job postings (avg 602 per year) available for job candidates with a doctoral degree in biological sciences. A little over half the jobs for biologists with doctoral degrees were posted by academic institutions (1343 jobs in six years) that hire scientists into permanent faculty and scientist positions, but also many term-limited postdoctoral training positions. Importantly, industries and public agencies also advertised 1,422 positions (avg 237 per year) for scientists with doctoral degrees in biological sciences. In total, within the state, 2.5 times as many non-academic jobs were advertised each year for Ph.D.-level biological scientists as the total number of biological sciences doctorate degrees that were awarded (see previous section). This does not include jobs at academic institutions, which also separately exceeded the number of awarded doctorate degrees by a factor of 2.8. Among the job advertisements reviewed in our market analysis, the non-academic jobs were advertised by biotech companies (474 jobs), biomedical companies (423 jobs), and pharmaceutical companies (178 jobs), as well as government agencies (54 jobs).

Total postings - Ph.D. or Prof degree (all postings):	3617
Summary of top employers (those with ≥10 postings)	
Sum of all academic (universities, research institutes):	1343
Washington University (1,177)	
University of Missouri (50)	
University of Kansas (46)	
Stowers Institute (43)	
Sum of all non-academic (companies, gov agencies):	1422
Bayer (255)	
Pfizer (159)	
Eurofins (49)	
Millipore Sigma (45)	
Mallinckrodt (38)	

Among these job postings, the top job titles (in order of frequency) were medical scientist, biological or life scientist, plant scientist, environmental scientist, food scientist, biochemist, epidemiologist, microbiologist, and wildlife biologist. The top locations for job postings included St. Louis, Kansas City, Chesterfield, Columbia, Jefferson City, and Springfield. Job locations also included over fifty cities and towns throughout the state, including places like Salem, Owensville, Sikeston, Potosi, Ava, Houston and many others (Fig 3).

There is a robust job market for doctoral-trained research scientists in Missouri, and future growth of biotech industries in the region is limited by the availability of a well-trained workforce. Regardless of how the data are parsed, the number of job positions advertised for scientists with doctoral degrees in biological sciences in Missouri exceeds the number of students graduated in Missouri by several times. This places all institutions, both academic and non-academic, in a challenging position to recruit heavily from other parts of the country as well as internationally. It also indicates that the majority of available high-skill, high-paying positions in these industries are filled by non-Missouri residents (or scientists trained outside of our state). This is a fact that was repeatedly emphasized in support letters. Chris Reed (Director of Talent Management, Benson Hill) stated in his support letter *"It is rare that we can identify, engage, and hire a St. Louis based, much less Missouri based, scientist"*, and *"Missouri would be better served to have more advanced training opportunities in our public universities because those individuals would be more invested or motivated in staying in Missouri, and contributing to the regional economy"*. Dr. Callis-Duehl (Danforth Center) stated *"Industry partners, like the Danforth Center, are importing talent from outside Missouri and often outside of the US to fulfill [biotech] positions."* Mr. Ridenour (BioNexus KC) stated *"Industry representatives...have cited challenges recruiting necessary talent, frequently resulting in regional companies recruiting nationally or internationally to meet local and regional needs."* We heard similar sentiments from other industry leaders we contacted. Dr. Taylor stated *"As a hiring manager and Science Fellow at Bayer, I have observed the need to develop and recruit talent in the Midwest firsthand. We have more success with acceptance and retention when we target students that attended a school in the Midwest or have family connections to the Midwest."* Dr. Borgschulte, Senior Director and Head of Bioprocessing Upstream R&D at MilliporeSigma, stated *"Recruiting top talent for senior scientist-level positions has been a persistent challenge for us at our sites in St. Louis, MO and Lenexa, KS, as we are competing with large biotech and pharmaceutical companies primarily located on the East and West coasts for the same talent pool of candidates. We have found our most successful recruiting efforts often arise from partnerships with regional universities."*

Another common refrain in our discussions with industry representatives was how important it is for companies to engage with students before they graduate in order to recruit them before they leave the region. In their labor market analysis, BIOSTL reported, in reference to doctoral graduates from current regional universities, "a notable share of these students will not stay in the area after program completion unless local employers connect with them before they graduate." These same points were emphasized in an article entitled *How mixing academia and industry opens doors in graduate school and beyond* ([Nature, Vol 617, May 2023](#)). This is where we think an emphasis on internship opportunities for our doctoral students will be critical to retaining our graduates in the region after they have graduated from Missouri S&T.

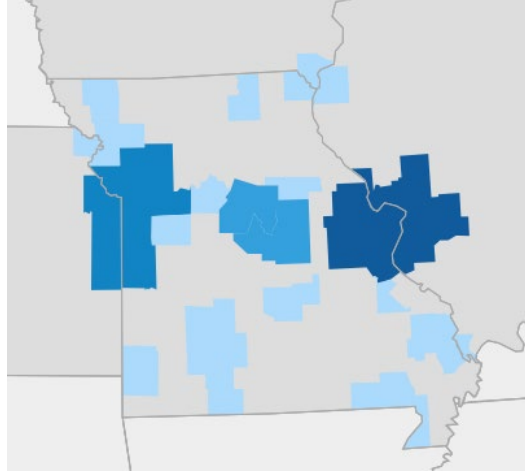


Figure 3: Regional coverage of biological sciences job postings that list a doctoral degree as an educational requirement (darker shades correspond to more job postings).

3.A.2. Student Demand for the Program

The state of Missouri is currently under-served by the size and capacity of doctoral programs in the biological sciences. In recent years, annual non-academic job postings exceeded annual doctoral degrees awarded by a factor of 2.5. When Missouri under-invests in doctoral training opportunities for our citizens, our students must find programs in other states to meet their educational goals, and our hiring institutions must attract talent from abroad to meet their workforce needs. As noted above, there is evidence that Missouri currently provides *insufficient numbers of doctoral training opportunities* in biological sciences when compared to our bordering Midwestern neighbors. The size of a Ph.D. program, and the number of students it graduates is a direct function of institutional capacity. The number of faculty in a department limits the amount of sponsored research support and the number of Ph.D. students that can be trained. The range of faculty expertise also impacts the range of disciplinary areas that graduate students can pursue. A review of the numbers of Ph.D. graduates from universities with doctoral programs in biological sciences by state can provide some indication of doctoral training capacity. Considering all public and private universities, Missouri ranks in the bottom half among our neighboring states in training capacity to support Ph.D. students in Biological and Biomedical Sciences programs as measured by the *number of Ph.D. graduates per million residents in all programs using CIP code 26 in 2021* (Fig 4a). CIP code 26 includes all programs that focus on biological sciences and the non-clinical biomedical sciences (definition from Department of Education). When considering only *public universities* with Ph.D. programs in biological and biomedical sciences, Missouri ranks last in capacity among our neighboring states by the same metric (Fig 4b).

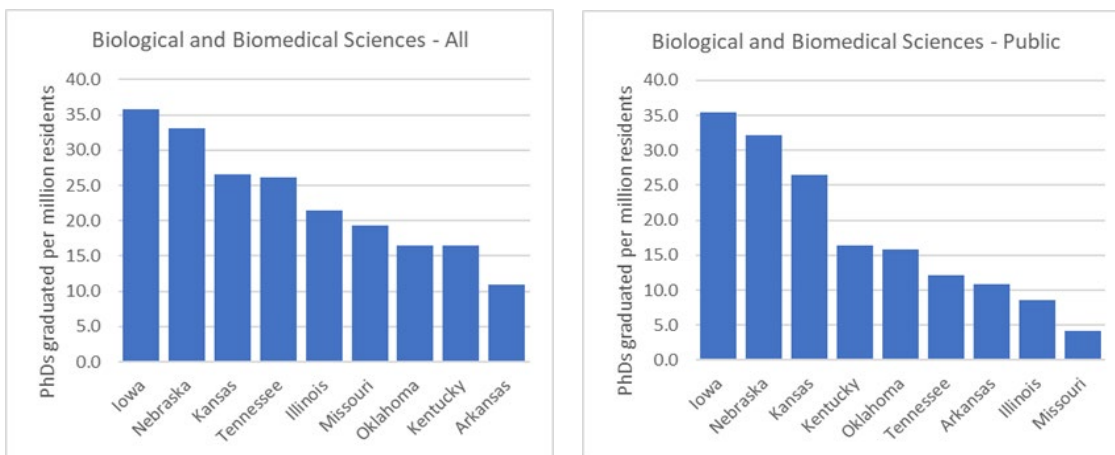


Figure 4: Number of PhDs graduated per million residents in Biological and Biomedical Sciences in 2021 (most recent available data). A) All universities public and private, B) public universities only.

In fact, Missouri capacity at public institutions is currently less than half of the next highest state, Illinois, and only 12% of the per capita capacity of our highest ranked neighbor, Iowa. Importantly, Missouri also ranks last in the number of public institutions that offer Ph.D. program options in Biological or Biomedical Sciences (CIP code 26) on a per capita basis. These numbers clearly show that, on a per capita basis, Missouri has less *capacity* in our public universities than any of our neighbors to train doctoral students in biological sciences. This is not a statement about the *quality* of existing Ph.D. graduate programs at Missouri institutions, including UMC and UMSL, relative to neighboring states. In order for the state of Missouri, and Missouri citizens, to participate in the bioeconomy, and attract businesses engaged in the biotechnology research, we must increase and diversify our capacity to train the next generation of experts and leaders in biotechnology fields. We cannot find ourselves dependent on programs outside our state to provide training to our citizens and import expertise to support our bioeconomy. A doctoral program in Biological Sciences at Missouri S&T will help address this capacity shortage.

Enrollment Projections

Projections of enrollment numbers in a new biological sciences Ph.D. program are based on a variety of factors. First and foremost, Missouri S&T is making bold investments in life sciences research in programs across our campus, with an emphasis on growing our life sciences and engineering programs. These investments include renovations to existing buildings, planning for new research buildings, equipment and specialized facilities, new faculty lines in Biological Sciences, and new bio-related engineering programs (e.g., Biomedical Engineering). These investments are targeted to expand research capacity, and to elevate visibility and competitiveness of our undergraduate and graduate programs in life sciences fields, including Biological Sciences. We have received approval to search in AY23-24 for a new Kummer Endowed Department Chair in Biological Sciences. This individual will be an accomplished scholar and will provide enhanced leadership in the department. We expect to add two additional new faculty to Biological Sciences in the next five years to

support expansion of our own undergraduate and graduate programs, as well as the hiring of new faculty in related fields to support the creation and expansion of other bio-related engineering programs on campus.

We anticipate that this increased visibility of life sciences will double the size of our own undergraduate program, possibly in the next five years, and that student credit hours (SCH) generated by students from other programs enrolling in our courses will more than double as well. Our expectation for overall enrollment growth is based on observations that undergraduate applications to the biological sciences program is currently the fourth highest on our campus behind only Aerospace Engineering, Mechanical Engineering and Computer Science, but our yield rate of new students from these applications is only half of the overall campus average (Fig. 5). Historically, the Biological Sciences program has not been a target for bold investments, rendering it less competitive than other programs on the Missouri S&T campus. That is changing quickly. The investments on our campus under the life sciences initiative in faculty hires, facilities enhancements, and new programs will elevate our yield rate to the campus average and make our undergraduate program one of the largest on our campus.

All of these investments are critical to our plan to support a vibrant doctoral program. The recruitment of top doctoral students requires excellent research programs and facilities, as well as graduate assistantship and fellowship support. Our capacity to attract and support doctoral students will depend on our ability to financially support them. A mature doctoral program should have capacity to provide graduate assistantships and fellowships from a variety of sources, with approximately two-thirds of student support coming from graduate teaching assistantships, and one-third coming from other sources. Graduate teaching assistantships, currently awarded to MS students, are used to support instruction primarily in lab courses. We propose that doctoral students can also be used to support teaching in expanded academic capacities that will include tutoring and grading, recitation sessions for large lecture classes, management of seminars and seminar courses, and lecturers in some introductory and non-majors lecture classes. These expanded uses of doctoral students as Graduate Teaching Assistants will also serve a critical role in reducing teaching effort for faculty members who will require a shift in their workload effort in order to tackle expanded sponsored research program aspirations. At present, our lab course enrollments support eight MS graduate teaching assistantships per semester (fall and spring only). These current MS assistantships will be redeployed to support our PhD students. With enrollment growth and the support of the Dean and the Provost, total assistantship support will be increased to fifteen assistantships per semester in five years. At the same time, we will count on new sponsored research, fellowships (e.g., Kummer Fellowships), and other sources (e.g., new faculty startup packages) to generate additional graduate student support. This means that during the first five years, we anticipate providing twelve months of support for all doctoral students through various sources of funding.

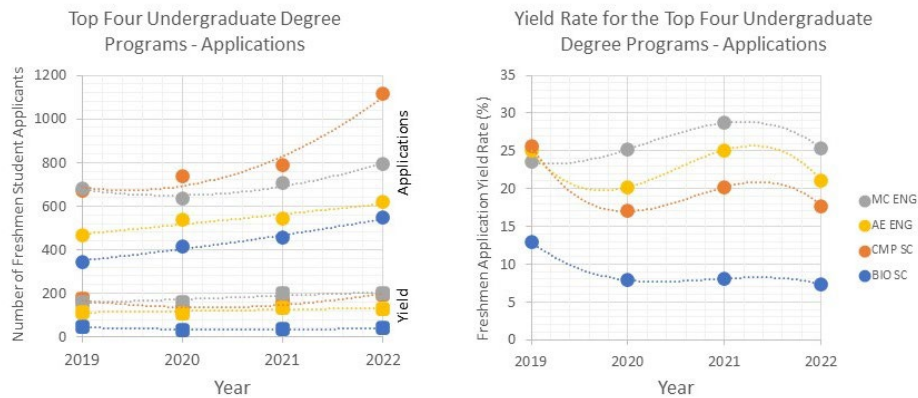


Figure 5: Number of first-time freshmen applications, yield (entering freshmen class size), and yield percentage for the top four undergraduate degree programs on the Missouri S&T campus based on overall application numbers.

Doctoral student recruitment and enrollment will depend on a combination of recruitment among our own undergraduate and master's degree students as well as recruitment from undergraduate and master's programs around the state (see section 3.C). We anticipate that our first doctoral students will be recruited from our own programs. Several current undergraduate and master's students have expressed an interest. Once the program is established, we anticipate that at least half the students who enter the program will be recruited from other colleges and universities.

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

Year:	1	2	3	4	5
Full-time	3	6	9	12	15
Part-time					
/Total	3	6	9	12	15

Table 1b. New Student Enrollment Projections (anticipated number of students enrolled in the program during the first five fall semesters following implementation that are new to the University – that is, recruited from other universities.)

Fiscal Year:	1	2	3	4	5
Full-time	3	3	3	3	3
Part-time					
Total	3	6	9	12	15

Table 1c. Projected Number of Degrees Awarded

Year:	1	2	3	4	5	6	7	8	9	10
# of Degrees Awarded¹	0	0	0	0	0	3	3	3	3	3

¹ Time to graduation varies for Ph.D. students but should average 5-7 years, and 4-6 years for students who enter with an MS degree. We should begin to reach a steady state of new and graduating students by year ten or sooner.

3.B. Financial Projections

A completed Pro Forma for the financial projections is included in Appendix 2.

3.B.1. Additional Resources Needed

Two new faculty lines - The Dean of CASE has pledged two new tenure track faculty lines in the next five years as a key component of investments in life sciences initiatives. This pledge includes startup packages competitive with Biological Sciences assistant professors at R1 and R2 universities, and the startup packages are necessary to build research programs that will support this proposed Ph.D. program. These new faculty lines will be essential to expand research capacity in the Biological Sciences and to provide new faculty expertise in areas of molecular and biomedical science that have been identified as priorities for the life sciences initiative. New faculty members are already needed to meet the demand for biology collaborators with researchers in other departments, including several engineering programs. This demand for collaborators will increase further with the addition of a planned bioengineering doctoral program. These two new faculty members will also be required to address the need for three new proposed graduate courses for this doctoral program. Additional program growth in the Department will be dictated by total enrollment growth in Biological Sciences programs. The Department will aim to maintain the university average of 18:1 student to faculty ratio for biology majors within the department, and growth in program enrollments will provide resources to add faculty lines.

Office staff support - This Ph.D. proposal fits within the College of Arts, Science and Education plans to add three new doctoral programs (also including Psychological Sciences and Technical Communication). All three new programs will require new office support. At present, one office manager serves the Biological Sciences Department. The office manager's job duties include course scheduling, hiring and payroll management, ordering and package receiving (teaching and research), filing work orders, assistance with budget management (all department and faculty accounts), webmaster, social media posting, and office receptionist. A centralized solution within the college will be necessary to support growth in the Biological Sciences Department that will include enhanced research productivity and budget management as well as the new Ph.D. program. This additional office support is not included in the budget of this proposal.

Expanded Research lab space and graduate student office space – The west wing of Schrenk Hall was partially renovated in 2019. Planning for renovation of the east wing of Schrenk Hall is underway, with a commitment of \$27 million to the next phase of renovations of teaching and research labs, and faculty and student office space. These renovations are ongoing, and not included in the budget of this proposal.

A ‘BioPlex’ interdisciplinary life sciences and engineering research lab building has been proposed and recently added to the Campus Master Plan. The cost has been estimated at \$90-100 million. This building will provide life sciences research lab space and host interdisciplinary biomolecular and biomedical research for several departments, including Biological Sciences, Chemistry, Chemical and Biochemical Engineering, and Materials Science and Engineering. This new building will be integral to the expanded research lab needs of the Biological Sciences Department. This proposed new interdisciplinary building will serve future needs of researchers in programs across campus. It is not included in the budget for this proposal.

Expanded budget for added departmental expenses – The Dean of CASE has pledged that the department will receive additional annual budget support in the amount of \$1000 per graduate student to support expenditures like new student recruitment, student travel, publication costs, computer and software expenses, equipment replacement, and equipment maintenance and service contracts.

3.B.2. Revenue

Direct revenue from a doctoral program in biological sciences will come from three sources:

- Tuition dollars generated by sponsored support for graduate student research. We anticipate an increasing graduate enrollment to about fifteen doctoral students within five years of the initiation of the program, and we anticipate that one-third of graduate student support will come from sponsored research, fellowships, and other sources. Graduate students in our doctoral program will receive their summer support through research assistantships derived from external funding. The remainder of their support will come from teaching assistantships. Within five years, we anticipate fifteen doctoral students in this program with sponsored research tuition support contributing to program revenue.
- The increased capacity for research provided by a doctoral program will result in enhancement of overhead revenue from sponsored projects. We expect a boost in grant productivity resulting from growth of our department and enhanced research capabilities.
- Our focus on translational research and engineering and industry collaborations should result in patentable research outcomes.

3.B.3. Net Revenue

Doctoral programs are not net revenue generators. The one-time expenses for this program include investments in new equipment for the department, expended by new faculty using startup funds. Recurring expenses include salary and benefits for two new faculty members.

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

	Year 1	Year 2	Year 3	Year 4	Year 5
1. Expenses per year					
A. One-time					
New/Renovated Space					
Equipment					
Library					
Consultants					
Other (startup packages)			600,000		600,000
Total one-time	0	0	600,000	0	600,000
B. Recurring					
Faculty			\$80,000	\$82,400	\$169,744
Staff (50%)					
Benefits	0	0	28,496	29,351	60,463
Equipment (including software, computers, and equip. maintenance)	2400	4800	7200	9600	12000
Graduate Teaching Assistants	62,088	127,895	186,263	248,351	310,438
Library					
Other (recruiting and student travel)	600	1200	1800	2400	3000
Total recurring	65,088	133,895	303,759	372,101	555,645
Total expenses (A+B)	65,088	133,895	903,759	372,101	1,155,645
2. Revenue per year					
Tuition/Fees ¹	42,300	87,138	134,628	184,896	238,054
Institutional Resources					
State Aid -- CBHE					
State Aid -- Other					
F&A Funds Returned to the University					
Total revenue	42,300	87,138	134,628	184,896	238,054
3. Net revenue (loss) per year	(22,788)	(46,757)	(769,130)	(187,205)	(917,591)
4. Cumulative revenue (loss) ²	(22,788)	(69,546)	(838,675)	(1,025,881)	(1,943,472)

1 – revenue based on 6 credit hours of tuition paid from sponsored research (GRA support) per student.

2 – these revenue projections reflect only the institutional investments in graduate assistantships and two new faculty. These projections do not capture the full benefits of expanded sponsored research that will be enhanced by this program and these new faculty.

3.B.4. Academic and Financial Viability

There are no financial concerns associated with this program. Academically, the program requires a minimum enrollment of 10 students to maintain a vibrant and active learning environment.

Table 3. Enrollment for Academic and Financial Viability

Viability	Minimum Enrollment
Academic	10
Financial	NA
Overall	10

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

3.C.1. Marketing Plan

This program will be marketed towards undergraduate / master's level students with degrees in Biological Sciences and related disciplines. We will use a four-pronged approach towards advertising. First, we will utilize our website by enhancing faculty pages and creating videos of faculty interviews. Second, we will use social media, such as LinkedIn, Research Gate, Instagram, Twitter, and Facebook to advertise our program and openings in our Ph.D. program. Third, we will advertise via regional venues (e.g., MO Academy of Sciences, MoPhys, etc.) using email subscriptions, tables at conferences and meetings, and their websites. Lastly, we will advertise in academic and professional venues (e.g., American Society of Microbiology, American Society of Cell Biology, etc.) using the same methods as with the regional venues.

The graduate coordinator / chair will be responsible for marketing the program. That person will have help from a designated staff person in the department, who will help manage enrollment numbers, ensure campus paperwork is completed, track progress of students, and record student outcomes. There will also be a student ambassador who will help with social media posts. Campus branding will help the graduate coordinator develop media and optimize search engines.

In order to measure if the marketing strategy is effective, data will be collected on the number of recruiting events attended, the academic background of accepted students (including location of undergraduate institution, size of undergraduate institution, undergraduate major, etc.), how the applicants heard of the program, and number of views on social media posts.

As the program grows, marketing will change accordingly. In addition to videos of faculty, videos of graduate students will be posted on the departmental website. The successful outcomes of the students will be highlighted on social media, attracting more students to the program.

3.C.2. Student Success Plan

The Biological Sciences Ph.D. program at Missouri S&T will build on our existing strengths by enhancing collaboration among academic departments and research centers, UM-System campuses, and industry. The program will improve curricular and co-curricular coordination while supporting the engagement of all students in demonstrated high-impact teaching and learning practices. Support for graduate student learning and success will be infused across the curriculum and co-curriculum, and outcomes will be routinely assessed and tracked to help ensure ongoing improvement. Abundant campus resources and services—including the Student Success Center, Technical Editing Services, and the Writing Center—are dedicated to supporting student learning. Student persistence and on-time degree completion will be systematically addressed (see Monitoring Student Success below).

Our student success plan was developed around three core elements: academic development, career development, and social and emotional development.

Academic Development

The academic program will lead to the acquisition of the skills, knowledge, and attitudes needed to be effective scientists.

- Ongoing support and assessment of progress with mentor/advisor. Regular mentor/advisor interaction, Regular committee interaction
- Selection of rigorous courses linked to interest, skills, and career pathways
- Provision of timely intervention
- Learning experiences outside the classroom
- Progress in meeting rigorous expectations
- Interdisciplinary program with graduate certificate requirement

Career Development

The student will investigate their own interests and abilities as they relate to the world of science in a dynamic economy. The one-size-fits all approach, which has driven academics for the past century, does not address the complex and varied needs of today's biologist. The customized plan of our Ph.D. program will include varied and flexible educational opportunities, personal connections, and elective coursework, and targeted support tied to each student's education and/or career goals. This plan will allow students to make better career choices with the academic foundation to achieve their career and personal goals.

- Attend professional meetings
- Career exploration activities
- Regular mentor/advisor interaction

Social & Emotional Development

The Student Success Plan supports positive social and emotional development, allowing students to more fully engage in the school environment and take the risks necessary for optimal academic performance.

- Broadened awareness of self within a global context
- Utilizing supportive campus resources

Monitoring Student Success

To ensure success of the program, students and faculty will be surveyed every two years for the first ten years, and then every five years after. Metrics on student activities will be kept by the Chair of Graduate Studies. The survey will include questions on:

- 1) Academic Performance. Academic performance refers to metrics that measure and track academic progress and achievement. GPA is a straightforward metric that correlates to student grades. First-year performance can indicate how well students are persisting through terms and predict the overall success in the students' program of study. Poor academic performance can affect other metrics such as retention and graduation rates, and lengthen time to completion, resulting in more time that a student stays in the institution.
- 2) Education and Career Goals. Tracking educational and career goals requires students to formally meet with an advisor each semester. Goals will be set (including presenting posters, outlining manuscripts, attending conferences, establishing a professional network, etc.). A workflow should be put in place that tracks the student's academic progress.

- 3) Time to completion. Time to completion is the time it takes for a student to attain the desired degree. This metric will allow the department to measure whether students are taking longer than the national average to complete their degrees, if there are extra courses, inefficient use of resources, or delays in availability of courses.
- 4) Passing preliminary exams.
- 5) Graduation Rates. Graduation rate refers to the number of students who achieved the degree.
- 6) Retention Rates. Retention rate refers to the number of students who persist through an academic program. This metric will help identify why students leave the program and help to uncover issues such as insufficient resources. High retention rates can lead to increased funding and elevated ranking to attract quality prospects and faculty.
- 7) Quality and accessibility of classes. Will be assessed through student evaluations and faculty peer observations.
- 8) Accessibility of required research equipment. Accessed by requests for new equipment and maintenance/repair of existing equipment.

Student success in related programs

The Biological Sciences Department has an enviable track record of success in developing innovative, distinctive curricula and creating opportunities for students to engage in high-impact practices. Our curricula provide a flexible, competency-based framework for curricular and co-curricular learning, and we are recognized for excellence in such areas as undergraduate research experience, service learning, and experiential learning.

Our B.S. and B.A. programs in biological sciences have represented the largest program in CASE/CASB since the inception of the college in 2014, showing that S&T has the capability to attract students interested in the biological disciplines. Our new B.S. degree in Environmental Science has exceeded enrollment predictions by double in its first year. This demonstrates that S&T has the infrastructure and reputation to continue to expand on an educational program in environmental biology, one of the three pillars in this proposal.

Of the 80 students to earn the Biomedical Engineering Minor (2016-2023) at Missouri S&T, over half (42) have earned degrees in Biological Sciences. In February 2023, a new Biomedical Engineering Design Team was formally recognized, and the team members include 40-50% Biological Sciences majors, with 40% of the officers being biology majors. This highlights that Biological Sciences is critical to the success of the biomedical science and engineering program initiatives on the S&T campus.

Another pillar in this proposal is an extension of one of our BioInnovation undergraduate certificate program. First offered in Spring 2020, the initial program had two teams

(consisting of 2-3 students) form Living and Learning Communities (LLCs), and since then, 30.6% of the teams pitched in a regional competition with 84% of those students winning, and one team filing a patent disclosure. Examples of undergraduate success include the [Bionic Bowel](#), [GuideLine](#), [Striae Away](#), [Foliograft](#), [Bertilde](#), [DentiGraft](#), and all three winners of the inaugural [Kummer Start-Up Challenge](#). All of these teams have won in competitions against teams comprised of medical students, graduate students, and practicing professionals. The BioInnovation track for our Ph.D. program will create a similar translational educational experience for our graduate students.

Our master's program currently has the highest number of enrolled students in its history, with a 50% increase from the previous year, an 80% increase from 5-years previous, as well as an 80% increase from 10-years ago.

3.C.3. Transition Plan

The primary responsible person will be the Director of the Biological Sciences Graduate Studies program, who is elected by the Biological Sciences faculty. Should the Director step down or be removed from the position, a new director will be appointed. This will ensure a seamless transition in recruiting, retaining, and matriculation of students.

3.C.4. Exit Strategy

If the program does not meet University expectations after ten years, the program will undergo remediation at the department level. The department efforts, led by the Chair of Graduate Studies, will begin the remediation by re-evaluating who is the target audience, examining advertising strategies, and identifying any misguidance in success outcomes and assessments of the program. We expect that by year 10, a minimum of 10 students will be enrolled at various stages in the Ph.D. program in Biological Sciences to achieve academic viability.

The decision to discontinue the program will be based on a discussion between the Department Chair, Dean, and Provost. At that time, current Ph.D. students can finish their program obtaining the same degree, but no more students will be recruited. Alternatively, Ph.D. students in Biological Sciences, will be merged with a department appropriate to their field of study (i.e., Chemistry or Bioengineering) where each student can finish their course of study.

4. Institutional Capacity

This program will be housed in the Department of Biological Sciences. Currently, this department supports undergraduate and master's degree programs in Biological Sciences, as well as hosting an interdisciplinary Environmental Sciences program. We anticipate that a doctoral program in our department will largely supplant our current thesis master's program in terms of redirection of existing and new graduate student support resources. However, the thesis master's program will continue to be supported as an alternative option that some graduate students may choose, as well as serving as a tool to recruit graduate students who may matriculate into the doctoral program upon completion of their theses.

5. Program Characteristics

5.A. Program Outcomes

Campus Graduate Learning Objectives (GLOs) + program specific GLOs

Students completing the doctoral program in Biological Sciences will have:

- an ability to apply knowledge of subject matter within the field of biological sciences.
- an ability to communicate effectively with scientists and non-scientists orally, in writing, and by other means.
- an ability to engage in productive critical thinking to solve research problems using a variety of approaches and integrating diverse disciplines.
- an ability to develop professionally as a biological scientist.
- an ability to independently identify, explain, and develop scholarship including a clear plan for addressing open research questions.
- an ability to exhibit ethical and professional conduct.
- developed skills to promote a climate of inclusion and engage with diverse members of the scientific community.

5.B. Program Design & Content

Curriculum

The goal for this doctoral program will be to train leaders and experts in biological sciences pursuing a variety of paths leading to careers in industry, public policy and regulation, and academia. As the market share of academic jobs across all science domains has been in decline in the past two decades, it will be critical for our program to emphasize and train students to excel in non-academic career paths, which continue to grow. A focus on interdisciplinary training will be central to this goal. We envision our doctoral program to be divided into three complementary tracks (Fig 6) that reflect the breadth of our programs and the ambitions of the University vision for life sciences.

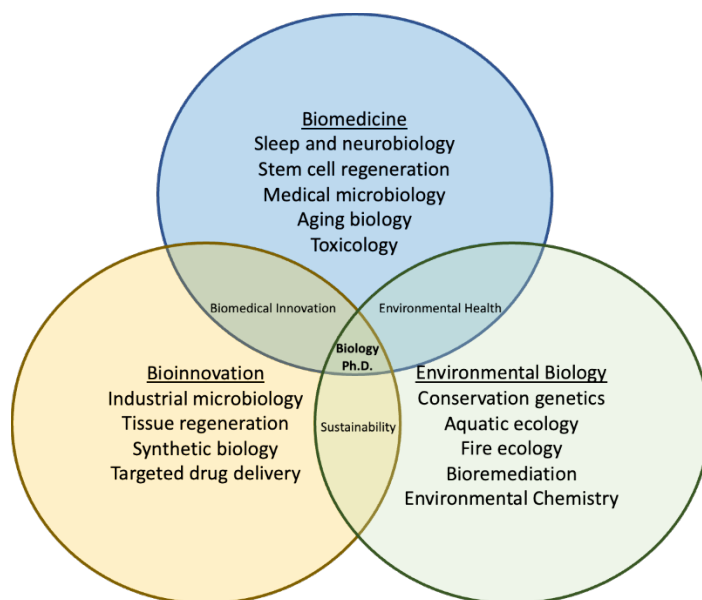


Figure 6: The doctoral program in Biological Sciences will support three tracks: Biomedicine, Bioinnovation and Environmental Biology. Listed under each track are research focal areas of present faculty.

The curriculum for this program will utilize existing coursework available to graduate students on the Missouri S&T campus. Some of the instructional effort required by this proposed Ph.D. program will result from a shift in focus from a department thesis-master's program to a new Ph.D. program. As a part of this transition, three new courses will be developed to serve as the foundation of each of our Ph.D. tracks. The faculty of the Biological Sciences anticipate developing these three courses as part of the regular, continuing, and ongoing process of revising, renewing and refreshing program curriculum. The addition of a new department chair (currently in process) and two new junior faculty in the first five years of this program (commitment from the Dean) will increase department capacity to offer the additional curriculum required by this Ph.D. program. Future growth of the department into the targeted areas of BioInnovation, Biomedicine, and Environmental Biology, will enable

the expansion of the curricular offerings. Equally important will be access by Biological Sciences Ph.D. students to cross-disciplinary courses offered in subjects including Chemistry, Chemical Engineering, Computer Science, Information Science and Technology, Materials Science and Engineering, Statistics, and others. Efforts to provide cross-disciplinary graduate student competencies include opportunities to pursue current and future graduate certificates, available at Missouri S&T and the other campuses of the UM System, in areas including data science, science entrepreneurship, and science communication, for example. Future certificates will be developed at S&T and certificates available online from the other campuses in the UM System, will also be promoted as options for our graduate students.

A critical component of the doctoral student curriculum in our program will be promotion of opportunities for our graduate students to pursue paid internships with industry and agency partners. We will develop an advisory board that will include workforce development leaders in the St. Louis and Kansas City areas to facilitate the connection of students with such opportunities. This will present a challenge for our faculty mentors whose research program momentum may be affected by the interruptions created when graduate students pursue these opportunities. However, we feel strongly that these opportunities are essential to the professional development of our students, and we are hopeful that such partnerships will also foster development of new collaborative opportunities for our students and faculty. Internships may be timed to coincide with the end of a student's data collection efforts during the period that the student is mostly analyzing data and writing, or internships could be scheduled near the beginning of a student's program before the student begins data collection. Flexibility between student and faculty mentor will be a key to success.

Degree requirements: Consistent with the Missouri S&T graduate catalog degree requirements, the Biological Sciences Ph.D. program at Missouri S&T will require 72 hours of graduate credit. For students who enter the program directly with a baccalaureate degree, this will include a minimum of 30 credit hours of 4000-, 5000-, and 6000-level lecture courses, and a minimum of 30 credit hours of graduate research. Students who enter with a master's degree will receive a block of 30 credit hours which will count toward the total seventy-two-hour program requirement. Students entering with an MS will be required to complete a minimum of 12 hours of 6000-level lecture courses, and 24 credit hours of graduate research. To maintain Ph.D. candidacy, a minimum GPA of 3.0 from 5000- and 6000-level courses is required.

A qualifying exam based upon a research proposal written and defended by the student will be successfully completed no later than the end of the fifth semester of enrollment, and a plan of study will be approved by a student's advisory committee by the end of the semester in which the qualifying exam is passed. A comprehensive exam will be completed after the student has completed their coursework. Upon conclusion of research, the student will complete a written dissertation and successfully defend the dissertation in their final exam (defense).

Development of Degree Plan of Study:

Biological Sciences Degree Tracks: Our program will be divided into three doctoral degree tracks, with a new Biological Sciences graduate course as the entry point of each track. Students will be able to choose between one of three graduate tracks: 1) Bioinnovation, 2)

Biomedicine, or 3) Environmental Biology. Each track includes one required course, two elective content area courses, and a proposal writing course (*minimum of 12 credit hours*). Additionally, all students enroll in graduate seminar at least twice (1 credit hour each), and graduate journal discussion at least once (2 credit hours each).

Data Analytical Competency: All students in the Biological Sciences Ph.D. program will complete a minimum of 6 hours of data analytic competency courses. Options include any graduate courses in statistics or any graduate computer programming, database management, machine-learning, or artificial intelligence courses (4000-, 5000-, and 6000-level). (*minimum 6 credit hours*)

Professional Development: All students will be required to complete a minimum of two semester hours of a graduate journal discussion (BIOSCI 6202) and two semester hours of a graduate seminar (BIOSCI 5020). Graduate students who are interested in industry career paths will be strongly encouraged to cultivate industry connections and to perform an industry-supported internship prior to graduation.

Optional Non-Biological Sciences Graduate Certificate: All students will have the option to earn a graduate certificate offered outside of the Department of Biological Sciences. Alternatively, students may develop a program of study that includes an equivalent amount of coursework in a focused area outside of Biological Sciences if a certificate is not available that meets the student's needs. Such a plan would be approved by the student's committee (*12 credit hours for non-biology graduate certificate*)

Graduate Lecture Courses numbered 4000-, 5000- or 6000-level must sum to 30 Credit Hours: The doctoral degree at Missouri S&T requires 30 hours of lecture coursework for students who do not already hold a master's degree. These minimum course requirements can be met through any combination of courses that fulfill one of the three Biological Sciences degree tracks, the Data Analytical Competency requirement, the optional non-biological sciences graduate certificate, and any additional elective courses selected to meet the 30-hour credit minimum. The requirement for students who already hold a master's degree is 12 hours, and those students may apply courses completed for the master's degree to meet the degree track and data analytical competency requirements.

Biological Sciences Graduate Track Requirements

BioInnovation Track – Train students to design and develop biologically-related or biotechnological products geared for the marketplace.

Required Course: Advanced Principles of Biodesign (BIO SCI 6XXX)

Elective Courses (choose two):

Molecular Genetics (BIO SCI 4323)

Nanobiotechnology (BIO SCI 4666)

Bioinformatics (BIO SCI 5323)

Biomaterials II (MSE 6210)

Advanced Tissue Engineering (MSE 6240)

Advanced Stem Cell Biology (BIO SCI 6373)

Advanced Toxicology (BIO SCI 6383)

Bioremediation (BIO SCI 6463)
Advanced Genomics (BIO SCI 6433)
Advanced Microbial Metabolism (BIO SCI 6513)
Proposal Writing Course: Research Proposal Writing (BIO SCI 6223)

Biomedicine Track – Train students to investigate and explore the processes that govern human health, development, and pathologies.

Required Course: Current Topics in Biomedical Sciences (BIO SCI 6XXX)

Elective Courses (choose two):

Advanced Tissue Engineering (MSE 6240)
Biomaterials II (MSE 6210)
Pathogenic Microbiology (BIO SCI 5313)
Biology of Aging (BIO SCI 5343)
Developmental Biology (BIO SCI 5353)
Pharmacology (BIO SCI 5533)
Bioinformatics (BIO SCI 5323)
Virology (BIO SCI 5493)
Advanced Cancer Cell Biology (BIO SCI 6353)
Advanced Stem Cell Biology (BIO SCI 6373)
Molecular Cell Biology (BIO SCI 65413)
Advanced Toxicology (BIO SCI 6363)
Advanced Genomics (BIO SCI 6433)
Advanced Biomolecules (BIO SCI 6523)
Advanced Neurobiology (BIO SCI 6533)
Advanced Nanotechnology in Biomedicine (BIO SCI 6666)

Proposal Writing Course: Research Proposal Writing (BIO SCI 6223)

Environmental Biology Track – Train students to understand the complex interrelationships between living organisms and their physical and biological environments and to address complex biological questions that require the comprehension of multiple disciplines.

Required Course: Current Topics in Environmental Biology (BIO SCI 6XXX)

Elective Courses (choose two):

Advanced Global Ecology (BIO SCI 6563)
Advanced Biodiversity (BIO SCI 5423)
Environmental Microbiology (BIO SCI 6313)
Advanced Freshwater Ecology (BIO SCI 6363)
Population and Conservation Genetics (BIO SCI 5443)
Advanced Toxicology (BIO SCI 6383)
Geomicrobiology (BIO SCI 6343)
Bioremediation (BIO SCI 6463)

Proposal Writing Course: Research Proposal Writing (BIO SCI 6223)

Non-Biological Sciences Graduate Certificates (examples):

Big Data Management and Analytics (COMP SCI)
Professional Communication (TECH COM)
Entrepreneurship and Technological Innovation (BUS)
Life Science Innovation and Entrepreneurship (Mizzou, online)
Health Ethics (Mizzou, online)
Informatics for Public Health (Mizzou, online)
Public Engagement (Mizzou, online)

Additionally, students in consultation with their committee may choose other graduate certificates outside of the Biological Sciences. Students may also construct their own non-biological sciences themed-course program of study from available graduate courses with committee approval.

Data Analytical Competency Courses:

Statistical Data Analysis Using SAS (STAT 5260)
Regression Analysis (STAT 5346)
Statistical Data Analysis (STAT 5353)
Probability and Statistics (STAT 5643)
Design and Analysis of Experiments (STAT 6344)
Multivariate Statistical Methods (STAT 6545)
Regression Analysis (COMP SCI 5204)
Evolutionary Computing (COMP SCI 5401)
Introduction to Data Mining (COMP SCI 5402)

Industry or Agency Paid Internship (optional):

BIO SCI 6085 Internship

Lists of Elective Courses Students May Take:

Elective courses offered in Biological Sciences
BIO SCI 4323 Molecular Genetics
BIO SCI 4393 Immunology
BIO SCI 4663 Animal Behavior
BIO SCI 5313 Pathogenic Microbiology
BIO SCI 5323 Bioinformatics
BIO SCI 5343 Biology of Aging
BIO SCI 5353 Developmental Biology
BIO SCI 5443 Population and Conservation Genetics
BIO SCI 5493 General Virology
BIO SCI 6210 Biomaterials
BIO SCI 6240 Advanced Tissue Engineering
BIO SCI 6313 Environmental Microbiology

BIO SCI 6343 Advanced Geomicrobiology
BIO SCI 6353 Advanced Cancer Cell Biology
BIO SCI 6363 Advanced Freshwater Ecology
BIO SCI 6373 Advanced Stem Cell Biology
BIO SCI 6383 Advanced Toxicology
BIO SCI 6423 Astrobiology
BIO SCI 6433 Advanced Genomics
BIO SCI 6463 Bioremediation
BIO SCI 6533 Advanced Neurobiology
BIO SCI 6563 Advanced Global Ecology
BIO SCI 6666 Advanced Nanobiotechnology

Elective courses in chemistry

CHEM 5001 Medicinal Chemistry
CHEM 5610 Biochemistry
CHEM 5620 Biochemical Metabolism
CHEM 5630 Biochemical Nanotechnology
CHEM 5710 Environmental Monitoring

Elective courses in Chemical Engineering

BIO ENG 6XXX Biomanufacturing (proposed)
CHEM ENG 5250 Isolation and Purification of Biologicals
CHEM ENG 5001 Drug and Gene Delivery
CHEM ENG 5161 Intermediate Molecular Engineering
CHEM ENG 5320 Introduction to Nanomaterials
CHEM ENG 4210 Biochemical Reactors

Elective courses in Information Science and Technology

IS&T 5251 Management and Leadership of Technological Innovation
IS&T 5520 Data Science and Machine Learning with Python

Elective courses in statistics

STAT 4210 Introduction to Statistical Data Science
STAT 5260 Statistical Data Analysis Using SAS
STAT 5346 Regression Analysis
STAT 5353 Statistical Data Analysis
STAT 5643 Probability and Statistics

Elective courses in computer science

COMP SCI 5204 Regression Analysis
COMP SCI 5401 Evolutionary Computing
COMP SCI 5402 Introduction to Data Mining

5.C. Program Structure

Students who enter the program directly with a BS degree will need to complete a minimum of 72 credit hours beyond their BS degree, which includes a minimum of 30 credit hours of 4000-, 5000-, and 6000-level lecture courses and minimum of 30 hours of research. A student entering with a MS degree can receive up to 30 credit hours toward their Ph.D., so that they would need to complete only the remaining 42 credit hours, including a minimum of 12 credit hours of 4000-, 5000-, and 6000-level lecture courses. Students will complete qualifying and comprehensive exams according to university guidelines as detailed above in section 5.B.

5.C.1. Program Structure Form

1. Total Credits Required for Graduation: 72
2. Residence requirements, if any: Not applicable
3. General education: Not applicable
4. **Major Requirements:** Total credits specific to degree: 72

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

Course	Hrs	Course	Hrs	Course	Hrs
Graduate seminar	2	Research credit hours	30	Optional non-biology graduate certificate, or elective lecture courses.	12
Graduate journal discussion	2	Degree track required course	3	Data analytical competency	6
Proposal writing course	3	Degree track elective courses	6		

5. **Free elective credits:** Total free elective credits: 8
6. Requirement for thesis, internship, or other capstone experience:
All students will conduct research and complete a dissertation. An internship (BioSci 6085 Internship) is optional.
7. Any unique features such as interdepartmental cooperation:

Students may choose courses from a variety of departments to complete their degree requirements. No specific interdepartmental cooperative agreements are proposed.

5.D. Program Goals and Assessment

- Student progress will be assessed after completion of two years in the program by preparing and defending a research proposal submitted to their graduate committee and completion of an accompanying oral examination.
- Students will meet on an annual basis with their graduate committee to assess progress toward completion of their research program.
- Students will be assessed on their ability to engage with diverse disciplines by completing coursework for earning a graduate certificate in a program outside of biological sciences
- Students will be assessed for communication skills through participation in departmental seminars and through engaging in teaching for a minimum of one semester.
- Graduating students will be assessed by their graduate committee using the standard campus rubric for evaluating achievement of graduate learning outcomes.
- Graduates will be surveyed on a regular basis (at least once every 5 years) to assess their professional development and career preparation.

5.E. Student Preparation

The target population for this program will be students who have completed a bachelor's or master's degree in Biological Sciences or a related undergraduate or graduate program. The course of preparative study will be dependent on the student's intended focal area of scholarship and the track (biomedical, bioinnovation, environment) the student chooses to pursue. The student's committee will determine if additional coursework is necessary for the student to succeed in their chosen track.

5.F. Faculty and Administration

The individuals with primary responsibility for the success of this new graduate program will be the Graduate Program Director in Biological Sciences and the Department Chair of Biological Sciences. These positions are currently filled by:

- Director - Dr. Melanie Mormile, Professor of Biological Sciences
- Chair - Dr. David Duvernell, Professor of Biological Sciences

The curriculum required to support this new program is primarily in place, and currently supports master's students in Biological Sciences as well as graduate students in other programs who chose to enroll in these courses as part of their programs of study. All graduate courses supporting the proposed program will be taught by members of the graduate faculty.

Members of the Biological Sciences Department who are members of the graduate faculty:

1. David Duvernell - Professor
2. Chen Hou - Associate Professor
3. Yue-Wern Huang - Professor
4. Melanie Mormile - Professor
5. Dev Niyogi - Professor
6. Stephen Roberts - Professor
7. Andrea Scharf - Assistant Professor
8. Julie Semon - Associate Professor
9. Katie Shannon - Teaching Professor
10. Matt Thimgan - Associate Professor
11. Robin Verble - Associate Professor
12. David Westenberg - Curators Distinguished Teaching Professor

5.G. Alumni and Employer Survey

We are committed to continuously gathering feedback from both alumni and employers to evaluate and improve the quality of this new program. Surveys and communication channels are utilized to collect relevant information, ensuring that the program meets the expectations and requirements of both alumni and employers. The following methods and schedules are used for collecting feedback from these key stakeholders:

Alumni Survey

Method: Online questionnaires and mailed surveys are sent to alumni who graduated three to five years prior. The survey focuses on evaluating their satisfaction with the program and the extent to which it prepared them for their careers.

Schedule: Alumni surveys are conducted biennially, allowing for a comprehensive and up-to-date understanding of alumni perspectives.

Expected/desired satisfaction rates: The department aims to achieve a satisfaction rate of at least 80% among respondents, with the goal of continuously improving the program based on alumni feedback.

Employer Survey

Method: Online questionnaires and surveys are distributed to employers of the program's graduates. The surveys seek to evaluate the preparedness and performance of alumni in their respective workplaces, as well as solicit suggestions for program improvements.

Schedule: Employer surveys are conducted every three years, allowing sufficient time to gather meaningful feedback while keeping the information current.

Expected/desired satisfaction rates: The department aims to achieve a satisfaction rate of at least 85% among employer respondents, using their input to adapt the program to better meet employer needs and expectations.

5.H. Program Accreditation

This new biological sciences Ph.D. degree needs no accreditation to function but will be assessed together with other graduate degrees in the biological sciences graduate program via the Higher Learning Commission.

6. Appendices

- Appendix 1: List of Participating Faculty (page 39)
- Appendix 2: New Program Pro Forma Biological Sciences PhD (page 40)
- Appendix 3: Letters of Support (page 41)
- Appendix 4: Response to External Reviews (page 53)

Appendix 1

List of Participating Faculty

Graduate Faculty of the Department of Biological Sciences

1. David Duvernell - Professor
2. Chen Hou - Associate Professor
3. Yue-Wern Huang - Professor
4. Melanie Mormile - Professor
5. Dev Niyogi - Professor
6. Stephen Roberts - Professor and Vice Chancellor
7. Andrea Scharf - Assistant Professor
8. Julie Semon - Associate Professor
9. Katie Shannon - Teaching Professor
10. Matt Thimgan - Associate Professor
11. Robin Verble - Associate Professor
12. David Westenberg - Curators Distinguished Teaching Professor

Appendix 2

New Program Pro Forma

Biological Sciences Ph.D.

New Degree Program Pro Forma							
Records							
Proposed program: Biological Science PHD							
University: Missouri S & T							
College: CASE							
Submitted:							
Preparer: David Durvernell							
Reviewed by College Fiscal Officer:				6/22/2023		Fiscal Officer Name: Jackie Sansone	
Reviewed by University-Level Fiscal Officer						Fiscal Officer Name: Lisa Cerney	
PROGRAM:	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
	FY25	FY26	FY27	FY28	FY29	FY30	FY31
Enrollment Projections							
Head Count Students - new incoming	3	6	9	12	15	15	15
Head Count Students - transfers within campus							
Student Credit Hours	12	12	12	12	12	12	12
Tuition Rate/Credit Hour	1,175	1,210	1,247	1,284	1,323	1,362	1,403
Fee Rate/Credit Hour							
Tuition Discount Rate (%)							
Scholarship Allowances (\$)	\$ 21,150.00	\$ 43,569.00	\$ 67,341.00	\$ 92,448.00	\$ 119,027.00	\$ 119,027.00	\$ 119,027.00
Revenue Projections	*****CALCULATED CELLS*****						
Tuition	42,300	87,138	134,628	184,896	238,054	245,160	252,540
Supplemental & Other Fees	-	-	-	-	-	-	-
Scholarship Allowances	-	-	-	-	-	-	-
Net Tuition and Fees	42,300	87,138	134,628	184,896	238,054	245,160	252,540
Other Income							
TOTAL PROGRAM REVENUE	\$42,300	\$87,138	\$134,628	\$184,896	\$238,054	\$245,160	\$252,540
Recurring State Support							
TOTAL REVENUE	\$42,300	\$87,138	\$134,628	\$184,896	\$238,054	\$245,160	\$252,540
Expenditure Projections							
Faculty Salaries			\$ 80,000	\$ 82,400	\$ 169,744.00	174,836	180,081
detail							
Technical Salaries							
detail							
Support Salaries (staff 50%)							
detail							
Graduate Teaching Assistants	\$ 62,088	\$ 127,895	\$ 186,263	\$ 248,351	\$ 310,438.20	310,438	310,438
Total Salaries	62,088	127,895	266,263	330,751	480,182	485,274	490,519
Benefits			28,496	29,351	60,463	62,277	64,145
Subtotal Salaries and Benefits	\$62,088	\$127,895	294,759	\$360,101	\$540,645	\$547,551	\$554,664
Operating Expense							
Computing Expenses	1,000	1,800	2,700	4,000	5,000	5,000	5,000
NonCapital Maintenance & Repair	400	1,000	1,500	2,000	2,000	2,000	2,000
Noncapital Equipment							
Supplies		1,000	1,500	1,800	3,000	3,000	3,000
Professional & Consulting	1,000	1,000	1,500	1,800	2,000	2,000	2,000
Travel & Training	600	1,200	1,800	2,400	3,000	3,000	3,000
Misc. Expenses(Equipment (including software, computers, and equip. maintenance))							
Subtotal Operating Expense	\$3,000	\$6,000	\$9,000	\$12,000	\$15,000	\$15,000	\$15,000
One-time Expenditures (Startup Costs)			\$ 600,000.00		\$ 600,000.00		
Additional Space Costs							
Subtotal One-time Expense	\$0	\$0	\$600,000	\$0	\$600,000	\$0	\$0
TOTAL EXPENDITURES	\$65,088	\$133,895	903,759	\$372,101	\$1,155,645	\$562,551	\$569,664
DIRECT MARGIN	(\$22,788)	(\$46,757)	(\$769,130)	(\$187,205)	(\$917,591)	(\$317,391)	(\$317,124)
CUMULATIVE DIRECT MARGIN	(\$22,788)	(\$69,545)	(\$838,675)	(\$1,025,881)	(\$1,943,472)	(\$2,260,863)	(\$2,577,987)
Subtract:							
Revenue from Transfers within Campus							
NET MARGIN TO THE CAMPUS	(\$22,788)	(\$46,757)	(\$769,130)	(\$187,205)	(\$917,591)	(\$317,391)	(\$317,124)
CUMULATIVE NET MARGIN TO THE CAMPUS	(\$22,788)	(\$69,545)	(\$838,675)	(\$1,025,881)	(\$1,943,472)	(\$2,260,863)	(\$2,577,987)
Campus Overhead Allocation							
MARGIN AFTER CAMPUS OVERHEAD	(\$22,788)	(\$46,757)	(\$769,130)	(\$187,205)	(\$917,591)	(\$317,391)	(\$317,124)
CUMULATIVE MARGIN AFTER CAMPUS OVERHEAD	(\$22,788)	(\$69,545)	(\$838,675)	(\$1,025,881)	(\$1,943,472)	(\$2,260,863)	(\$2,577,987)

Appendix 3

Letters of Support

Letters of Support

1. Dr. Colin Potts, Provost and Executive Vice Chancellor for Academic Affairs, Missouri S&T
2. Dr. Mehrzad Boroujerdi, Vice Provost and Dean, College of Arts, Sciences, and Education, Missouri S&T
3. Dr. David Borrok, Vice Provost and Dean of College of Engineering and Computing, Missouri S&T
4. Chris Reed, Director of Talent Management, Benson Hill
5. Dr. Kristine Callis-Duehl, Driemeyer Director of Education Research and Outreach, Donald Danforth Plant Science Center
6. Dennis Ridenour, President and Chief Executive Officer, BioNexus KC
7. Dr. Trissa Borgschulte, Senior Director and Head of Bioprocessing Upstream R&D, MilliporeSigma
8. Dr. Kevin Truman, Dean, School of Science and Engineering, UMKC
9. Dr. Christina Taylor, Computational Molecular Design Lead and Science Fellow Bayer -Crop Science Division



MISSOURI UNIVERSITY OF
SCIENCE AND TECHNOLOGY
— ROLLA, MISSOURI —

Office of the Provost

102 Parker Hall
300 W. 14th Street
Rolla, MO 65409
573-341-4138
provost@mst.edu
provost.mst.edu

June 16, 2023

To: UM System Office of Academic Affairs

From: Colin Potts, Provost and Executive Vice Chancellor for Academic Affairs

Subject: New Program Proposal, PhD Degree in Biological Sciences

I enthusiastically support the proposal for a PhD in Biological Sciences and recommend that it be forwarded to the to the UM System for review. This new degree program will be housed in the Department of Biological Sciences in the College of Arts, Sciences and Education (CASE).

Influential thought leaders have referred to the twenty-first century as the century of life sciences. Developments of fundamental knowledge in molecular biology, genomics, synthetic biology, and biotechnology will transform our quality of life in the coming decades, much as developments in the physical sciences and manufacturing heralded the industrial revolution. To play a significant role in the development, all of Missouri's public universities will need to contribute to fundamental research in the life sciences and applied research in biomedicine and environmental biology.

To meet this need, at Missouri University of Science and Technology we have recently embarked on an initiative to grow our "Bio-X" research constellation and develop programmatic collaborations with the University of Missouri College of Medicine. Many of our researchers across campus are already engaged in discovery-based research and problem-focused innovations in the areas with medical applications – from computing the optimal utilization of donated kidneys to the synthesis of ceramic-based biomaterials, and many more. The proposed doctoral program in Biological Sciences, along with our proposed PhD in Bioengineering will be he anchor programs of this vital strategic initiative and will provide the means to educate advanced graduates in the life sciences.

An equal opportunity employer

Date: August 1, 2023

To: Dr. Colin Potts, Provost and Executive Vice Chancellor for Academic Affairs

From: Dr. Mehrzad Boroujerdi, Vice Provost and Dean, College of Arts, Sciences, and Education

Mehrzad Boroujerdi

Subject: Support for developing a Ph.D. in Biological Sciences

I am writing to express my enthusiastic support for the launch of a new doctoral program in Biological Sciences at Missouri University of Science & Technology because I believe such a program will enhance the university's academic profile, foster interdisciplinary collaborations, attract exceptional faculty and students, and stimulate economic growth in the region.

Context: Modern advances in information science, automation, and materials sciences are bringing about the fusion of biological, digital, and physical worlds. At least 6 of the 17 UN Sustainable Development goals deal specifically with such human health and well-being issues as food security and improved nutrition, healthy living, water and sanitation, climate change, marine resources, and sustainable use of ecosystems. According to the 2021 National Intelligence Council's Global Trends report, "by 2040, biotechnology innovations most likely will enable societies to reduce disease, hunger, and petrochemical dependence and will transform how we interact with the environment and each other."

We in Missouri need to augment our human capital in the realm of biotechnology and life sciences considering that the state is ranked 42 in terms of public health and quality of health care. The proposed Ph.D. in biological sciences is one important step toward realizing that goal. As doctoral students engage in research projects, they often attract support from various sectors, such as biotechnology companies, healthcare institutions, and government agencies. These collaborations will create new job opportunities, stimulate technological advancements, and enhance the overall economic growth and prosperity of the local and regional community.

Missouri S&T is the one STEM-focused campus in the UM System and yet, ironically, it currently does not offer a Ph.D. degree in biological sciences. As S&T embarks on its crucial Bio-centric initiative, this proposed doctoral program and the adjoining one on Bioengineering (proposed by the College of Engineering and Computing) can turn S&T into a hub for cutting-edge scientific discoveries in the medical and health fields. These two new doctoral programs will also substantially augment the quality and reach of the UM system's NextGen Precision Health Initiative.

Assets: The Biological Sciences department already offers BA, BS, and MS degrees plus a graduate track pathway. It receives by far the largest number of applications and has the largest number of undergraduate majors among all the disciplines in the College of Arts, Sciences, and Education. The addition of a Ph.D. program in a STEM-oriented campus makes logical sense considering that biology, as a vast and evolving discipline, intersects with numerous other scientific and engineering fields. The new doctoral program will take advantage of our existing human capital, facilities, research centers, and curricular offerings on the S&T campus and will be enhanced by future investments. As envisioned, the new Ph.D. in Biological Sciences will (a) significantly contribute to the expansion and enrichment of the university's academic offerings; (b) facilitate interdisciplinary research and generate innovative solutions to complex biological challenges; (c) enable high-caliber domestic and international students to pursue academic as well as non-academic pathways (government, industry, NGOs); (d) help bring more life science and biotechnology external funding opportunities to Missouri; and (e) enhance the skill set of the local labor force.

The College of Arts, Sciences, and Education recognizes the need for investment in the Biological Sciences Department to capitalize on program growth potential and achieve expected outcomes. The college commits to two faculty lines (salary, fringe, startups) over the next five years, an additional staff member, and additional anticipated operating expenses as budgeted in the proposal. The department will receive additional budget support in the amount of \$1,000 per graduate student to support expenditures like new student recruitment, student travel, publication costs, computer and software expenses, equipment replacement, and equipment maintenance and service contracts.

I strongly believe that S&T has the necessary resources, expertise, and vision to successfully establish and sustain this program, and I encourage you to move forward with its implementation. I am confident that the new doctoral program in biological sciences will be a resounding success and will allow S&T to position itself as a leading institution in biological education and research.



College of Engineering and Computing

Date: June 15, 2023

To: Dr. Colin Potts, Provost and Executive Vice Chancellor for Academic Affairs
Dr. David Duvernell, Department Chair, Biological Sciences

From: Dr. David Borrok, Vice-Provost and Dean, College of Engineering and Computing

Subject: Support for the creation of a PhD in Biological Sciences

The College of Engineering and Computing at Missouri S&T strongly supports the creation of a new PhD in Biological Sciences within our College of Arts Science and Education. This new degree will catalyze collaborations between our two colleges and provide synergies that will transform bio-related engineering and health research at Missouri S&T. The new PhD in biological sciences, as well as new facilities and faculty members in this area, will not only provide linkages to existing bio-related engineering research but will connect directly to new programs in biomedical engineering (BS) and bioengineering (PhD) that we are in the process of creating in our college. This university-wide focus on expanding our bio-related education and research satisfies a key part of our mission by addressing grand societal challenges, such as those associated with human health and well-being.

Collaborations between our engineering and science colleagues have already been extensive and highly productive. Faculty members in the Biological Sciences have been involved in or led collaborative efforts with engineers in numerous projects, including wound healing and bone regeneration, drug delivery in cancer treatments, infectious respiratory disease detection, traumatic brain injury, 3D bioprinting, AI modeling of population dynamics, mitigation of nonpoint source nutrient pollution, and biohydrogen production to name a few. The fact is that cross disciplinary collaborations are essential for the advancement of many of the most impactful initiatives on the Missouri S&T campus. Our engineers report that collaborators in the life sciences are in high demand but are unfortunately in limited supply. The addition of a PhD program in Biological Sciences would remedy this situation through the addition of new facilities and faculty members focused on cutting-edge life science health research.

We also believe strong internal collaborations between the life sciences and engineering at Missouri S&T will enable us to better connect to ongoing activities on other UM system campuses, including those identified within the UM system's NextGen Precision Health initiative. The doctoral program in Biological Sciences will also help us achieve our goal of providing advanced training opportunities for students to meet the acute workforce needs of the biotechnology sector in Missouri.



May 26th, 2023

To Whom It May Concern,

I'm writing in support of the need for the creation of a PhD program In Biological Sciences at Missouri S&T.

I lead Talent Management for Benson Hill. My role is to lead Talent Acquisition and Organizational Development. Benson Hill is a publicly traded Agriculture Technology (Ag Tech) company based in St. Louis. We employ a multi-pronged approach to improving the nutrients (mainly protein increase) in Soy and Yellow Pea. We do this via our Data Science, Artificial Intelligence, and Machine Learning platform called CropOS. CropOS creates a digital genetic version of the plants. From there, our Lab Technicians, Scientists, Breeders, Agronomist, Research Teams get to work in designing what has been predicted or devised by CropOS.

This list of titles is only a small representation of those involved. The key work that is needed is in Plant Genetics. This could be CRISPR genetic editing techniques, evaluation of protein function, sensory analysis, flavor profiles, trait discovery, vector technology, or genotyping and phenotyping prediction.

One of our biggest hurdles in getting to our goals is that lack of local talent at the Scientist level. It is rare that we can identify, engage, and hire a St. Louis based, much less Missouri based, Scientist. The bulk of our candidates and applicants are out of state and require Visa sponsorship. We see many from Iowa and Wisconsin. We do our best to engage out of market talent, but it becomes expensive and very time-consuming. I'm also competing with additional markets. If I had homegrown or homebased talent, we could better attain our organizational goals.

We do have local private universities that have programs that support some of the areas of science we seek but the bulk of those student are non-domestic and all but intend to leave St. Louis or Missouri as soon as they complete their degree(s). **Missouri would be better served to have more advanced training opportunities at our public universities because those individuals would be more invested or motivated in staying in Missouri, and contributing to the regional economy when they graduate.**

If Missouri would be able to build a program around the core areas of biochemistry, genetics, molecular biology, cell biology, and crop science Benson Hill and the growing list of St. Louis based Ag Tech companies would greatly benefit.

Specific to Missouri S&T, they have built an incredible reputation in the Scientific community. If we could build Crop Science and Crop Genetics programs there, our region would do better at attracting out of market students who then stay.

Sincerely,

Chris Reed
Director of Talent Management
Cell: 314.323.9990
creed@bensonhill.com



I am writing this letter on behalf of the Donald Danforth Plant Science Center to express our wholehearted support for a new Ph.D. program in Biological Sciences at Missouri University of Science and Technology (Missouri S&T). This program could play a crucial role in meeting the growing demand for highly skilled researchers in the biosciences in the St. Louis region, particularly within the expanding fields of agriculture and biotechnology.

The St. Louis region has emerged as a prominent hub for agricultural and biotechnology industries, and the need for highly trained individuals equipped with both biological expertise and data science skills is rapidly increasing. As a renowned plant science research and innovation institution, we understand the importance of fostering interdisciplinary collaboration and training scientists who can bridge the gap between biological systems and cutting-edge technologies. Missouri S&T is uniquely positioned to connect biological sciences with math, computer science, and engineering to produce researchers who can bring together these fields for true innovation. The fusion of biology and engineering, as offered by the new Ph.D. program in bioengineering, holds immense potential for advancing research and innovation in the agri-food sector. The ability to harness biological insights and leverage computational and data-driven approaches is becoming increasingly critical in addressing the challenges faced by the agricultural industry, such as food security, sustainable agriculture, climate change, and developing novel biotechnological solutions.

We support a new Ph.D. program in Biological Sciences at Missouri S&T that will equip its graduates with the necessary knowledge and skills to excel as industry researchers in the rapidly evolving biosciences landscape. In fact, in our experience, a Ph.D. program that focuses on training students for industry research as opposed to academic research is unique in this area and relatively unique across the country, with the potential to open doors for students from across the state and beyond who want to go into the hundreds of industry jobs in the St. Louis metro area in the life sciences that go unfilled every year. Industry partners, like the Danforth Center, are importing talent from outside Missouri and often outside of the US to fulfill these positions.

The Donald Danforth Plant Science Center, as a partner in research and innovation, is excited to support Missouri S&T in this program. We envision a future where graduates from this program will play instrumental roles in driving scientific advancements, developing sustainable agricultural practices, and leading the way in biotechnology breakthroughs within the St. Louis region and beyond.

Thank you for your attention to this matter. We look forward to collaborating with Missouri S&T to nurture the next generation of industry researchers and create a thriving biosciences ecosystem in the St. Louis region.

Thank you!

Kris

Dr. Kristine Callis-Duehl

Driemeyer Director of Education Research and Outreach

Donald Danforth Plant Science Center

Improving the Human Condition Through Plant Science



June 12, 2023

David Duvernell, PhD
Professor and Chair, Biological Sciences
Missouri S&T
Schrenk 105, 400 W. 11th Street,
Rolla, MO 65409

Dear Dr. Duvernell,

On behalf of BioNexus KC, I am pleased to offer this letter of support for the proposed new doctoral-level training program in the biological sciences at Missouri S&T. BioNexus KC was created to establish the prominence of the bi-state Kansas City region in the life sciences, and we are committed to upholding our vision of the KC region as a global leader at the nexus of human and animal health benefiting all our citizens and our economy. Our priorities include fostering collaboration, accelerating innovation, and advancing regional opportunities. The need for more educated and skilled workers in biological sciences-related industries is a top priority for BioNexus KC and is foundational to continued industry growth in the KC region and across Missouri.

Large gaps exist in the entry-level life sciences manufacturing workforce, but industry also needs workers with advanced training who can serve in senior scientist positions. Industry representatives involved in pharmaceutical development, medical research, and biotechnology have all cited challenges recruiting necessary talent, frequently resulting in regional companies recruiting nationally or internationally to meet local and regional needs. By investing in our regional educational institutions and life science intermediaries, we can enhance academic-industry connections and develop a robust pipeline of talent to better meet industry needs.

We are excited to learn that Missouri S&T is proposing new programming initiatives that will address these needs in our state. A new program for doctoral-level training in the biological sciences, along with a new doctoral program in bioengineering, will create a dynamic, interdisciplinary, collaborative environment to enhance current and future cutting-edge research and advanced training opportunities. Missouri S&T brings a unique set of strengths to these efforts that include strengths in data science and analytics, as well as a well-established reputation of engagement between academics and industries.

We look forward to opportunities to work with the leadership and faculty members of these new programs, and particularly to partner with the Biological Sciences Department. As the life science intermediary for the KC region, we will help establish future industry partnerships and provide guidance to the programs in an advisory capacity.

Sincerely,

A handwritten signature in black ink, appearing to read "Dennis Ridenour", written in a cursive style.

Dennis Ridenour
President and Chief Executive Officer
BioNexus KC

2909 Laclede Avenue
St. Louis, MO 63103 USA
Phone: +1 314-771-5765

Dear Dr. Duvernell,

Thank you for reaching out to MilliporeSigma to discuss our interests in and needs for scientists with advanced degrees in the Life Sciences disciplines. I was excited to hear about Missouri S&T's efforts to initiate a doctoral program in the Biological Sciences. As the Senior Director and Head of Bioprocessing Upstream R&D at MilliporeSigma, I can attest that there is a strong market need for highly trained scientists with strong skills in biochemistry and cellular and molecular biology. Recruiting top talent for senior scientist level positions has been a persistent challenge for us at our sites in St. Louis, MO and Lenexa, KS, as we are competing with large biotech and pharmaceutical companies primarily located on the East and West coasts for the same talent pool of candidates. We have found our most successful recruiting efforts often arise from partnerships with regional universities. Our organization has established internship and research collaboration programs with various local academic institutions that help feed our future talent candidate pool. We look forward to future engagement in these areas with Missouri S&T and hope that your academic programs will help strengthen our local work force.

Sincerely,

Trissa Borgschulte, PhD
Senior Director of Bioprocessing Upstream R&D



MilliporeSigma is a business of Merck KGaA, Darmstadt, Germany

June 29, 2023

Dr. David Duvernell
Professor of Biological Sciences
Missouri University of Science and Technology
105 Schrenk Hall
Rolla, MO 65409

Dear Professor Duvernell:

As Dean of the UMKC School of Science and Engineering (SSE) it is my pleasure to provide this letter of support for your department's plans to develop a Ph.D. program in Biological Sciences on the Missouri S&T campus. Existing and emerging biosciences and technologies have become important areas of growth in research and teaching as workforce development needs in the biosciences have expanded significantly over the past 10 years.

Our UMKC School of Science and Engineering (SSE) Biological and Biomedical Systems Division Director Dr. Ted White and I have reviewed your proposal and look forward to opportunities for faculty on our respective campuses to collaborate on projects in the future. It is clear that Missouri S&T students will benefit greatly from the development of new courses and the enrichment of existing courses in the proposed Ph.D. program in Biological Sciences.

I believe their combined excellent academic training, professional experience and research credentials of your department's faculty will ensure that this proposal's objectives and goals will be successfully met. I wholeheartedly support this proposal. Please contact me at trumank@umkc.edu or 816-235-2361 if you need additional information.

Sincerely,

A handwritten signature in blue ink, appearing to read "Kevin Z. Truman".

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



Dr. Collin Potts
Provost and Executive Vice Chancellor for Academic Affairs
Office of the Provost
102 Parker Hall
300 W 13th St., Rolla, MO 65409

New Degree Program at Missouri S&T

Dear Dr. Potts,

I am Dr. Christy Taylor, Computational Protein Design Lead in the Plant Biotechnology Data Science & Analytics program in the Crop Science LP Division at Bayer. As an alumnus of Missouri S&T, it is my pleasure to write in support of the proposed Biological Sciences doctoral graduate program.

I received my undergraduate degree in Chemistry with minors in Math and Biological Sciences from Missouri S&T, earned a Ph.D. from the Massachusetts Institute of Technology in computational protein design, and I conducted computational chemistry research at Washington University in St. Louis as a postdoctoral researcher.

Today, I supervise and lead a team of Ph.D. data scientists working at the interface of biology, chemistry, and data science. We leverage computational methods to design proteins and expression elements that are put into plants for insect control and herbicide tolerance. Members of this team received degrees in Chemistry, Electrical Engineering, Computer Science, and Biochemistry. Interdisciplinary teams like this are found throughout Bayer's global R&D organization, where we have unprecedented development and application of cutting-edge data science & data engineering. Advanced model and application development require data scientists who understand both disciplines: genetic and genomic data scientists, agronomic data scientists, and chemical and protein data scientists.

As a hiring manager and Science Fellow at Bayer, I have observed the need to develop and recruit talent in the Midwest firsthand. We have more success with acceptance and retention when we target students that attended a school in the Midwest or have family connections to the Midwest. Bayer has invested resources to help recruit students in the Midwest through initiatives such as mentorship programs at several universities in the Midwest, providing numerous global opportunities for students located in the Midwest.

Missouri S&T holds a unique position in Missouri, providing a rigorous curriculum in the sciences and engineering in a smaller university setting. There are many parallels between both of my alma maters, MIT and Missouri S&T. The large concentration of STEM-oriented majors and size of the undergraduate population size are very similar. At MIT, students can take classes across different departments as part of their Ph.D. curriculum. Biologists can take computer science, math, or chemistry courses to supplement their degrees. The smaller size drives collaboration among faculty members and students across departments, bringing a diversity of thought that can drive innovation. Expanding the Biological Science Program to include a Ph.D. will help drive

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July 31, 2023

Christina M. Taylor, Ph.D.

Bayer – Crop Science Division
Plant Biotechnology
Data Science and Analytics

chrisitna.taylor@bayer.com

www.bayer.com



Page 2 of 2

more collaborations between Biological Sciences and many of the areas in which Missouri S&T exhibits strength. I see Missouri S&T in a unique position to do the same by adding this degree program to the Biological Sciences program.

At Bayer, we support and value programs designed to develop graduate students in data science and biology. I believe that all three tracks proposed for the new Biological Sciences Ph.D. program could benefit the research at Bayer in St. Louis and Kansas City across various divisions within Bayer Crop Science LP. As a research scientist and hiring manager in Missouri, I firmly support the funding of this proposal.

Yours sincerely,

A handwritten signature in black ink that reads "Christina M Taylor".

Christina M Taylor, Ph.D.
Computational Molecular Design Lead and Science Fellow
Bayer – Crop Science Division
Plant Biotechnology
Data Science and Analytics

Appendix 4

Response to External Reviews

Appendix 4

Department Chair Response to External Reviews

We are very pleased to have received strong support from our peer evaluators for our PhD program proposal. Here we summarize our responses to input provided by our reviewers.

Will the proposed curriculum produce high-quality graduates who can make significant contributions in the field?

All three of our reviewers note strengths in our proposal. The reviewers identify the alignment of this proposed program with the University's vision for future growth as a strength. They also identify the potential for internship opportunities as relatively novel for PhD programs, and a strength of our proposal.

Dr. Nadim cautioned that the proposal focuses more on breadth than on depth of knowledge. He cautioned that the requirement for a Graduate Certificate, while “admirable”, may impose too great a burden of course work for this program relative to typical biology PhD programs. A counterpoint to this criticism is that the Missouri S&T graduate catalog specifies that graduate students must complete 30 hours of lecture coursework. Also, Dr. Ligon praised the certificates as “wisely leveraging academic resources outside the department”. We accept the suggestion that making a non-biological sciences graduate certificate a *requirement* may be too restrictive for some students' plans of study. ***Therefore, we have revised the proposal to make the non-biology graduate certificate optional rather than required.***

Dr. Nadim also suggested that the depth of knowledge in our program could be enhanced by requiring student rotations. While we agree that student rotations are a valuable experience for students to help build knowledge of “experimental strategies and approaches”, we disagree that rotations would fit well into this program at its inception. Our concern is that our department will not have the capacity, either in the number of research labs, or support resources, to effectively implement a rotation system for first- and second-year PhD students. We think there are other ways that students will gain the cross-disciplinary knowledge they will need, including through engagement with mentors in cross-disciplinary collaborative projects, and optionally, through internships. A more formalized rotation system will be a priority for us once our program has grown in capacity.

Dr. Nadim expressed concern that the comprehensive exam is not well described. A comprehensive exam is a standard part of any PhD program, and it is described in the Missouri S&T graduate catalog. We respectfully disagree that more information is needed about this aspect of the program proposal.

Is there a sufficient market for doctoral students interested in this area to allow the program to meet the proposed enrollment projections?

We are grateful that all three of our peer reviewers very enthusiastically agreed with the assertion that there is both a market and an acute need for a doctoral program focused on our target areas of Biomedical, Bioinnovation, and Environment. None of the three reviewers expressed any concerns about this assertion.

Do the courses, faculty, and financial plan outlined in the proposal provide the necessary elements for doctoral-level education in the field?

All three reviewers in one way or another expressed concern about the financial plan and its deep reliance on extensive external grant support to fund graduate student stipends from the outset. Dr. Nadim expressed this concern most directly by suggesting that if the university does not provide a larger initial investment, then the program will fail to achieve its target enrollment goal of 25 graduate students in five years. He stated that the plan was “simply unrealistic”. On reflection, we agree with these concerns. The capacity of the department to meet a 25-graduate student expectation in the first five years is slim with the level of support provided in this proposal and considering current funding levels in the department in the absence of a PhD program. ***After a discussion with our dean, we have revised our initial five-year expectations to a target of 15 graduate students in the program, but with the same commitment level for graduate assistantship support.*** This target level will result in those resources translating into approximately two-thirds of the assistantship support for graduate students coming from the university as opposed to the one-third of assistantship support suggested in our draft proposal. Dr. Nadim did note that “even with a lower total number of students, a doctoral program in biological or life sciences is an absolutely essential component of any research active science-focused university...”.

Dr. Joshi was complimentary of our plan to include internships with industries. He also offered a caution that “a lot of effort needs to be invested by the program administrators to connect students with such opportunities. We agree, and we have proposed developing an advisory board of industry representatives, like those who provided our support letters, to assist us with making industry connections to our students. This plan will undoubtedly have to be further developed and revised once the program has begun.

How does this program compare with other similar programs in the country and does the program have the potential to achieve a national reputation?

All three reviewers responded positively to the structure and goals set forth in this program proposal. All were very supportive of a model for a PhD program that emphasized as a primary goal the training of graduate students for industry and non-academic careers. All three were supportive of the internship option, identifying it as a strength of this proposal. No major weaknesses were identified in this proposal relative to similar programs in the country. They all emphasized that this program will have the potential to achieve a national reputation once, as Dr. Nadim put it, the program is able to “get off the ground and get through its growing pains and resolve the issues facing any new program”.

Do you have any other comments, questions, or concerns regarding the proposed doctoral program?

All three reviewers concluded their review with praise for our proposed doctoral program and compliments on the case we have presented for the need and benefits of this proposed program.

Executive Summary

New Degree Program: BS in Data Science University of Missouri-Columbia

The Colleges of Engineering and Arts and Science are jointly proposing the new BS in Data Science in response to four robust areas of opportunity: 1) the emergence and rapid growth of the data science career path, and concomitant workforce demand in Missouri and beyond; 2) strong undergraduate/graduate programs in the triad of disciplines at the foundation of this interdisciplinary field (Computer Science, Mathematics, and Statistics); 3) a strong MU graduate program in Data Science (MS and graduate certificates); and 4) expanding faculty expertise in data science across campus – an expertise integral to many, if not all, of the research areas of the Mizzou Forward initiative.

A recent US News and World Report ranked Data Science third among technology majors with degrees sought across virtually every sector: banking and finance; construction and engineering; medicine and health care; marketing, strategic communication, and journalism; education and policy; etc. Data science is also increasingly relevant to core academic and industrial research. Job market analysis from Lightcast indicates that Missouri has new openings for 111 data scientists a year, with over 2,500 data scientists employed across the state.

Growth in this industry over the next ten years is predicted between 31% and 45%, which means the need for data scientists will only increase. However, the handful of existing programs in the state cannot meet current and projected demand. The proposed MU program will add capacity to support the Missouri labor market now and in the future.

The BS in Data Science aligns with the goals in the campus strategic plan. It is a workforce-ready undergraduate degree with high earning potential in an important and growing interdisciplinary area of relevance to virtually every industry and academic field. With the strength of existing curricula, faculty, computing infrastructure, and research expertise across the core areas of Data Science, the MU Colleges of Engineering and Arts & Science are well positioned to deliver a quality undergraduate experience and degree.

No. 5

Recommended Action – BS in Data Science

University of Missouri-Columbia

It was recommended by the University of Missouri System Office of Academic Affairs, endorsed by President of the University of Missouri Mun Y. Choi, recommended by the Academic, Student Affairs and Research & Economic Development Committee, moved by Curator_____, seconded by Curator_____ that the following action be approved:

that the University of Missouri-Columbia be authorized to submit the attached proposal for a BS in Data Science to the Coordinating Board for Higher Education for approval.

Roll call vote of the Committee:

YES

NO

Curator Blitz

Curator Graves

Curator Layman

Curator Sinquefield

The motion _____.

Roll call vote of Board:

YES

NO

Curator Blitz

Curator Brncic

Curator Fry

Curator Graves

Curator Holloway

Curator Layman

Curator Sinquefield

Curator Wenneker

Curator Williams

The motion_____.

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Executive Summary

The Colleges of Engineering and Arts and Science are jointly proposing the new BS in Data Science in response to four robust areas of opportunity: 1) the emergence and rapid growth of the data science career path, and concomitant workforce demand in Missouri and beyond; 2) strong undergraduate/graduate programs in the triad of disciplines at the foundation of this interdisciplinary field (Computer Science, Mathematics, and Statistics); 3) a strong MU graduate program in Data Science (MS and graduate certificates); and 4) expanding faculty expertise in data science across campus – an expertise integral to many, if not all, of the research areas of the Mizzou Forward initiative. A fifth area of opportunity is the increasing number of collaborations between the Colleges of Engineering and Arts & Science, which house the three departments supporting the degree.

A recent US News and World Report ranked Data Science third among technology majors with degrees sought across virtually every sector: banking and finance; construction and engineering; medicine and health care; marketing, strategic communication, and journalism; education and policy; etc. Data science is also increasingly relevant to core academic and industrial research. Job market analysis from Lightcast indicates that Missouri has new openings for 111 data scientists a year, with over 2,500 data scientists employed across the state.

Growth in this industry over the next ten years is predicted between 31% and 45%, which means the need for data scientists will only increase. However, the handful of existing programs in the state cannot meet current and projected demand. The proposed MU program will add capacity to support the Missouri labor market now and in the future.

The BS in Data Science aligns with the goals in the campus strategic plan. It is a workforce-ready undergraduate degree with high earning potential in an important and growing interdisciplinary area of relevance to virtually every industry and academic field. With the strength of existing curricula, faculty, computing infrastructure, and research expertise across the core areas of Data Science, the MU Colleges of Engineering and Arts & Science are well positioned to deliver a quality undergraduate experience and degree.

1. Introduction

The BS in Data Science extends the benefits of a research-intensive university and the strength of its faculty to the MU undergraduate mission. It is reflected in the research of the Mizzou Forward focus area, “New Frontiers in Science, Engineering and Technologies” and aligns squarely with the following goals in the campus strategic plan:

- To create new degree programs based on student demand, workforce needs, and emerging opportunity;
- To develop new interdisciplinary undergraduate and graduate degree programs to magnify departmental strengths; and
- To increase undergraduate enrollment by attracting additional students to MU.

Structure of Proposed Degree

The degree consists of the 60 hours of coursework:

- A foundational core of 10 courses (30 hours) across the triad of disciplines that inform data science (computer science, mathematics, and statistics);
- An intermediate core of 4 courses (12 hours) that builds on the foundation in two of the three triad areas while moving students towards their focus area;
- An advanced focus area of 4 courses (12 hours) in one of the three triad disciplines; and
- Experiential coursework (6 hours) in internship or research to prepare students for career and/or graduate school.

The coursework allows students to easily complete their major and general education requirements within the 120-credit hour minimum for undergraduate degrees, with room for additional minors or certificates to further prepare them for career or advanced study (e.g., a minor in business, construction management, physics; a certificate in cyber security, professional communication, sports analytics, biostatistics, information systems and technology). With careful planning, students are also able to double or dual major in the affiliated triad disciplines (Computer Science, Math, Statistics) or in Information Technology.

The degree has been carefully designed with an eye to future development, such as a data science minor; “4+1” or accelerated BS/MS programs in one or more of four disciplines (Data Science, Computer Science, Mathematics, Statistics) as well as additional tracks within the major in the advanced coursework (e.g., industrial engineering; marketing analytics; health statistics). In the future, a joint online degree with UMSL, and possibly other campuses in the UM System, may be possible.

Students who complete the degree with the Computer Science focus will receive their degrees from the College of Engineering; those who complete in Mathematics or Statistics will receive their degrees from the College of Arts and Science.

Relevance to Missouri (and Beyond): Workforce Development

The Data Science BS is a workforce-ready degree with high earning potential. A recent US News and World Report ranked it third among technology majors. Data Science degrees are sought across virtually every sector: banking and finance; construction and engineering; medicine and health care; marketing, strategic communication, and journalism; and education and policy. Students who earn the BS often go on to pursue a master's for higher-level jobs. Data science is also increasingly relevant to core academic and industrial research.

Job market analysis from Lightcast indicates that Missouri has new openings for 111 data scientists a year, with over 2500 data scientists employed across the state. However, growth in this industry over the next ten years is predicted between 31 and 45%, which means the need for data science degree holders will only increase. At the same time, the handful of existing programs in the state (UMSL, William Jewell, and Maryville University) and the number of degree conferrals per year (11 in 2021) cannot meet current demand. The MU program will add capacity to support the Missouri labor market now and in the future.

Financial viability and startup costs

The costs for launching the new program at MU are minimal, thanks to existing undergraduate and graduate programs and curriculum in the areas of the data science triad; a flourishing Data Science MS program that has over 100 students currently enrolled with multiple emphasis areas (geospatial analytics; high performance computing; biohealth analytics; human centered design; strategic communications and journalism); research-intensive faculty; and the necessary computing infrastructure already in place. Initial start-up costs are largely confined to marketing and student services (advising), as well as additional graduate TA support; the estimated \$35K of this cost in year zero will be covered by the Colleges as a worthwhile investment. Should the program grow as expected (and the estimates for growth in the proposal err towards the conservative), these costs, as well as any new faculty line(s) are accounted for in projected revenues. Similarly, should the program prove non-viable (which is highly unlikely), the discontinuance and teach-out costs are minimal.

The proposed BS in Data Science is a workforce-ready undergraduate degree in an important and growing interdisciplinary area of relevance to virtually every industry and academic field. With the strength of existing curricula, faculty, computing infrastructure, and research expertise across the core areas of Data Science, the MU Colleges of Engineering and Arts & Science are well positioned to deliver a quality undergraduate experience and degree.

2. University Mission and Other Academic Programs

2.A. Alignment with Mission

The BS in Data Science will allow undergraduate students to work and learn side by side with faculty who are advancing science in the emerging and multidisciplinary field of data science. These students will go on to benefit the state of Missouri by working in an area that is in high demand by employers in the state, and will continue to be so for the foreseeable future.

Alignment with Campus Strategic Plan

The proposed BS in Data Science aligns with the MU strategic plan goals to “Create new degree programs and revise existing programs based on student demand, workforce needs and emerging opportunities.” Data Science easily meets all three of these criteria. Both students and faculty in the three contributing fields (Computer Science, Mathematics, and Statistics) are keenly aware of the exponential growth of the discipline and its application to research and the workforce. According to analysis of Lightcast report information, there is across the board demand for Data Scientists locally, regionally, and nationally. Missouri alone has a strong growth outlook for job openings in DS. Its relevance for research and industry globally is also worth noting.

The BS in Data Science program also aligns with the call to “Develop new and revise existing interdisciplinary undergraduate and graduate degree programs to magnify departmental strengths.” The proposed BS in Data Science capitalizes on teaching and research expertise across two colleges (Engineering and Arts and Science) and three departments (Computer Science, Mathematics, and Statistics) to create a program that is coherently interdisciplinary, academically rigorous, and workforce ready.

Also, core to the Strategic plan, the program will increase undergraduate enrollment by attracting additional students to MU. The proposed BS in Data Science will be attractive to students as an emerging and relevant field with excellent pay and employment opportunities.

Program Priority

One of the sub-areas identified in Mizzou Forward under the research area “New Frontiers in Science, Engineering and Technologies” is “Computing and Communication”. The course requirements and learning outcomes of the Data Science BS focus on computing including computerized analysis and computer programming, with an emphasis on the applicability – the communicability – of data.

2.B. Duplication & Collaboration Within UM System and the State

Duplication within UM System

UMSL currently offers a BS in Data Science and Analysis. Launched at UMSL in Fall 2022, the program was built upon preexisting undergraduate certificates in Actuarial Science and Data Science, with additional emphasis areas that draw likewise from existing courses in biology, computer science, economics, mathematics, social science, and supply chain analytics.

Rationale

The proposed Data Science BS is likewise grounded in resources, opportunities, and experiences specific to MU. These are our strong undergraduate and graduate programs in Statistics and Mathematics in the College of Arts and Science, together with Computer Science in the College of Engineering. It also leverages the faculty and research that informs our existing and highly interdisciplinary Data Science and Analytics graduate program, which offers an MS degree and a graduate certificate.

While MU also foresees building out additional emphasis areas that draw on other robust MU curricular and research areas (digital merchandizing; transportation; industrial & manufacturing systems; geographical information systems; biohealth, strategic communication), given our strengths in the core triad disciplines of data science, we have chosen to begin with a program that concentrates on these – all the more so because they are the triad of core disciplines as recognized by national organizations such as ABET (Accreditation Board for Engineering and Technology).

MU also has excellent infrastructure, including computing facilities designed for data science research and graduate education – an important resource for students studying data science at the undergraduate level.

To this end, the MU degree is built upon a set of core computational, mathematical, and statistical courses; an intermediate core that expands on the core triad while allowing students to build towards an advanced focus area in one of the three disciplines that constitutes final twelve hours of the degree.

The MU degree does not duplicate UMSL's, but it does create potential opportunities for collaboration between MU and UMSL on data science education in Missouri. UMSL has strengths in its existing Certificate in Data Science and courses developed by their Colleges of Arts and Sciences and Business Administration that support data science education as well as its ties to industry and the community of the Saint Louis region. MU graduates from our existing programs in math, statistics, and engineering already find employment in significant numbers not only in St. Louis, but also Kansas City and Springfield, as well as beyond the state's borders. Future MU/UMSL collaborations might include intercampus course sharing to expand educational opportunities for students in data science. For example, MU has strengths in health informatics, whereas UMSL's Data Science program incorporates business coursework into its

certificate and degree in ways that MU's proposed program does not. More ambitiously, it could pave the way for future joint online certificates or even an online degree.

In sum, the data science programs at MU and UMSL will be complementary; together, they are also far better poised to build out workforce capacity in data science and analysis across the state - something that no one program can do alone.

Duplication within the State

Maryville University of Saint Louis and William Jewell College both offer a degree in Data Science. However, William Jewell does not include a track in computer science, which will limit many career paths after graduation. Additionally, the programs at both institutions are small and are not located at research-intensive universities. The program at MU has the benefit of the strong background of research and teaching faculty in Statistics, Mathematics and Computer Science.

Collaboration

While there currently exists no collaboration within the State or UM System, faculty from three departments across two colleges on the MU campus are collaborating on the BS in Data Science program. A committee will be formed to make curriculum decisions and to coordinate the program. The committee will be composed of faculty representatives from each of the three core departments (two faculty from EECS, one faculty from MATH, and one faculty from STAT), with a rotating program coordinator/director appointed by joint decision of the deans of Arts & Science and Engineering.

3. Business-Related Criteria & Justification

3.A. Market Analysis

3.A.1. Rationale and Workforce Demand

According to labor analytics company Lightcast, Missouri is a hotspot for Data Science Jobs. The national average for an area this size is 2,042 employees, while there are 2,564 here in Missouri. Data Scientist job growth nationwide is projected to be over 45% in the next ten years according to Lightcast analysis indicating that this is an emerging opportunity and an area of workforce need. The program will prepare students to become competitive and marketable data scientists in Missouri, regionally, nationally, and internationally through strong connections to the industries.

Meeting Missouri's Needs

According to Lightcast, there are 111 annual unique openings in Missouri for Data Scientists. This is a conservative estimate, as it reflects only one job title for which a Data Science BS would be appropriate; for example, there are 746 unique job postings for Management Analysts, 324 unique postings for Computer and Information Systems Managers, etc. Existing data science programs in the state can only produce enough degree completions to supply roughly 10% of the market demand for new Data Science employment.

This percentage plummets when analyzing analogous job titles rather than focusing narrowly on postings for 'data scientists.' New programs at UMSL and the proposed program at the University of Missouri – Columbia will still not be able to completely fill the current need in the state of 111 (growing each year) and the expected growth of the field. The University of Missouri projects that with a steady state enrollment of 225, approximately 20 degree completions can be achieved in the proposed BS in Data Science within the next 5 years and 55 in the years beyond 5.

Wage Analysis

The median earnings for a data scientist is \$48.32/hr in the nation, \$42.14 in the region (Missouri and surrounding states), and \$38.28/hr in the state of Missouri. The expected wage growth rate is 40-45% over the next ten years according to Lightcast.

3.A.2. Student Demand for Program

The Bureau of Labor Statistics projects 31.4% increase in employment (19,800 additional jobs) for data scientists between 2020 and 2030. This compares to the number of additional jobs in a well-established field such as Mechanical Engineering (7% increase in employment or 20,900 new jobs). To fill these jobs, many students will be seeking educational opportunities such as the BS in Data Science, to prepare them.

Table 1a. Student Enrollment Projections

Year	1	2	3	4	5
Full-time	20	40	59	98	167
Part-time	0	0	1	2	3
Total	20	40	60	100	170

The enrollment projection is based on the incoming student enrollment projects with an 80% retention rate through year 4. This retention rate is based on the year-to-year retention rate of 93% typical of other degree programs such as Computer Science or Information Technology which require courses that are similar to those included in the Data Science requirements.

Table 1b. New Student Enrollment Projections

Year	1	2	3	4	5
Full-time	2	10	20	30	49
Part-time	0	0	0	0	1
Total	2	10	20	30	50

To obtain these numbers, we will recruit 10 incoming (new to MU) students per year initially, gradually increasing to 30-40 by year 5. We expect a 93% year-to-year retention rate each year and a minimum of a 75% 4-year graduation rate. Data Science well known among students and is consistently in the last few years ranked as a top job by organizations such as Glassdoor. The job market reports attached to this proposal support the idea that the job market for Data Scientists is very good currently and rapidly growing.

Table 1c. Projected Number of Degrees/Certificates Awarded

Year	1	2	3	4	5	6	7	8	9	10
Completions	0	2	8	15	20	35	55	55	55	55

3.B. Financial Projections

Resources

The budget outlines a plan to leverage existing instructors, Teaching Assistants (TAs), computing infrastructure, existing advising staff, marketing, and general operation costs.

Recurring expenses are associated with the day-to-day operation of the program, instructional costs, cloud computing infrastructure for student projects, website and marketing, and staff support. The current faculty and graduate teaching assistant (GTA) costs are tied directly to the number of students projected into the program and will vary with enrollments.

Years 1-3, the program will leverage current faculty, advising staff, and cyber engineer from all participating departments without new hires. After Year 4, the program is expected to have sufficient revenue and resource to recruit 2-3 FTE TT/NTT faculty and advising staff if necessary, but this will be determined by the respective colleges based on student demand. In addition, the cost of graduate teaching assistants is also budgeted to ensure the quality of learning for core courses (Years 1-5) and focus area courses (Years 3-5).

The total cost of the resources described here for year one is \$174,000, increasing to \$756,000 in year 5. The steady state cost of resources is expected to be \$790,000.

3.B.1. Additional Resources Needed

Faculty

To ensure delivery of core courses, the program will allocate funding for \$10K per course to cover core and intermediate core courses for Years 1-2 and elective courses for Years 3-5. These instructors will work with the focus area leads to ensure that their courses meet the rigor the program requires. Starting from Year 4, the program is expected to have enrollment number to recruit 2-3 FTE TT/NTT faculty across the core and focus areas to ensure the quality of the training program. All salaries include benefits for benefit-eligible positions.

Graduate Teaching Assistants

Graduate students associated with the program may be supported by graduate teaching assistant funds. We will recruit top-notch doctoral students from focus area programs to serve as Graduate Teaching Assistants (GTAs). One half-time (0.50 FTE) GTA will be assigned to a course for every 80 students. The approximate monthly salary is \$2000 for a 0.50 FTE GTA. This rate reflects the need of including student insurance and other fees. We expect the focus area department will cover the tuition cost for the GTAs. Each 0.5 FTE TA will cost \$20,000 annually for fall and spring semesters. The GTA budget in Year 1 is \$40,000 as budgeted and by year 5, the TA budget expands to \$400,000 as enrollment increases.

Level	Number
Tenure Track	0
Non-Tenure Track	.75
Post-Doc Fellows	0
Graduate Teaching/Research Assistant	10
Adjunct	0

Supporting Staff

To support student activities, Academic Advisors, \$64,000 is budgeted to cover costs of existing advising staff from participating departments. A one-time expense of \$5000 is included to support equipment needed by staff for this program.

A new advisor will be needed as enrollment expands at year 3. Until year three, current A&S and Engineering advisors for the Statistics, Mathematics, and Computer Science programs will advise Data Science students.

Marketing

Budget for these materials fall under the \$50,000 marketing budget annually. We anticipate that existing and very extensive marketing efforts by the College of Engineering and the College of Arts and Science will also support marketing for this program. Data Science will be included in our existing online, billboard, and printed materials marketing efforts. The marketing budget included here will support additional efforts to include Data Science in the existing and new marketing efforts.

Operations

Other operating costs are estimated at \$20,000 annually. These costs will include office supplies, materials, and compensation for the director.

Zero Cost

There is zero library cost associated with the program proposal. This can be attributed to the changing nature of libraries (for example, movement to online resources and a reduced need for space to support student and faculty needs). And, the existing library resources for research and teaching in the areas of Computer Science, Mathematics, and Statistics are adequate for Data Science in terms of journals, books, and other materials needed for students interested in data science. This is a consequence of having active graduate programs and research in the area of data science for a number of years.

The program also relies on existing computing resources and a movement toward the use of student owned computers. Cyberinfrastructure beyond the resources currently available to undergraduate students (e.g., cloud computing) will be provided.

3.B.2. Revenue

Sources of Revenue

The initial startup of the program will require modest institutional support of \$35K-\$112K (cumulative negative net revenue of \$112K is indicated in year zero and year 1 in a scenario where enrollment is 50% of expectations). These costs will be covered by the College of Engineering and College of Arts & Sciences. However, these funds will be compensated by future revenue as the program grows.

Based on the enrollment projection for students new to MU the total revenue in year one will be \$239,000, increasing to \$2,200,000 in year five (using the Tier 3 tuition rate). At the steady state, the total revenue for data science students is \$3,000,000.

3.B.3. Net Revenue

This program is expected to start generating net revenue early in its life cycle, as demonstrated by Table 2 and Appendix 1.

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

	Year 1	Year 2	Year 3	Year 4	Year 5
1. Expenses per year					
A. One-time					
<i>New/Renovated Space</i>					
<i>Equipment</i>			5,000		
<i>Library</i>					
<i>Consultants</i>					
<i>Other</i>	51,000	52,020	53,060	54,122	55,204
Total one-time	51,000	52,020	58,060	54,122	55,204
B. Recurring					
<i>Faculty</i>	50,000	51,000	52,020	53,060	54,122
<i>Staff</i>			64,784	66,079	67,401
<i>Teaching Assistants</i>	40,600	41,412	126,721	258,510	395,521
<i>Benefits</i>	32,272	32,917	86,743	134,519	184,171
<i>Equipment</i>					
<i>Library</i>					
<i>Other</i>					
Total recurring	122,872	125,329	330,268	512,169	701,214
Total expenses (A+B)	\$173,872	\$177,349	\$388,328	\$566,290	\$756,418
2. Revenue per year					
<i>Tuition/Fees</i>	239,304	488,181	746,916	1,269,758	2,201,760
<i>Institutional Resources</i>					
<i>State Aid -- CBHE</i>					
<i>State Aid -- Other</i>					
Total revenue	\$239,304	\$488,181	\$746,916	\$1,269,758	\$2,201,760
3. Net revenue (loss) per year	\$65,433	\$310,831	\$358,588	\$703,467	\$1,445,342
4. Cumulative revenue (loss)	\$30,141	\$340,972	\$699,560	\$1,403,028	\$2,848,370

3.B.4. Financial and Academic Viability

Table 3. Enrollment for Financial and Academic Viability

Enrollment	Minimum for Financial Viability	Minimum for Academic Viability
Full-time	35	40
Part-time	0	0
Total	35	40

Enrollment of 35 students is the break-even enrollment that allows the revenue to equal expenses in year 5. Enrollment of 40 students will allow classes to fill with a minimal number of students for collaborative work as needed.

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

3.C.1. Marketing Plan & Strategy

The Data Science program will be integrated into recruitment activities currently managed by each of the two colleges, as well as general MU admissions and recruitment activities (e.g., college fairs, Meet Mizzou Days, high school visits, and community college visits). There are additional, discipline-specific opportunities to recruit through existing MU events aimed at K12 and early career undergraduate students, such as Project Lead the Way; First Robotics; Robotic Camps, and the American Statistical Association's DataFest.

Marketing will include digital advertisements targeted at students and their parents, when appropriate. Digital advertising and printed materials will be designed and purchased. To attract students, recruiting events will also be used such as on-campus visits and high school presentations.

The following individuals will be responsible for marketing:

A. College of Engineering

1. Danene Brooks, Director of Marketing and Communications
2. Cassandra Siela, Director of Recruitment and Retention

B. College of Arts and Science

1. A&S director of Marketing and Communications (TBD)
2. Ellison Land and Raynesha Green, recruitment coordinators

Note that CoE and A&S strategic communications and recruitment professionals will work collaboratively on these materials.

Projected Program Growth

Advertising will initially focus on the introduction of the program. Later marketing efforts will emphasize job placements, emerging market needs, and new developments in the field of data science at MU and more generally.

Marketing Costs

Marketing costs are estimated to start at \$50K per year, with annual increases of 2%.

3.C.2. Student Success Plan

Both Colleges of Arts and Science and Engineering have extensive tutoring, academic advising, outreach programs, and career development services to help students succeed in courses and guide them successfully through their programs and relevant co-curriculars and extracurriculars.

Achieving Enrollment Outcomes

Both colleges have recruiters that will work with campus-level recruiters to encourage both FTC and transfer students to join the new Data Science program. Each also has extensive retention programs that will help to support healthy enrollment.

For comparison, in Fall 2022 the University of Michigan, which offers a similar joint program between its College of Engineering and College of Literature, Science, and the Arts (LSA) had an enrollment of 262 undergraduates. (UMichigan has a larger undergraduate population, of course, but the projected number of MU students is the same when adjusted for size.)

3.C.3. Transition Plan

The program and its faculty board will be overseen by a faculty director. (This is typical of interdisciplinary undergraduate programs in the College of Arts and Science whose faculty are drawn from multiple departments.) Dr. Lawrence Ries, Statistics, will serve in this inaugural role. Directors will serve 3-year terms, with the possibility of renewal. Each new director will be selected jointly by the Dean of the College of Engineering and the College of Arts and Science. If the director leaves the institution, a new director or interim director will be appointed immediately to take over responsibility for the program. The director will be responsible for maintaining the curriculum (leading committee work), ensuring courses are taught so that students can complete the degree, and manage ABET accreditation tasks.

3.C.4. Exit Strategy

If enrollment fails to achieve 100 students within 5 years, this program will be reviewed to determine what steps should be taken to improve enrollment or if the program should be discontinued. In the case of hiatus or discontinuance, required courses will continue to be taught until the final students in the program have

completed their coursework. Many of the courses in Data Science will be of value to students outside of the curriculum, which will allow each of them to be offered even if Data Science student enrollment is low.

4. Institutional Capacity

Both the College of Arts and Science and College of Engineering have advising, student support, instructional, and classroom capacity that can sustain fluctuations in the number of students. With the expected enrollment of 170 students at year 5, this represents a small percentage of the over 10,000 students currently enrolled between the two colleges. It is expected that additional revenue from the proposed program will be used to expand instructional and advising capacity in the two colleges. A new academic advisor will be hired if the program meets enrollment targets. The cost of this expansion of capacity is included in the budget pro forma.

5. Program Characteristics

5.A. Program Outcomes

The proposed BS in Data Science is a collaborative, interdisciplinary effort involving the core departments of Electrical Engineering & Computer Science (EECS), Mathematics (MATH), and Statistics (STAT). Through foundational coursework the triad of disciplines that inform data science as a field – computer science, statistics, and mathematics – the program will prepare students to become competitive and marketable data scientists in Missouri, regionally, nationally, and internationally through strong connections to the industries. Core courses will prepare students for more advanced work in upper-level courses that include data science applications in one of the three core fields; these will serve as the advanced focus area of 12 credit hours, together with an additional six hours of experiential, field-specific coursework in research and/or internship. This new program will reflect the diversity of the emerging field of data science by offering emphases in several core areas in advanced data science involving computing and mathematical/statistical modeling.

Learning Objectives

Students who complete the BS in Data Science will learn terminology, foundational concepts and intermediate skills in at least two of the three areas (computer science, mathematics, and/or statistics) that constitute the discipline while gaining advanced skills in the third that serves as the focus area. In addition, they will gain significant hands-on experience in their focus area through the 6 hours of internship and/or research coursework that fulfills the capstone for the major.

The eight specific learning objectives and listed below are adapted from the student outcomes and curriculum requirements proposed by CAC (Computing Accreditation Commission) as criteria for accreditation for data science undergraduate programs,

which has recently been approved by ABET (Accreditation Board for Engineering and Technology).

Table 4. Student Learning Objectives

1	Demonstrate application of theory, data science techniques, and tools from computer science, statistics, and mathematics and employ the resulting knowledge to satisfy stakeholders' needs.
2	Acquire representative data as well as manage, prepare, integrate, and analyze data.
3	Develop and deploy models informed by data.
4	Visualize and communicate the knowledge obtained from the data.
5	Demonstrate knowledge of data ethics and governance including legitimate use and algorithmic fairness as well as privacy, security, and stewardship.
6	Learn and apply statistical and mathematical skills and techniques including inference, modeling, linear algebra, probability, and optimization.
7	Learn and apply computer science skills and techniques including data structures and algorithms.
8	Demonstrate competency in objectives 1-7 through a major project, integration and application of data science knowledge and skills acquired throughout the curriculum to their particular advanced focus area (i.e. computer science, mathematics, or statistics) to provide a context for data science activities.

5.B. Program Design and Content

Curriculum Design Process

The curriculum has been designed to meet the outcomes listed in the ABET accreditation criterion for programs in Data Science. ABET specifies the quantity of credit hours and some details on content required for courses. Similar programs were also analyzed to help determine the appropriate courses needed for a data science program. The courses required in the curriculum and the content of newly created courses was also influenced by the expertise of faculty instructors and researchers at MU which allows us to form a program that is unique to MU. In addition, university policies such as general education requirements and the minimum number of credit hours were also factored into the design.

Sequence of Courses

Within the major proper, all students must complete a total of 60 hours, consisting of the following four parts: 1) a core curriculum of 10 required courses (30 credits); 2) four intermediate-level core courses (12 credits) from a restricted list of six; 3) four advanced courses (12 credits) within the chosen focus area of Computer Science, Mathematics, or Statistics; and 4) 6 credits of experiential coursework consisting of case studies, internships, research, and/or thesis, 3 credits of which meet the MU capstone requirement.

Within the core and intermediate courses in the areas of mathematics, statistics, and computer science. Each of these sequences have courses that start at lower numbered courses and progress to higher course numbers, each having a prerequisite as the lower numbered course. Taking a sequence of lower division courses serves as prerequisite material for a collection of upper division which may be taken in the advanced focus areas in mathematics, statistics, and computer science.

5.C. Program Structure

General Description

This program requires a total of 120 credit hours for completion. Within the major, all students complete a total of 60 hours, consisting of the following four components: 1) a core curriculum of 10 required courses (30 credits); 2) 4 intermediate-level core courses (12 credits) from a restricted list of six; 3) 4 advanced focus area courses (12 credits) within the chosen focus area of Computer Science, Mathematics, or Statistics; and 4) 6 credits of experiential coursework consisting of case studies, internships, research, and/or thesis, 3 credits of which meet the MU capstone requirement.

Students who complete the degree with the Computer Science focus will receive their degrees from the College of Engineering; those who complete in Mathematics or Statistics will receive their degrees from the College of Arts and Science.

Program Requirements

The BS in Data Science requires a total of 120 credit hours for completion. Within the major proper, all students must complete a total of 60 hours, consisting of the following four parts: 1) a core curriculum of 10 required courses (30 credits); 2) four intermediate-level core courses (12 credits) from a restricted list of six; 3) four advanced courses (12 credits) within the chosen focus area of Computer Science, Mathematics, or Statistics; and 4) 6 credits of experiential coursework consisting of case studies, internships, research, and/or thesis, 3 credits of which meet the MU capstone requirement. Students may meet the 6-credit requirement through a combination of such experiential coursework.

Students who complete the degree with the Computer Science focus will receive their degrees from the College of Engineering; those who complete in Mathematics or Statistics will receive their degrees from the College of Arts and Science.

Students earning a Bachelor of Science in Data Science are required to complete all University general education, University undergraduate requirements, degree, and major requirements, including selected foundational courses, which may fulfill some University general education requirements.

Major Core Requirements

Core Courses

DATA SCI 1030	Foundations of Data Science	3
STAT 2800	Intuition, Simulation, and Data	3
CMP SC 1300	Computing with Data in Python	3
CMP SC 2300	Introduction to Computational Data Visualization	3
CMP SC 3380	Database Applications and Information Systems	3
STAT 4510	Applied Statistical Models I	3
STAT 4520	Applied Statistical Models II	3
MATH 1400	Calculus for Social and Life Sciences I	3
or MATH 1500	Analytic Geometry and Calculus I	
MATH 2320	Discrete Mathematical Structures	3
MATH 4140	Matrix Theory	3
Total Credits		30

Intermediate Courses

Students must select 12 credits from the following list.

CMP SC 4350	Big Data Analytics	3
CMP SC 4720	Introduction to Machine Learning and Pattern Recognition	3
STAT 4560	Applied Multivariate Data Analysis	3
STAT 4640	Introduction to Bayesian Data Analysis	3
MATH 2100	Calculus for Social and Life Sciences II	3
or MATH 1700	Calculus II	
MATH 4500	Applied Analysis	3

Advanced Focus Courses

Students must select 12 credits from within one of the focus areas in the following list.

Computer Science Focus

CMP SC 4540	Neural Models and Machine Learning	3
CMP SC 4740	Interdisciplinary Introduction to NLP	3
CMP SC 4750	Artificial Intelligence I	3
CMP SC 4770	Introduction to Computational Intelligence	3

Statistics Focus

STAT 4150	Applied Categorical Data Analysis	3
STAT 4310	Sampling Techniques	3
STAT 4330	Methods in Sports Analytics I	3
STAT 4340	Methods in Sports Analytics II	3
STAT 4410	Biostatistics and Clinical Trials	3
STAT 4420	Applied Survival Analysis	3

STAT 4430	Applied Longitudinal Data Analysis	3
STAT 4450	Applied Statistical Methods for Bioinformatics	3
STAT 4540	Experimental Design	3
STAT 4610	Applied Spatial Statistics	3
STAT 4710	Introduction to Mathematical Statistics	3

Mathematics Focus

MATH 4100	Differential Equations	3
MATH 4310	Numerical Linear Algebra	3
MATH 4355	Quantitative Finance and Insurance I	3
MATH 4540	Mathematical Modeling I	3
MATH 4590	Quantitative Finance and Insurance II	3

Experiential Courses

Students must select 6 credits from the following list.

CMP SC 4990	Undergraduate Research in Computer Science	0-6
CMP SC 4995	Undergraduate Research in Computer Science - Honors	1-6
MATH 4960	Special Readings in Mathematics	1-3
MATH 4996	Honors in Mathematics	2
STAT 4999	Departmental Honors in Statistics	1-3
STAT 4085	Problems in Statistics for Undergraduates	1-3
INTDSC 4971	Capstone Internship in Interdisciplinary Studies	1-6

Residency Requirements

There are no additional residency requirements for the new program.

Internship, Thesis or Other Capstone

Six hours of experiential coursework are required, three hours of which meet the capstone requirement.

Unique Features:

Three departments will collaborate to offer the core, intermediate, advanced focus, and experiential courses as well as maintain the curriculum and offer the courses on a regular basis. Some courses will be taught by faculty in the College of Arts & Science and the College of Engineering.

Admission Requirements

Students that meet the minimum admission requirements set by MU will be eligible to be admitted into the new program. No additional special qualifications are required.

5.D. Program Goals & Assessment

Assessment Learning Outcomes

Processes consistent with ABET procedures to assessing student outcomes will be used in this program. Student outcomes will be assessed in courses using examples of student assignments.

Retention and Graduation Rate Goals

The goal is to, on average, retain 93% of students from year to year. This will allow for the program to maintain an 80% retention rate through year 4. In addition, the graduation rate goal is 75%. These goals are in line with the performance of other engineering, technology, and science- based programs at the University of Missouri.

Other goals include attainment of ABET accreditation by continuously improving courses, the curriculum and resources for students and assessing student outcomes of the program. A goal of over 95% career outcome will be considered a measure of success of the program as well.

5.E. Student Preparation

Entering freshmen are expected to have completed 17 units of approved high school course work (in grades 9-12), including 4 units in English, 4 in mathematics and 3 in science with laboratory. Mathematics should include 2 units of algebra, 1 unit of plane and solid geometry (combination course), and 1/2 unit of trigonometry. Additional senior mathematics is recommended.

5.F. Faculty and Administration

Lawrence Ries will be the inaugural director of the BS in Data Science program. Dr. Ries has extensive experience in course instruction and administration as the current associate chair of Statistics. Dr. Ries will be compensated with an extra month of pay and a course release. The director, who will have a term of three years and dedicate 10% of their time to the program, will be selected by the Dean of Arts and Science and the Dean of Engineering. The responsible departments for this program are Electrical Engineering and Computer Science, Statistics, and Mathematics.

Instructional Needs

Instructional needs will be met by existing faculty initially. Existing courses will be expanded and additional TAs will be hired as described in the financial plans.

Table 5. Faculty Listing

Name	Position	Percentage of Time Dedicated to Program
Grant Scott	Associate Prof., EECS	10%
Lawrence Ries	Teaching Prof. and Associate Chair, Stat.	10%
Derek Anderson	Associate Professor, EECS	10%
Dustin Belt	Assistant Prof., Math	10%

Credentials for Teaching Assignment

An MS or a PhD are required for teaching in the area of Data Science or one of the focus areas of Computer Science, Mathematics, Statistics, or related fields.

Faculty Involvement

Faculty will be expected to advise students on matters of career development and selection of upper division courses. 90% of credit hours in the major that will be assigned to full-time faculty.

5.G. Alumni and Employer Survey

Alumni Survey

Alumni surveys will be used to assess program educational objectives on a yearly basis. This information will be used to continuously improve the BS in Data Science program.

Employer Survey

An Industrial Advisory Board (IAB) will be formed and made of representatives from key employers of Data Scientists. This board will be used to advise the faculty as they continuously improve the program. Employers will be surveyed to determine the level to which the program is achieving its educational objectives every two years. The survey will include questions related to each of the educational objectives.

5.H. Accreditation

Within 5 years of starting the program, a request for evaluation will be made to the Computing Accreditation Commission to coincide with the next ABET review cycle.

6. Appendices

- Appendix 1: Pro Forma (page 23)
- Appendix 2: Letters of Support (page 24)

Appendix 1

Pro Forma

Please see first tab for instructions.

UNDERGRADUATE PROGRAM PRO FORMA

(1) UNIVERSITY OF MISSOURI - Columbia
 PROFORMA: BS in Data Science Projection as of May, 2023
 Prepared by: Roger Fales Approved by: Melissa Amos-Landgraf, CoE; Todd Mackley, COLUM - 6/2/202

PROGRAM:	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
(2) Enrollment Projections								
Head Count Students - new incoming/transfer	4	18	36	54	90	153	203	203
Non-Resident	-	2	4	6	10	17	22	22
Tuition Rate/YR (\$8300/Semester)	16,600	16,932	17,271	17,616	17,968	18,328	18,694	19,068
(3) Non-Resident - est. 10% (18,400/Semester)	36,800	37,536	38,287	39,052	39,834	40,630	41,443	42,272
Fee Rate/Credit Hour	-	-	-	-	-	-	-	-
(4) Tuition Discount Rate (%)	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
(5) Revenue Projections	*****CALCULATED CELLS*****							
Tuition	66,400	379,848	774,890	1,185,582	2,015,489	3,494,857	4,706,683	4,800,817
Supplemental & Other Fees	-	-	-	-	-	-	-	-
Scholarship Allowances	(24,568)	(140,544)	(286,709)	(438,665)	(745,731)	(1,293,097)	(1,741,473)	(1,776,302)
Net Tuition and Fees	41,832	239,304	488,181	746,916	1,269,758	2,201,760	2,965,210	3,024,515
Other Income								
TOTAL PROGRAM REVENUE	\$41,832	\$239,304	\$488,181	\$746,916	\$1,269,758	\$2,201,760	\$2,965,210	\$3,024,515
Recurring State Support								
TOTAL REVENUE	\$41,832	\$239,304	\$488,181	\$746,916	\$1,269,758	\$2,201,760	\$2,965,210	\$3,024,515
(6) Expenditure Projections								
Faculty Salaries								
10k per course, 4 core, 1 upper level	\$ 20,000	\$ 50,000	\$ 51,000	\$ 52,020	\$ 53,060	\$ 54,122	\$ 55,204	\$ 56,308
Technical Salaries								
GTAs 1/80 students in 1 course in years 1-2 and 3 courses in	\$ -	\$ 40,600	\$ 41,412	\$ 126,721	\$ 258,510	\$ 395,521	\$ 403,431	\$ 411,500
Support Salaries								
Academic advisor salary + benefits	\$ -	\$ -	\$ -	\$ 64,784	\$ 66,079	\$ 67,401	\$ 68,749	\$ 70,124
Total Salaries	20,000	90,600	92,412	243,524	377,650	517,043	527,384	537,932
Benefits	7,124	32,272	32,917	86,743	134,519	184,171	187,854	191,611
Subtotal Salaries and Benefits	27,124	\$122,872	\$125,329	\$330,268	\$512,169	\$701,214	\$715,238	\$729,543
Operating Expense								
Computing Expenses								
NonCapital Maintenance & Repair								
Noncapital Equipment								
Supplies								
Professional & Consulting								
Travel & Training								
Misc. Expenses, marketing and recruitment	50,000	51,000	52,020	53,060	54,122	55,204	56,308	57,434
Subtotal Operating Expense	50,000	\$51,000	\$52,020	\$53,060	\$54,122	\$55,204	\$56,308	\$57,434
(7) One-time Expenditures (Startup Costs)								
Office Equipment (advisor, desk, phone, computer, chair)				\$ 5,000				
(8) Additional Space Costs								
Subtotal One-time Expense	\$ -	\$0	\$0	\$5,000	\$0	\$0	\$0	\$0
TOTAL EXPENDITURES	\$77,124	\$173,872	\$177,349	\$388,328	\$566,290	\$756,418	\$771,546	\$786,977
DIRECT MARGIN	(\$35,292)	\$65,433	\$310,831	\$358,588	\$703,467	\$1,445,342	\$2,193,664	\$2,237,537
CUMULATIVE DIRECT MARGIN	(\$35,292)	\$30,141	\$340,972	\$699,560	\$1,403,028	\$2,848,370	\$5,042,034	\$7,279,572
Subtract:								
(9) Revenue from Transfers within Campus								
NET MARGIN TO THE CAMPUS	(\$35,292)	\$65,433	\$310,831	\$358,588	\$703,467	\$1,445,342	\$2,193,664	\$2,237,537
CUMULATIVE NET MARGIN TO THE CAMPUS	(\$35,292)	\$30,141	\$340,972	\$699,560	\$1,403,028	\$2,848,370	\$5,042,034	\$7,279,572
(10) Campus Overhead Allocation - 10%	4,183	23,930	48,818	74,692	126,976	220,176	296,521	302,451
MARGIN AFTER CAMPUS OVERHEAD	(\$39,475)	\$41,502	\$262,013	\$283,897	\$576,492	\$1,225,166	\$1,897,143	\$1,935,086
CUMULATIVE MARGIN AFTER CAMPUS OVERHEAD	(\$39,475)	\$2,027	\$264,040	\$547,937	\$1,124,429	\$2,349,595	\$4,246,738	\$6,181,824

(11) Assumptions:

Appendix 2

Letters of Support

August 9, 2023

Dear Dr. Ries,

I strongly support the development of a degree program in Data Science at Mizzou. I graduated with a master's degree in statistics from Mizzou in 1995, then spent five years teaching statistics at the university level before moving to industry. I have been a data scientist in title for the past 10 years and have been performing the work of a data scientist for more than 20. My education in statistics provided a valuable foundation for my career, but it is the acquired expertise in data science that has proven most useful.

Currently, I manage the data science team at a health care analytics company and provide data and software to our mail order pharmacy, which serves the needs of medically-complex patients. Our company exists because of data and our success is due to the products we have created to provide actionable information to our health plan clients and our pharmacy. While knowledge of statistics is necessary in this endeavor, it is the components of data science that truly make this possible: understanding data and business/market needs, storing and safeguarding data, creating efficient and scalable processes/programs/algorithms, developing models, and communicating insights to stakeholders.

During the past 20 years, I have found that there are many people skilled at statistical analysis, many skilled at programming, and few skilled at both. This combination of skills is crucial to the type of work my team and our company does. In addition, the accelerating volume of data demands new tools and new ways of thinking. In my opinion, programs in Data Science are not only welcome, but are necessary for producing the next generation of data analysts.

Sincerely,

Dan Smith

Vice President, Data Science

RxAnte, Inc.

571.414.8917

dsmith@rxante.com

Endorsement of Mizzou's New Undergraduate Data Science Program

Manny Burke <manuel.burke@salesforce.com>

Thu 2023-08-17 10:14

To: Scott, Grant J. <scottgs@missouri.edu>

WARNING: This message has originated from an External Source. This may be a phishing expedition that can result in unauthorized access to our IT System. Please use proper judgment and caution when opening attachments, clicking links, or responding to this email.

Dear Dr. Scott,

I hope this email finds you in good spirits. As a proud University of Missouri alum and Lead Solution Engineer at Salesforce/Tableau, I am writing to enthusiastically support the proposed undergraduate interdisciplinary Data Science program at Mizzou.

In my current role at Tableau (Salesforce), I harness the power of data analytics to help businesses make informed decisions. Leveraging a broad array of tools, I design and implement tailored solutions that enable organizations to visualize complex data, draw actionable insights, and drive strategic growth. Collaboration with cross-functional teams and engaging with clients on various levels is central to my role. My graduate degree provided me with a strong foundation in data analysis and interpretation, communication skills, and critical thinking — key attributes I utilize daily.

The current technological landscape requires professionals with a comprehensive understanding of mathematics, computer science, statistics, and domain-specific knowledge. Mizzou's proposed program would meet this need, positioning the university as a leader in innovative education.

Businesses like ours are actively seeking entry-level data science graduates. The proposed program at Mizzou could become a vital pipeline for skilled graduates and provide hands-on internships, preparing students to contribute meaningfully to various sectors.

The growth of AI and data analytics in the industry, led by companies like Salesforce, Microsoft, Snowflake, and Databricks, emphasizes the immediate need for skilled AI engineers. The proposed program would play a crucial role in nurturing future innovators, aligning with the industry's direction.

In conclusion, Mizzou's undergraduate interdisciplinary Data Science program promises to be a significant advancement, meeting current market demands and fostering the next generation of tech leaders. I am confident that this initiative would further strengthen the University's reputation and contribute positively to the tech industry.

Please feel free to reach out if you need further information or have any questions.

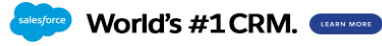
Best regards,

Manuel Burke

Lead Solution Engineer | Tableau at Salesforce

Mail: manuel.burke@salesforce.com

Mobile: +1 470-479-5515



MU School of Medicine Honor Code

Executive Summary

CRR 200.020.E.9 authorizes the adoption of student honor systems to investigate facts, hold hearings and impose sanctions relating to student conduct in academic programs within the University, subject to Chancellor and Board of Curators approval. Student honor systems shall contain at minimum the same standards set forth in CRR 200.010, Standard of Conduct. Pursuant to these rules, the University of Missouri-Columbia School of Medicine is proposing certain revisions to its current Honor Code:

- to define clear standards of conduct to which medical students will be held accountable;
- to clarify the process for evaluating alleged violations of the standards;
- to expand and clarify the rights of the Respondent in the hearings; and
- to delineate the sanctions that may be imposed for violations of the standards of conduct.

A previous set of revisions was discussed at the Board of Curators' April 20, 2023 meeting, but action to approve them was tabled to allow additional review to ensure consistency with anticipated changes to the University's general Standard of Conduct (CRR 200.010) and Rules of Procedures in Student or Student Organization Conduct Matters (CRR 200.020).

CRR 200.010 and CRR 200.020 were amended by action of the Board of Curators at its June 29, 2023 meeting. Since then, the Office of the General Counsel has worked with the School of Medicine to further revise the Honor Code to appropriately reflect those changes. The Honor Code has been further reviewed for consistency with the terms and spirit of those amended student conduct rules and procedures. The attached proposed revisions represent the product of those efforts. They are aimed at updating the rules; focusing on the educational objectives of the student conduct process; ensuring processes that are fair and transparent to the participants; and providing additional process for students and organizations beyond the due process already established under the existing rules.

Noteworthy areas addressed in the proposed changes include:

- Changes to align the Honor Code *procedures* with due process standards in CRR 200.020;
- Changes to align the Honor Code *sanctions* with CRR 200.020
- Establishes that hearing panels will be composed of 5 faculty members and 4 student members;
- Clarifies that Student conduct involving alleged discrimination and harassment, including sexual harassment, will be addressed through the University's Title IX / equity procedures in CRR Ch. 600; and
- Updates, including cross-references to rules, addressing notice by email, etc.

The revisions were approved by faculty and students of the School of Medicine. The revisions have also been reviewed and approved by the Dean of the School of Medicine, General Counsel and the Chancellor.

November 16, 2023

No. 6

Recommended Action – Revisions to the MU School of Medicine Student Honor Code

It was recommended and endorsed by President of the University of Missouri Mun Choi, recommended by the Academic, Student Affairs and Research & Economic Development Committee, moved by Curator _____, and seconded by Curator _____, that the following action be approved:

that the University of Missouri – Columbia School of Medicine Student Honor Code, pursuant to Collected Rules and Regulations, Section 200.020.E.9., be revised as attached.

Roll call vote of the Committee: YES NO

Curator Blitz
Curator Graves
Curator Layman
Curator Sinuefield

The motion _____.

Roll call vote of the Board: YES NO

Curator Blitz
Curator Brncic
Curator Fry
Curator Graves
Curator Holloway
Curator Layman
Curator Sinuefield
Curator Wenneker
Curator Williams

The motion _____.

University of Missouri School of Medicine Honor Code

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PREAMBLE

Upon graduation from medical school to enter the profession of medicine, it is customary that the graduates pledge themselves to abide by a set of principles which will guide them in adhering to and upholding the ethics and high standards of the profession of medicine. The Hippocratic Oath is commonly administered in such commencement exercises. Paraphrased, it indicates that as physicians we:

- Will be loyal to the profession of medicine, just and generous to its members
- Will lead our lives and practice our art in uprightness and honor
- Will enter whatsoever house for the good of the sick to the utmost of our power
- Will hold ourselves far aloof from wrong, from corruption, from tempting of others to vice
- Will exercise our art solely for the care of patients and will give no drug, perform no operation for a criminal purpose even if solicited, far less suggest it

- Will keep inviolably secret whatsoever we shall see or hear of the lives of men which is not fitting to be spoken.

Alternatively, and with increasing frequency, graduating classes of medical students elect to adhere to the Declaration of Geneva.

By the act of matriculation at the University of Missouri-Columbia School of Medicine, we pledge ourselves to uphold the principles of these declarations which define the ethics and high standards of the profession of medicine to which we aspire.

In particular, recognizing our specific role as students aspiring to practice medicine, we additionally pledge ourselves to the tenets set forth in Article 1 of this Honor Code

Article 1 – Standards of Professional Conduct

A. Professional Integrity

1. Honesty

A student shall deal honestly with people including, but not limited to, colleagues, instructors, representatives of the University, patients, attending physicians, and other members of the health care team. Students are expected to demonstrate honesty and integrity in all aspects of their interactions with patients and staff — particularly in assuring accuracy and completeness of their documentation in medical records. The student shall be willing to admit errors and must not mislead others or promote the student at the patient's expense. Students shall strive to report those students who violate these Standards of Professional Conduct ("Standards").

Scientists and students who participate in research have a responsibility to provide research results of the highest quality; to gather facts meticulously; to keep impeccable records of work done; to interpret results realistically, not forcing them into preconceived molds or models; and to report new knowledge through appropriate channels. Co-authors of research reports must be sufficiently acquainted with the work of their co-workers so they can personally vouch for the integrity of the study and validity of the findings, and must have been active in the research itself.

In all cases of academic dishonesty, the instructor shall make an academic judgment about the student's grade on that work and in that course. The instructor shall also report the alleged academic dishonesty.

Examples of academic dishonesty include, but are not limited to, the following:

Cheating — 1) use of any unauthorized assistance including, but not limited to, notes, textbooks, unauthorized electronic devices or prohibited internet resources (including but not limited to Box, Google drive, Microsoft teams or other stated resources on the exam sheet), in taking quizzes, tests, or examinations; 2)

dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments; 3) acquisition or possession without permission of tests or other academic material belonging to a member of the University faculty, staff, or students; 4) in any way giving assistance to others who are participating in any of the three preceding types of behavior; 5) falsifying attendance records or other official documents; or 6) submitting the same paper, project, or document for a grade or credit in multiple courses.

Plagiarism — 1) use by paraphrase or direct quotation of the published or unpublished work of another person without fully and properly crediting the author with footnotes, citations or bibliographical reference; 2) unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials; or 3) unacknowledged use of original work/material that has been produced through collaboration with others without release in writing from collaborators. The detection may involve the use of commercially available software.

Sabotage — unauthorized interference with, modification of, or destruction of the work or intellectual property of another member of the University community.

Examples of dishonesty related to clinical practice include, but are not limited to, the following:

Falsification of Patient's Medical Record — writing progress notes regarding the patient's status that are false including, but not limited to, clinical observations or results in the patient's chart when the student has not seen or evaluated the patient, or using incorrect times of data entry.

Falsification of Patient's Medical Information — reporting medical information such as physical examination findings, lab values, test results, and any other relevant patient information to other students, residents, attending physicians, preceptor, the patient, the patient's family, or other relevant medical personnel that has been fabricated by the student.

2. Responsibility

Students must not be harmful, dangerous, or negligent to the mental or physical health of a patient or the public. Negligent means the failure to use that degree of skill and learning ordinarily used under the same or similar circumstances by other students.

Students must be familiar with and follow the rules and regulations of School of Medicine, the University, and the applicable health care professional organizations. Students shall be familiar with and comply with the policies and procedures of clinical sites where they are assigned.

While the University and School of Medicine are committed to the rights of students to free expression, they also have the responsibility to restrict certain conduct which violates the law or University policy, or otherwise directly interferes with the functioning of the University or School of Medicine and/or its clinical affiliates. Students are expected to be knowledgeable of and comply with the limits on free expression as set forth in the University “Commitment to Free Expression,” available at <https://freespeech.missouri.edu/commitment-to-free-expression/> .

Students shall be responsible in their use of personal and professional social media accounts. “Social media” includes any electronic communication or networking using an online service, platform, or site to share information, ideas, personal messages, images, photographs, or other content including, but not limited to, emails, Facebook, Twitter, LinkedIn, YouTube, Snapchat, Instagram, GROUPME, TikTok, Reddit, Tumblr, and blogs. Students shall use appropriate judgment and be respectful and professional in all social media communications. Information shall be truthful and not misleading or deceptive. Content on social media is considered to be published material and therefore must comply with Federal copyright laws.

B. *Professional Behavior*

1. Prohibition Against Discrimination, Harassment, and Sexual Misconduct

A student shall be dedicated to providing supervised, competent health care services with compassion, respect for human dignity, and without discrimination.

Students shall not harass, engage in sexual harassment, sexual discrimination, or sexual misconduct with any other individual, or discriminate on the basis of race, color, national origin, ancestry, religion, sex, pregnancy, sexual orientation, gender identity, gender expression, age, disability, protected veteran status, or any other status protected by applicable Missouri or Federal law, either in person or on social media. (*See* Section 600.010 CRR.)

2. Representation

A student shall accurately represent the student to others including, but not limited to, colleagues, instructors, representatives of the University, patients, attending physicians, and other members of the health care team.

Examples of misrepresentation include, but are not limited to, the following:

- a. A student shall never use the title of “Doctor” or M.D., as this clearly misrepresents the student’s position, knowledge, and authority.

- b. Use of fraud, deception, lies, or bribery in securing any certificate of registration or authority, diploma, permit or license issued, or in obtaining permission to take any examinations.
- c. Impersonation of any person holding a certificate of registration or authority, permit, license or allowing any person to use his/her certificate of registration or authority, permit, license, or diploma from any school.
- d. Forgery, alteration, or misuse of a patient's medical records or knowingly furnishing false information to the health care team and/or professional organizations.

Representations on social media shall accurately reflect that any opinions voiced are those of the student and the student is not speaking on behalf of the University, or School of Medicine and/or its clinical affiliates.

The student is expected to be thoughtful and professional when interacting with patients and their families, attending physicians, preceptors, supervising residents, and other students, and whenever their behavior may influence adversely the judgments of others about School of Medicine and/or its clinical affiliates, or the University. Students shall comply with the code of ethics for their applicable health care profession both on campus and at clinical affiliates, by conduct and speech, and when using social media.

Students shall maintain a neat and clean appearance, and dress in attire that is generally accepted as professional by the patient populations served and in compliance with any policies of clinical affiliates.

Students are required to learn about a patient's values, traditions, and beliefs as they relate to the care and treatment options available to the patient. The goal is to develop mutual trust between the patient and student, and to develop an effective student-patient relationship. If there is an irresolvable conflict between the ethical beliefs and values of a student and a patient, the student needs to avoid argument, judgment of the patient's personal integrity, or any action that would cause the patient to avoid seeking appropriate medical treatment and care. The student should seek to understand the patient's value system. A student avoids making assumptions based on stereotypes or preconceived ideas, and asks questions of patients about their beliefs, values, and lifestyle in a respectful, open, and empathetic manner. The student's role is to explain the options available to the patient thoroughly and objectively, giving appropriate time and emphasis to each option while remaining sensitive to the patient's value system. Should a patient wish to pursue an option of treatment or care that the student is not comfortable with, the student should discuss the situation with a supervisor.

3. Confidentiality and Privacy

A student shall respect the rights of patients, colleagues, and other health care professionals, and shall safeguard the confidentiality and privacy of patient communications and protected health information within the constraints of the law.

The patient's right to privacy in regard to his/her medical record, which includes privacy of personal and social history, is a fundamental tenet to health care.

The discussion in public of the problems of an identified patient, without the patient's permission, by students violates patient confidentiality and privacy laws and is unethical. Under no circumstances can any medical record be removed from an institution. Names and any other identifiers of patients shall be omitted from any documents used for these presentations unless disclosures are permitted by the HIPAA Laws.

Any protected health information of patients, or any patient identifiers, hospital room numbers, or photographs of patients or their hospital or clinic rooms shall not be posted on social media.

Students are prohibited from communicating with patients and/or their authorized representatives or family members on social media. Any conversations regarding specific patient health care conditions, treatments, or particular processes in a clinical setting can be mutually beneficial for the professional community; however, these must only occur without identifying patients and when using professional social media sites that maintain the privacy and security of communications with registered users.

4. Assessment of Personal Competence (Self-Evaluation)

Students shall seek consultation and supervision whenever their ability to play their role in the care for a patient is inadequate because of lack of knowledge or experience.

Students are expected to respond to constructive criticism by appropriate modification of behavior.

It is unacceptable for a student to attempt procedures or to prescribe therapies without supervision.

5. Awareness of Impairments

The student will not use alcohol or drugs or practice while under a physical or mental health condition if such impairs his/her ability to perform the work of the profession or results in compromised patient care. It is also the responsibility of every student to strive to protect the public from an impaired colleague and to assist that colleague whose capability is impaired because of alcohol or drug use, or a physical or mental health condition. Students shall self-report and/or seek assistance if they are aware of any potential self-impairment. Additionally, any student who displays signs of impairment should be reported by a peer or School of Medicine faculty or staff

member. Any retaliation against a student for good faith reporting of a peer suspected of impairment shall constitute a violation of professional conduct.

CONSTITUTION

To implement and administer this Honor Code, we establish the following Constitution under which we shall operate.

Article I - The Hearing Committee

Section 1:

The Hearing Committee shall be established to determine whether there is sufficient evidence that violations of the Honor Code may have occurred.

Section 2:

The Hearing Committee shall consist of two elected members of each class who are not affiliated with the Honor Council in any way and a faculty member appointed by the Dean serving as a non-voting, ex officio chair of the Committee.

Section 3:

Elections of members to serve on the Hearing Committee of the M-1 class shall be held on or in the week following the date of the first grade release of the academic year.. Members' terms begin on the day of election and continue to the Monday following spring commencement of that year. M-2, M-3 and M-4 classes shall elect Hearing Committee members prior to May 1 and terms shall run for one year, beginning the Monday following spring commencement of that year.

The Hearing Committee shall meet prior to the date of spring commencement to elect a Chair. The Chair is responsible for assigning a member of the Hearing Committee to take minutes during any proceedings. The Honor Code shall then be reviewed for meaning and clarity to assure that all Hearing Committee members understand all of its provisions. A Hearing Committee member will also orient the M-1 members to the responsibilities of the Hearing Committee as soon as they are elected.

Section 4:

An alleged violation of the Honor Code should be reported as soon as possible after observed or known by any student, or any faculty member of the School of Medicine, to any member of the Hearing Committee. The reporter will be asked to submit a written or emailed report to Hearing Committee member, stating the possible violation, describing the facts related to the possible violation, and naming all people involved and possible witnesses.

If the reporter/Respondent is a member of the Hearing Committee or Honor Council, the individual will abstain from participating as a member of that Committee/Council while the investigation is active. The individual will not converse with members of that Committee/Council in any capacity other than as the reporter/Respondent of an incident.

Section 5:

Upon receipt of the aforementioned report, a copy, with the reporter's name withheld, will be forwarded at once to the involved student ("Respondent") and then a formal investigation shall be called by the Hearing Committee member involved. A preliminary meeting will be scheduled within 48 hours, if possible, and held within a reasonable period of time.

The meeting shall consist of at least 5 Hearing Committee members. The reporter and the Respondent will meet individually with the Hearing Committee. The Hearing Committee may also interview witnesses. The Hearing Committee will review the available information and determine whether there is a possible violation of the Honor Code, or whether the report should be referred to another individual or office of the University, such as the Equity Office or Title IX Coordinator, or whether the investigation shall be closed. Student conduct involving discrimination and harassment, including sexual harassment shall be governed by Section 600.030: Resolution Process for Resolving Complaints of Sexual Harassment under Title IX, and Section 600.040: Equity Resolution Process for Resolving Complaints of Discrimination and Harassment against a Faculty Member or Student or Student Organization. If the investigation is closed, the identity of the reporter and the Respondent shall not be disclosed.

Section 6:

If the information supports a possible violation of the Honor Code, a second meeting of the Hearing Committee will be called. At least 5 Hearing Committee members must attend this meeting. At this meeting, the Respondent and reporter shall meet together with the Hearing Committee. Witnesses may also be invited to attend this meeting at the discretion of the Hearing Committee. The second meeting will serve to collect additional information to compile a more complete report. If the reporter refuses to meet with the Hearing Committee, the investigation will be closed unless there are other witnesses or sufficient information to continue the investigation.

Section 7:

The Hearing Committee shall vote whether there is sufficient information to support a possible violation of the Honor Code and to refer the investigation to the Honor Council. In determining whether the investigation shall be referred to the Honor Council, a majority of the Hearing Committee members present must agree. The report of the investigation must be submitted to the Honor Council and the Associate Dean of Student Programs within 72 hours after the Hearing Committee decision.

Section 8:

If a majority of Hearing Committee members do not agree that there is a possible violation of the Honor Code, then the Associate Dean for Student Programs is sent a report. If the Associate Dean for Student Programs believes that there may be a reason to pursue an investigation further, then the Associate Dean shall meet with the Hearing Committee to discuss the matter. Only the Hearing Committee or another University office or individual may pursue an investigation. If the investigation is closed, no information relating to the investigation shall become part of the Respondent's general personal and academic file. Such information shall only be maintained by the Hearing Committee and Honor Council, and shall only be disclosed at the direction of the Hearing Committee or Honor Council, with subsequent notification to the Respondent. All information relating to the investigation shall be destroyed once Respondent permanently leaves the SOM or graduates.

Section 9:

All reports made to the Hearing Committee and proceedings of the Hearing Committee are to be held in the strictest confidence. Minutes shall be maintained of all proceedings.

Article II – Organization of the Honor Council

Section 1:

The purpose of the Honor Council is to investigate the alleged violations of the Honor Code, to determine if violations occurred, and what, if any, sanctions, should be imposed.

Section 2:

~~The Honor Council shall consist of all class presidents, one elected member from each of the M-1 and M-2 classes, two members will be elected from each of the M-3 and M-4 classes. The Honor Council shall consist of all class presidents, all class presidents, one elected member from each of the M-1 and M-2 classes, two members will be elected from each of the M-3 and M-4 classes.~~

Section 3

Election ~~s~~ for ~~the~~ members of the Honor Council from the M-1 class shall be held on or in the week following, the first ~~_~~grade release. Member ~~s~~² terms ~~s~~ begin on the day of election and continue to the Monday following spring commencement of that year. ~~M-2~~, M-3 and M-4 classes shall elect ~~_2~~ members ~~s~~ prior to May 1 and terms shall run for one year, beginning the Monday following spring commencement of that year.

Section 4:

~~A. (A)~~ The Honor Council shall meet prior to the day of spring commencement to elect a Chair. The Chair will be responsible for assigning a member of the Honor Council to maintain minutes from all proceedings. The Honor Code shall then be reviewed for meaning and clarity to assure that all Honor Council members understand ~~all of all~~ its provisions. ~~The Chair or a delegate shall be involved in the planning of and participate in the orientation of the M-1 class as it pertains to the Honor Code.~~

~~(B)~~

~~B. — The Chair of the Honor Council shall be elected by the Honor Council from among its own ranks (exclusive of the class presidents). When deemed appropriate, a Hearing Panel of not less than nine (9) members will be appointed, with four (4) members being students from the Honor Council appointed by the Chair and five (5) members being faculty members appointed by the Dean, to hear any alleged violation of the Honor Code. The Chair will preside over the Hearing Panel as a non-voting member. The Hearing Panel shall have the authority of the whole Honor Council of any matter to which they are assigned. The Chair shall not have any vote in meetings of the Honor Council, and will serve as the Chair in proceedings involving alleged violations of the Honor Code.~~

~~C. — The Chair will orient the new Honor Council members within a week of their election.~~

~~D.A. — The Chair or a delegate shall be involved in the planning of and participate in the orientation of the M-1 class as it pertains to the Honor Code.~~

Article III – Procedure for Honor Council Hearing ~~Panelss~~

Section 1:

~~(A) A.~~ — Within one week of receiving the report of the formal investigation from the Hearing Committee, the Chair shall schedule a hearing with the ~~Hearing Panel~~ Honor Council with the hearing to be held within 30 calendar days of receipt of the report.

~~(B).~~ At least twenty (20) business days prior to the hearing with the Hearing Panel, the Respondent shall receive notice of the following information:

- (1) A detailed description of the alleged conduct at issue and applicable policies, rules, or regulations alleged to be violated;
- (2) A description of the applicable procedures, including right to have an adviser, who may be, but is not required to be, an attorney;
- (3) A statement of the potential sanctions/remedial actions that could result;

(4) A statement notifying the Respondent that they will be permitted to inspect, copy, and review any evidence obtained as part of the investigation that is directly related to the allegations to be addressed at the hearing, including the evidence upon which the University does not intend to rely in reaching a determination regarding responsibility and including inculpatory or exculpatory evidence;

(5) A statement notifying the Parties that they must be truthful when making any statement or providing any information or evidence to the University throughout the student conduct process, and all documentary evidence must be genuine and accurate;

(6) A statement that nothing in these procedures is intended to supersede nor expand alter any rights the individual may have under applicable state or federal statutory laws or the U.S. Constitution;

(7) The names of the members of the Hearing Panel who will hear the case, and information on how to raise an objection to any member or chair and the timeline in which to raise any objections; and

(8) The time, date, and location of the hearing. If the Respondent does not appear at the hearing, the hearing will be held in their absence.

(9) Notice that the parties may request a virtual hearing and/or any necessary accommodations.

(C) This Notice of Hearing letter will be made in writing and will be delivered either: 1) in person, 2) by email only to the Party's University-issued email account if the Party has consented electronically or in writing to receipt of all notifications by email; or 3) mailed to the mailing address of the respective Party as indicated in the official University records and emailed to the Party's University-issued email account. If there is no local address on file, mail will be sent to the Party's permanent address. Notice also shall be mailed and emailed to the Party's adviser, if an adviser has been identified by the Party. Notice is presumptively deemed delivered, when: 1) provided in person or 2) emailed to the individual Party (when prior consent — whether electronically or in writing — has been given to receipt of all notifications by email or 3) when mailed and emailed to the Party and the Party's adviser, if an adviser has been identified by the Party.

(D) Any request to reschedule the hearing shall be made in writing to the Chair, who shall have the authority to reschedule the hearing if the request is timely and made for good cause. The Chair shall notify the Associate Dean of Student Programs and the Respondent of the new date for the hearing. If the accused student fails to appear at the scheduled time, the Committee may hear and determine the matter. The Respondent, reporter, and witnesses shall be notified of the date, time, and place of the hearing, and shall be requested to attend the hearing. The alleged violation shall be described along with the date and place of the alleged violation. The Respondent shall be provided with the Respondent's rights as set forth in Section 2 below.

(E) Should any Respondent object to any member of the Hearing Panel, they must raise all objections, in writing, to the Associate Dean of Student Programs no later than 5 business days prior to the hearing unless, for good cause, the Associate Dean of Student Programs allows objections to be raised later. Such objection shall be confidential and shall not be disclosed to the Honor Panel. A member may be unseated by the Associate Dean of Student Programs for good cause. Good cause may include, but is not limited to, bias that would preclude an impartial hearing or circumstances in which the member's or chair's involvement could impact the accused student's work or learning environment due to current or potential interactions with the member or chair (e.g., a panel member serving as an instructor or advisor to the Respondent). If it is determined that a member or chair should be replaced, the Associate Dean of Student Programs will select a replacement member. The Associate Dean of Student Programs will provide a written response to all parties addressing any objections to a member.

~~—(F)~~

~~C. —The Respondent is presumed not responsible for any alleged violation of the Honor Code until a determination regarding responsibility is made at the conclusion of this process. If the Respondent fails to appear at the scheduled time, the Honor Council may hear and determine the matter in the Respondent's absence.~~

~~C. —~~

~~D. —A quorum of six Honor Council members shall be necessary for the hearing.~~

Section 2:

(A) The Respondent charged~~s~~ shall have the right:

(1) -To be present at the hearing.

(2) To remain silent during the hearing, with such silence not considered as evidence supporting a finding of a violation.

(3) To have an advisor or ~~an~~ attorney of the Respondent's choice appear at the hearing with the Respondent and to consult with such advisor/attorney during the hearing. ~~; however, the advisor/attorney will not be allowed to question witnesses and/or members of the Honor Council.~~

(4) To hear or examine evidence presented to the ~~Hearing Panel~~ ~~or~~ ~~Council~~ either directly or through their advisor or attorney.

(5) To question witnesses present and testifying at the hearing either directly or through their advisor or attorney.

(6) -To testify at the hearing and present evidence by witness, written report, other memoranda, photographs, affidavit, or any other relevant evidence the Respondent requests. It is the responsibility of the Respondent to assure that any such evidence be made available at the time of the ~~Honor Council~~ hearing. No evidence may be submitted for consideration after the conclusion of the hearing.

(7) -To make any statement to the ~~Hearing Panel~~~~Honor Council~~ in mitigation or explanation of the Respondent's conduct.

(8)
To be informed in writing of the findings and decisions of the ~~Hearing Panel~~~~Honor Council~~ and any sanctions it ~~imposes;~~imposes.

a. ~~————~~(9)
To appeal to the appropriate appellate body, as herein provided.

(B) At least ten (10) business days prior to the hearing, the Associate Dean of Student Programs will provide the Respondent:

(1) An investigative report that fairly summarizes the relevant evidence in an electronic format or hard copy for their review.

(2) A list of the names of the proposed witnesses to be called by the Associate Dean of Student Programs.

(3) Copies of all proposed documentary, photographic, video, or audio evidence.

(4) Notification that all the evidence gathered in the course of the investigation that is directly related to the allegations to be addressed at the hearing is available to the Respondent and instructions regarding how to request access to that information, which shall include evidence upon which the University does not intend to rely in reaching a determination regarding responsibility and including inculpatory or exculpatory evidence.

(5) If any evidence that otherwise would have been subject to inclusion in the notice is received after the notice is issued, such evidence will be provided to the accused student or student organization as soon as practicable before the hearing date.

Section 3:

The hearing shall be recorded, either by audio, video, digitally, or stenographically as determined by the Chair of the Hearing Panel ~~Honor Council~~, and shall serve as the official hearing record.

Section 4:

(A) The Chair of the Honor Panel ~~Council~~ shall call the hearing to order, call the roll of the Honor Panel ~~Council~~ members in attendance, ascertain the presence or absence of the Respondent, read the Notice of the Hearing, establish the presence of any advisor/attorney present, and set forth the procedures for the hearing. All requests to address the Hearing Panel ~~Honor Council~~ shall be addressed to the Chair, and the Chair will rule on all requests and points of order. The Chair may consult with the legal advisor for the Honor Panel ~~Council~~ at any time. Rules of common courtesy and decency shall be observed at all times. Witnesses may only be questioned by the Hearing Panel ~~Honor Council~~ members and the Respondent.

(B) The Chair or another Hearing Panel ~~Honor Council~~ member shall make opening remarks outlining the general nature of the alleged violation and any facts that the investigation has revealed. The Respondent may make an opening statement about the alleged violation at this time or after the conclusion of the presentation on behalf of the School of Medicine. The Chair shall call witnesses, including the Respondent, who will first be questioned by members of the Hearing Panel ~~Honor Council~~ and then by Respondent. Witnesses may present written reports or other evidence.

(C) The Respondent may then present evidence through witnesses and written reports or other documents or evidence. The Hearing Panel ~~Honor Council~~ members may question a witness after the witness is questioned by the Respondent.

(D) Following the hearing, the Hearing Panel ~~Honor Council~~ shall promptly deliberate in closed session out of the presence of the Respondent. Determinations are to be made regarding the validity of the alleged violation(s) and, if any violations are substantiated, the sanction(s) to be imposed. Two-thirds of the Hearing Panel ~~Honor Council~~ members present at the hearing must concur to determine responsibility (or lack thereof) for any violations of the Honor Code and to impose any sanction.

(E) The decision of the Hearing Panel ~~Honor Council~~ shall be based on a preponderance of evidence (i.e., a violation is more likely than not). ~~The Honor Council may consult with other individuals or examine other evidence prior to making a decision.~~

(F) The Hearing Panel ~~Honor Council~~ shall determine sanctions to be imposed for any substantiated violations of the Honor Code. Where there are multiple violations of the Honor Code, there can be separate sanctions imposed of each violation or one sanction for all violations. Requirements for education and/or training, or referral to a School of Medicine Committee or other resource may be imposed on a Respondent irrespective of whether a violation of the Honor Code occurred. Any such requirements do not constitute a sanction.

(G) Sanctions

1. Sanctions that could be imposed include:

a. *No Sanction.* Given when the Respondent is not found in violation of the Honor Code.

b. *Warning.* A written reprimand that the Respondent has violated the Honor Code. A copy of the warning is to be placed in the Respondent's academic file. There is no prohibition on a student receiving more than one warning; however, that fact that a student has received one or more warnings may be taken into account if there are subsequent violations of the Honor Code. A warning is not an adverse action.

c. *Probation.* A written reprimand to the Respondent for one or more violations of the Honor Code that includes a designated period of time, the probability of more severe sanctions if the Respondent again violates the Honor Code during the probationary period, and terms or conditions for the Respondent during the probationary period. A probation is an adverse action.

d. *Suspension.* An involuntary separation of the Respondent from the School of Medicine for a specified period of time or until specific conditions have been met, with a statement as to whether the suspension should relate back to the date of the violation, begins at the time imposed, or begins at a date specified in the future. At the conclusion of the suspension, the Respondent is automatically returned to student status. Conditions for readmission may be specified. A suspension is an adverse action.

e. *Dismissal.* An involuntary separation from the School of Medicine for an indefinite period of time. The order of dismissal may specify a date before which the faculty will not consider a petition for readmission from the Respondent. A dismissal is an adverse action.

f. *Expulsion.* Permanent separation of the Respondent from the School of Medicine. An expulsion is an adverse action.

2. Any of the above sanctions that are "adverse" will be included on a Respondent's MSPE. Additionally, this information will be reported by the School of Medicine on any future license certifications and verifications for the Respondent, and/or in response to any official requests for information made from other entities. Respondent may also have an obligation to report sanctions on licensure or other applications.

3. In addition to imposing or not imposing a sanction, the **Hearing Panel**~~Honor Council~~ may require the Respondent to meet other requirements, such as education, mentoring, or counseling.

Section 5:

(A) The ~~Honor Council Hearing Panel~~ shall make a ~~non-official~~ record of the hearing which shall include the ~~recording of the hearing~~~~recorded official hearing record~~, the Notice of the Hearing, any Exhibits, and the final report and ~~decision of the hearing panel~~~~recommendation of the Honor Council~~ ("Record of the Hearing").

~~A.~~

~~B.~~(B) The Record of the ~~h~~Hearing shall be filed in the permanent records of the Honor Council with copies provided to the Respondent, upon request, and the Associate Dean for Student Programs.

Section 6:

(A) ~~A.~~—The Associate Dean for Student Programs must then forward the Record of the Hearing to the Dean of the School of Medicine or the Dean's designee, who shall make the final decision to affirm, amend, or reverse the recommendation of the ~~Hearing Panel~~~~Honor Council~~, or remand the matter back to the ~~Hearing Panel~~~~Honor Council~~ for further proceedings. In making the final decision, the Dean may consult with the Senior Associate Dean for Education, the Associate Dean for Student Programs, and the Office of the General Counsel. In making the final decision, the Dean may consider whether the procedural requirements of this Honor Code have been substantially complied with, and whether the recommended sanction is warranted by the facts.

Commented [FS1]: This section was added at the request of Dr. Barohn.

(B) ~~B.~~—Any change in the sanction, including no sanction, shall be communicated to the ~~Hearing Panel and to the~~ Honor Council in writing with an explanation of the basis for the change and the Dean or designee shall meet and discuss with the Honor Council the rationale for the change. This communication shall be maintained in the permanent records of the Honor Council but shall not become part of the Record of the Hearing.

(C) ~~C.~~—The Dean shall notify the Respondent by University email of the final decision. Copies of the notice to the Respondent shall be sent to the ~~Hearing Panel~~~~Chair of the Honor Council~~ and will be placed in the Respondent's file and become part of the Record of the Hearing.

Section 7:

~~Upon completion of any hearing, including any appeal if requested, where there has been found to be a violation of the Honor Code, the final decision will be reviewed by the Dean, or the Dean's designee, to determine if the circumstances of the violation warrant an advisory statement to all enrolled students.~~

(A) Upon completion of any hearing, including any appeal if requested, where there has been found to be a violation of the Honor Code, the final decision will be reviewed by the Dean, or the Dean's designee, to determine if the circumstances of the violation warrant an advisory statement to all enrolled students.

~~A.~~ If such an advisory statement is determined to be needed, the language of that advisory statement shall be drafted in a manner to ensure the confidentiality of student information as required under the Family Educational Rights and Privacy Act (FERPA) and the confidentiality of any patient information as required under the Health Insurance Portability and Accountability Act (HIPAA).

~~B.~~
~~B.(C)~~ Any advisory statement issued under this Section shall be submitted to the Honor Council for comment prior to distribution.

Article IV – Right of Appeal

Section 1:

The Respondent may appeal to the University, as set forth in Section 200.020 CRR, the final decision of the Dean if the sanction is for suspension, dismissal, or expulsion.

Section 2:

During the appeal proceedings, the Respondent may attend classes pending the final decision, if permission is granted as provided in Section 200.020 CRR.

Article V – Confidentiality of Honor Council Hearings

Section 1:

All proceedings of the Honor Council Hearing Panel are to be held in the strictest confidence by the persons involved.

Section 2:

The Record of the Hearing shall be maintained in the strictest security by the Chair of the Honor Council and shall be filed permanently in the Office of the Dean.

Article VI – Revisions to the Honor Code

Section 1:

Revisions to the Honor Code must be approved by the Office of the General Counsel followed by a simple majority of the students voting within a voting period of 30 days, followed by approval of a simple majority of the members attending the next Faculty Affairs Council meeting, and approved or rejected by the Dean of the SOM within 1 week after the Faculty Affairs Council meeting. Approved proposed revisions shall be presented to the Board of Curators at their next meeting.

Section 2:

All enrolled students are subject to the jurisdiction of the Honor Code upon and during enrollment to the School of Medicine. All accepted students upon request, and all accepted students at the time of notification of acceptance, shall be sent a copy of the Honor Code. In addition, the presentation of the Honor Code shall be an integral part of the orientation of new students to the School of Medicine.

University of Missouri School of Medicine

Honor Code

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PREAMBLE

Upon graduation from medical school to enter the profession of medicine, it is customary that the graduates pledge themselves to abide by a set of principles which will guide them in adhering to and upholding the ethics and high standards of the profession of medicine. The Hippocratic Oath is commonly administered in such commencement exercises. Paraphrased, it indicates that as physicians we:

- Will be loyal to the profession of medicine, just and generous to its members
- Will lead our lives and practice our art in uprightness and honor
- Will enter whatsoever house for the good of the sick to the utmost of our power
- Will hold ourselves far aloof from wrong, from corruption, from tempting of others to vice
- Will exercise our art solely for the care of patients and will give no drug, perform no operation for a criminal purpose even if solicited, far less suggest it

- Will keep inviolably secret whatsoever we shall see or hear of the lives of men which is not fitting to be spoken.

Alternatively, and with increasing frequency, graduating classes of medical students elect to adhere to the Declaration of Geneva.

By the act of matriculation at the University of Missouri-Columbia School of Medicine, we pledge ourselves to uphold the principles of these declarations which define the ethics and high standards of the profession of medicine to which we aspire.

In particular, recognizing our specific role as students aspiring to practice medicine, we additionally pledge ourselves to the tenets set forth in Article 1 of this Honor Code

Article 1 – Standards of Professional Conduct

A. Professional Integrity

1. Honesty

A student shall deal honestly with people including, but not limited to, colleagues, instructors, representatives of the University, patients, attending physicians, and other members of the health care team. Students are expected to demonstrate honesty and integrity in all aspects of their interactions with patients and staff— particularly in assuring accuracy and completeness of their documentation in medical records. The student shall be willing to admit errors and must not mislead others or promote the student at the patient's expense. Students shall strive to report those students who violate these Standards of Professional Conduct ("Standards").

Scientists and students who participate in research have a responsibility to provide research results of the highest quality; to gather facts meticulously; to keep impeccable records of work done; to interpret results realistically, not forcing them into preconceived molds or models; and to report new knowledge through appropriate channels. Co-authors of research reports must be sufficiently acquainted with the work of their co-workers so they can personally vouch for the integrity of the study and validity of the findings, and must have been active in the research itself.

In all cases of academic dishonesty, the instructor shall make an academic judgment about the student's grade on that work and in that course. The instructor shall also report the alleged academic dishonesty.

Examples of academic dishonesty include, but are not limited to, the following:

Cheating — 1) use of any unauthorized assistance including, but not limited to, notes, textbooks, unauthorized electronic devices or prohibited internet resources (including but not limited to Box, Google drive, Microsoft teams or other stated resources on the exam sheet), in taking quizzes, tests, or examinations; 2)

dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments; 3) acquisition or possession without permission of tests or other academic material belonging to a member of the University faculty, staff, or students; 4) in any way giving assistance to others who are participating in any of the three preceding types of behavior; 5) falsifying attendance records or other official documents; or 6) submitting the same paper, project, or document for a grade or credit in multiple courses.

Plagiarism — 1) use by paraphrase or direct quotation of the published or unpublished work of another person without fully and properly crediting the author with footnotes, citations or bibliographical reference; 2) unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials; or 3) unacknowledged use of original work/material that has been produced through collaboration with others without release in writing from collaborators. The detection may involve the use of commercially available software.

Sabotage — unauthorized interference with, modification of, or destruction of the work or intellectual property of another member of the University community.

Examples of dishonesty related to clinical practice include, but are not limited to, the following:

Falsification of Patient's Medical Record — writing progress notes regarding the patient's status that are false including, but not limited to, clinical observations or results in the patient's chart when the student has not seen or evaluated the patient, or using incorrect times of data entry.

Falsification of Patient's Medical Information — reporting medical information such as physical examination findings, lab values, test results, and any other relevant patient information to other students, residents, attending physicians, preceptor, the patient, the patient's family, or other relevant medical personnel that has been fabricated by the student.

2. Responsibility

Students must not be harmful, dangerous, or negligent to the mental or physical health of a patient or the public. Negligent means the failure to use that degree of skill and learning ordinarily used under the same or similar circumstances by other students.

Students must be familiar with and follow the rules and regulations of School of Medicine, the University, and the applicable health care professional organizations. Students shall be familiar with and comply with the policies and procedures of clinical sites where they are assigned.

While the University and School of Medicine are committed to the rights of students to free expression, they also have the responsibility to restrict certain conduct which violates the law or University policy, or otherwise directly interferes with the functioning of the University or School of Medicine and/or its clinical affiliates. Students are expected to be knowledgeable of and comply with the limits on free expression as set forth in the University “Commitment to Free Expression,” available at <https://freespeech.missouri.edu/commitment-to-free-expression/> .

Students shall be responsible in their use of personal and professional social media accounts. “Social media” includes any electronic communication or networking using an online service, platform, or site to share information, ideas, personal messages, images, photographs, or other content including, but not limited to, emails, Facebook, Twitter, LinkedIn, YouTube, Snapchat, Instagram, GROUPME, TikTok, Reddit, Tumblr, and blogs. Students shall use appropriate judgment and be respectful and professional in all social media communications. Information shall be truthful and not misleading or deceptive. Content on social media is considered to be published material and therefore must comply with Federal copyright laws.

B. *Professional Behavior*

1. Prohibition Against Discrimination, Harassment, and Sexual Misconduct

A student shall be dedicated to providing supervised, competent health care services with compassion, respect for human dignity, and without discrimination.

Students shall not harass, engage in sexual harassment, sexual discrimination, or sexual misconduct with any other individual, or discriminate on the basis of race, color, national origin, ancestry, religion, sex, pregnancy, sexual orientation, gender identity, gender expression, age, disability, protected veteran status, or any other status protected by applicable Missouri or Federal law, either in person or on social media. (*See* Section 600.010 CRR.)

2. Representation

A student shall accurately represent the student to others including, but not limited to, colleagues, instructors, representatives of the University, patients, attending physicians, and other members of the health care team.

Examples of misrepresentation include, but are not limited to, the following:

- a. A student shall never use the title of “Doctor” or M.D., as this clearly misrepresents the student’s position, knowledge, and authority.

- b. Use of fraud, deception, lies, or bribery in securing any certificate of registration or authority, diploma, permit or license issued, or in obtaining permission to take any examinations.
- c. Impersonation of any person holding a certificate of registration or authority, permit, license or allowing any person to use his/her certificate of registration or authority, permit, license, or diploma from any school.
- d. Forgery, alteration, or misuse of a patient's medical records or knowingly furnishing false information to the health care team and/or professional organizations.

Representations on social media shall accurately reflect that any opinions voiced are those of the student and the student is not speaking on behalf of the University, or School of Medicine and/or its clinical affiliates.

The student is expected to be thoughtful and professional when interacting with patients and their families, attending physicians, preceptors, supervising residents, and other students, and whenever their behavior may influence adversely the judgments of others about School of Medicine and/or its clinical affiliates, or the University. Students shall comply with the code of ethics for their applicable health care profession both on campus and at clinical affiliates, by conduct and speech, and when using social media.

Students shall maintain a neat and clean appearance, and dress in attire that is generally accepted as professional by the patient populations served and in compliance with any policies of clinical affiliates.

Students are required to learn about a patient's values, traditions, and beliefs as they relate to the care and treatment options available to the patient. The goal is to develop mutual trust between the patient and student, and to develop an effective student-patient relationship. If there is an irresolvable conflict between the ethical beliefs and values of a student and a patient, the student needs to avoid argument, judgment of the patient's personal integrity, or any action that would cause the patient to avoid seeking appropriate medical treatment and care. The student should seek to understand the patient's value system. A student avoids making assumptions based on stereotypes or preconceived ideas, and asks questions of patients about their beliefs, values, and lifestyle in a respectful, open, and empathetic manner. The student's role is to explain the options available to the patient thoroughly and objectively, giving appropriate time and emphasis to each option while remaining sensitive to the patient's value system. Should a patient wish to pursue an option of treatment or care that the student is not comfortable with, the student should discuss the situation with a supervisor.

3. Confidentiality and Privacy

A student shall respect the rights of patients, colleagues, and other health care professionals, and shall safeguard the confidentiality and privacy of patient communications and protected health information within the constraints of the law.

The patient's right to privacy in regard to his/her medical record, which includes privacy of personal and social history, is a fundamental tenet to health care.

The discussion in public of the problems of an identified patient, without the patient's permission, by students violates patient confidentiality and privacy laws and is unethical. Under no circumstances can any medical record be removed from an institution. Names and any other identifiers of patients shall be omitted from any documents used for these presentations unless disclosures are permitted by the HIPAA Laws.

Any protected health information of patients, or any patient identifiers, hospital room numbers, or photographs of patients or their hospital or clinic rooms shall not be posted on social media.

Students are prohibited from communicating with patients and/or their authorized representatives or family members on social media. Any conversations regarding specific patient health care conditions, treatments, or particular processes in a clinical setting can be mutually beneficial for the professional community; however, these must only occur without identifying patients and when using professional social media sites that maintain the privacy and security of communications with registered users.

4. Assessment of Personal Competence (Self-Evaluation)

Students shall seek consultation and supervision whenever their ability to play their role in the care for a patient is inadequate because of lack of knowledge or experience.

Students are expected to respond to constructive criticism by appropriate modification of behavior.

It is unacceptable for a student to attempt procedures or to prescribe therapies without supervision.

5. Awareness of Impairments

The student will not use alcohol or drugs or practice while under a physical or mental health condition if such impairs his/her ability to perform the work of the profession or results in compromised patient care. It is also the responsibility of every student to strive to protect the public from an impaired colleague and to assist that colleague whose capability is impaired because of alcohol or drug use, or a physical or mental health condition. Students shall self-report and/or seek assistance if they are aware of any potential self-impairment. Additionally, any student who displays signs of impairment should be reported by a peer or School of Medicine faculty or staff

member. Any retaliation against a student for good faith reporting of a peer suspected of impairment shall constitute a violation of professional conduct.

CONSTITUTION

To implement and administer this Honor Code, we establish the following Constitution under which we shall operate.

Article I - The Hearing Committee

Section 1:

The Hearing Committee shall be established to determine whether there is sufficient evidence that violations of the Honor Code may have occurred.

Section 2:

The Hearing Committee shall consist of two elected members of each class who are not affiliated with the Honor Council in any way and a faculty member appointed by the Dean serving as a non-voting, *ex officio* chair of the Committee.

Section 3:

Elections of members to serve on the Hearing Committee of the M-1 class shall be held on or in the week following the date of the first grade release of the academic year.. Members' terms begin on the day of election and continue to the Monday following spring commencement of that year. M-2, M-3 and M-4 classes shall elect Hearing Committee members prior to May 1 and terms shall run for one year, beginning the Monday following spring commencement of that year.

The Hearing Committee shall meet prior to the date of spring commencement to elect a Chair. The Chair is responsible for assigning a member of the Hearing Committee to take minutes during any proceedings. The Honor Code shall then be reviewed for meaning and clarity to assure that all Hearing Committee members understand all of its provisions. A Hearing Committee member will also orient the M-1 members to the responsibilities of the Hearing Committee as soon as they are elected.

Section 4:

An alleged violation of the Honor Code should be reported as soon as possible after observed or known by any student, or any faculty member of the School of Medicine, to any member of the Hearing Committee. The reporter will be asked to submit a written or emailed report to Hearing Committee member, stating the possible violation, describing the facts related to the possible violation, and naming all people involved and possible witnesses.

If the reporter/Respondent is a member of the Hearing Committee or Honor Council, the individual will abstain from participating as a member of that Committee/Council while the investigation is active. The individual will not converse with members of that Committee/Council in any capacity other than as the reporter/Respondent of an incident.

Section 5:

Upon receipt of the aforementioned report, a copy, with the reporter's name withheld, will be forwarded at once to the involved student ("Respondent") and then a formal investigation shall be called by the Hearing Committee member involved. A preliminary meeting will be scheduled within 48 hours, if possible, and held within a reasonable period of time.

The meeting shall consist of at least 5 Hearing Committee members. The reporter and the Respondent will meet individually with the Hearing Committee. The Hearing Committee may also interview witnesses. The Hearing Committee will review the available information and determine whether there is a possible violation of the Honor Code, or whether the report should be referred to another individual or office of the University, such as the Equity Office or Title IX Coordinator, or whether the investigation shall be closed. Student conduct involving discrimination and harassment, including sexual harassment shall be governed by Section 600.030: Resolution Process for Resolving Complaints of Sexual Harassment under Title IX, and Section 600.040: Equity Resolution Process for Resolving Complaints of Discrimination and Harassment against a Faculty Member or Student or Student Organization. If the investigation is closed, the identity of the reporter and the Respondent shall not be disclosed.

Section 6:

If the information supports a possible violation of the Honor Code, a second meeting of the Hearing Committee will be called. At least 5 Hearing Committee members must attend this meeting. At this meeting, the Respondent and reporter shall meet together with the Hearing Committee. Witnesses may also be invited to attend this meeting at the discretion of the Hearing Committee. The second meeting will serve to collect additional information to compile a more complete report. If the reporter refuses to meet with the Hearing Committee, the investigation will be closed unless there are other witnesses or sufficient information to continue the investigation.

Section 7:

The Hearing Committee shall vote whether there is sufficient information to support a possible violation of the Honor Code and to refer the investigation to the Honor Council. In determining whether the investigation shall be referred to the Honor Council, a majority of the Hearing Committee members present must agree. The report of the investigation must be submitted to the Honor Council and the Associate Dean of Student Programs within 72 hours after the Hearing Committee decision.

Section 8:

If a majority of Hearing Committee members do not agree that there is a possible violation of the Honor Code, then the Associate Dean for Student Programs is sent a report. If the Associate Dean for Student Programs believes that there may be a reason to pursue an investigation further, then the Associate Dean shall meet with the Hearing Committee to discuss the matter. Only the Hearing Committee or another University office or individual may pursue an investigation. If the investigation is closed, no information relating to the investigation shall become part of the Respondent's general personal and academic file. Such information shall only be maintained by the Hearing Committee and Honor Council and shall only be disclosed at the direction of the Hearing Committee or Honor Council, with subsequent notification to the Respondent. All information relating to the investigation shall be destroyed once Respondent permanently leaves the SOM or graduates.

Section 9:

All reports made to the Hearing Committee and proceedings of the Hearing Committee are to be held in the strictest confidence. Minutes shall be maintained of all proceedings.

Article II – Organization of the Honor Council

Section 1:

The purpose of the Honor Council is to investigate the alleged violations of the Honor Code, to determine if violations occurred, and what, if any, sanctions, should be imposed.

Section 2:

The Honor Council shall consist of all class presidents, one elected member from each of the M-1 and M-2 classes, two members will be elected from each of the M-3 and M-4 classes.

Section 3

Election for the member of the Honor Council from the M-1 class shall be held on or in the week following, the first grade release. Member terms begin on the day of election and continue to the Monday following spring commencement of that year. M-2, M-3 and M-4 classes shall elect members prior to May 1 and terms shall run for one year, beginning the Monday following spring commencement of that year.

Section 4:

(A) The Honor Council shall meet prior to the day of spring commencement to elect a Chair. The Chair will be responsible for assigning a member of the Honor Council to maintain minutes from all proceedings. The Honor Code shall then be reviewed for meaning and clarity to assure that all Honor Council members understand all its provisions. The Chair or a delegate shall be involved

in the planning of and participate in the orientation of the M-1 class as it pertains to the Honor Code.

(B) When deemed appropriate, a Hearing Panel of nine (9) members will be appointed, with four (4) members being students from the Honor Council appointed by the Chair and five (5) members being faculty members appointed by the Dean, to hear any alleged violation of the Honor Code. The Chair will preside over the Hearing Panel as a non-voting member. The Hearing Panel shall have the authority of the whole Honor Council of any matter to which they are assigned.

Article III – Procedure for Honor Council Hearing Panels

Section 1:

(A) Within one week of receiving the report of the formal investigation from the Hearing Committee, the Chair shall schedule a hearing with the Hearing Panel.

(B) At least twenty (20) business days prior to the hearing with the Hearing Panel, the Respondent shall receive notice of the following information:

- (1) A detailed description of the alleged conduct at issue and applicable policies, rules, or regulations alleged to be violated;
- (2) A description of the applicable procedures, including right to have an adviser, who may be, but is not required to be, an attorney;
- (3) A statement of the potential sanctions/remedial actions that could result;
- (4) A statement notifying the Respondent that they will be permitted to inspect, copy, and review any evidence obtained as part of the investigation that is directly related to the allegations to be addressed at the hearing, including the evidence upon which the University does not intend to rely in reaching a determination regarding responsibility and including inculpatory or exculpatory evidence;
- (5) A statement notifying the Parties that they must be truthful when making any statement or providing any information or evidence to the University throughout the student conduct process, and all documentary evidence must be genuine and accurate;
- (6) A statement that nothing in these procedures is intended to supersede nor expand alter any rights the individual may have under applicable state or federal statutory laws or the U.S. Constitution;
- (7) The names of the members of the Hearing Panel who will hear the case, and information on how to raise an objection to any member or chair and the timeline in which to raise any objections; and

(8) The time, date, and location of the hearing. If the Respondent does not appear at the hearing, the hearing will be held in their absence.

(9) Notice that the parties may request a virtual hearing and/or any necessary accommodations.

(C) This Notice of Hearing letter will be made in writing and will be delivered either: 1) in person, 2) by email only to the Party's University-issued email account if the Party has consented electronically or in writing to receipt of all notifications by email; or 3) mailed to the mailing address of the respective Party as indicated in the official University records and emailed to the Party's University-issued email account. If there is no local address on file, mail will be sent to the Party's permanent address. Notice also shall be mailed and emailed to the Party's adviser, if an adviser has been identified by the Party. Notice is presumptively deemed delivered, when: 1) provided in person or 2) emailed to the individual Party (when prior consent — whether electronically or in writing — has been given to receipt of all notifications by email or 3) when mailed and emailed to the Party and the Party's adviser, if an adviser has been identified by the Party.

(D) Any request to reschedule the hearing shall be made in writing to the Chair, who shall have the authority to reschedule the hearing if the request is timely and made for good cause. The Chair shall notify the Associate Dean of Student Programs and the Respondent of the new date for the hearing. If the accused student fails to appear at the scheduled time, the Committee may hear and determine the matter. The Respondent shall be provided with the Respondent's rights as set forth in Section 2 below.

(E) Should any Respondent object to any member of the Hearing Panel, they must raise all objections, in writing, to the Associate Dean of Student Programs no later than 5 business days prior to the hearing unless, for good cause, the Associate Dean of Student Programs allows objections to be raised later. Such objection shall be confidential and shall not be disclosed to the Honor Panel. A member may be unseated by the Associate Dean of Student Programs for good cause. Good cause may include, but is not limited to, bias that would preclude an impartial hearing or circumstances in which the member's or chair's involvement could impact the accused student's work or learning environment due to current or potential interactions with the member or chair (e.g., a panel member serving as an instructor or advisor to the Respondent). If it is determined that a member or chair should be replaced, the Associate Dean of Student Programs will select a replacement member. The Associate Dean of Student Programs will provide a written response to all parties addressing any objections to a member.

(F) The Respondent is presumed not responsible for any alleged violation of the Honor Code until a determination regarding responsibility is made at the conclusion of this process.

Section 2:

(A) The Respondent charged shall have the right:

- (1) To be present at the hearing.
 - (2) To remain silent during the hearing, with such silence not considered as evidence supporting a finding of a violation.
 - (3) To have an advisor or an attorney of the Respondent's choice appear at the hearing with the Respondent and to consult with such advisor/attorney during the hearing.
 - (4) To hear or examine evidence presented to the Hearing Panel either directly or through their advisor or attorney.
 - (5) To question witnesses present and testifying at the hearing either directly or through their advisor or attorney.
 - (6) To testify at the hearing and present evidence by witness, written report, other memoranda, photographs, affidavit, or any other relevant evidence the Respondent requests. It is the responsibility of the Respondent to assure that any such evidence be made available at the time of the hearing. No evidence may be submitted for consideration after the conclusion of the hearing.
 - (7) To make any statement to the Hearing Panel in mitigation or explanation of the Respondent's conduct.
 - (8) To be informed in writing of the findings and decisions of the Hearing Panel and any sanctions it imposes.
 - (9) To appeal to the appropriate appellate body, as herein provided.
- (B) At least ten (10) business days prior to the hearing, the Associate Dean of Student Programs will provide the Respondent:
- (1) An investigative report that fairly summarizes the relevant evidence in an electronic format or hard copy for their review.
 - (2) A list of the names of the proposed witnesses to be called by the Associate Dean of Student Programs.
 - (3) Copies of all proposed documentary, photographic, video, or audio evidence.
 - (4) Notification that all the evidence gathered in the course of the investigation that is directly related to the allegations to be addressed at the hearing is available to the Respondent and instructions regarding how to request access to that information, which shall include evidence upon which the University does not intend to rely in reaching a determination regarding responsibility and including inculpatory or exculpatory evidence.

(5) If any evidence that otherwise would have been subject to inclusion in the notice is received after the notice is issued, such evidence will be provided to the accused student or student organization as soon as practicable before the hearing date.

Section 3:

The hearing shall be recorded, either by audio, video, digitally, or stenographically as determined by the Chair of the Hearing Panel and shall serve as the official hearing record.

Section 4:

(A) The Chair of the Honor Panel shall call the hearing to order, call the roll of the Honor Panel members in attendance, ascertain the presence or absence of the Respondent, read the Notice of the Hearing, establish the presence of any advisor/attorney present, and set forth the procedures for the hearing. All requests to address the Hearing Panel shall be addressed to the Chair, and the Chair will rule on all requests and points of order. The Chair may consult with the legal advisor for the Honor Panel at any time. Rules of common courtesy and decency shall be observed at all times. Witnesses may only be questioned by the Hearing Panel members and the Respondent.

(B) The Chair or another Hearing Panel member shall make opening remarks outlining the general nature of the alleged violation and any facts that the investigation has revealed. The Respondent may make an opening statement about the alleged violation at this time or after the conclusion of the presentation on behalf of the School of Medicine. The Chair shall call witnesses, including the Respondent, who will first be questioned by members of the Hearing Panel and then by Respondent. Witnesses may present written reports or other evidence.

(C) The Respondent may then present evidence through witnesses and written reports or other documents or evidence. The Hearing Panel members may question a witness after the witness is questioned by the Respondent.

(D) Following the hearing, the Hearing Panel shall promptly deliberate in closed session out of the presence of the Respondent. Determinations are to be made regarding the validity of the alleged violation(s) and, if any violations are substantiated, the sanction(s) to be imposed. Two-thirds of the Hearing Panel members present at the hearing must concur to determine responsibility (or lack thereof) for any violations of the Honor Code and to impose any sanction.

(E) The decision of the Hearing Panel shall be based on a preponderance of evidence (i.e., a violation is more likely than not).

(F) The Hearing Panel shall determine sanctions to be imposed for any substantiated violations of the Honor Code. Where there are multiple violations of the Honor Code, there can be separate sanctions imposed of each violation or one sanction for all violations. Requirements

for education and/or training, or referral to a School of Medicine Committee or other resource may be imposed on a Respondent irrespective of whether a violation of the Honor Code occurred. Any such requirements do not constitute a sanction.

(G) Sanctions

1. Sanctions that could be imposed include:

a. *No Sanction.* Given when the Respondent is not found in violation of the Honor Code.

b. *Warning.* A written reprimand that the Respondent has violated the Honor Code. A copy of the warning is to be placed in the Respondent's academic file. There is no prohibition on a student receiving more than one warning; however, that fact that a student has received one or more warnings may be taken into account if there are subsequent violations of the Honor Code. A warning is not an adverse action.

c. *Probation.* A written reprimand to the Respondent for one or more violations of the Honor Code that includes a designated period of time, the probability of more severe sanctions if the Respondent again violates the Honor Code during the probationary period, and terms or conditions for the Respondent during the probationary period. A probation is an adverse action.

d. *Suspension.* An involuntary separation of the Respondent from the School of Medicine for a specified period of time or until specific conditions have been met, with a statement as to whether the suspension should relate back to the date of the violation, begins at the time imposed, or begins at a date specified in the future. At the conclusion of the suspension, the Respondent is automatically returned to student status. Conditions for readmission may be specified. A suspension is an adverse action.

e. *Dismissal.* An involuntary separation from the School of Medicine for an indefinite period of time. The order of dismissal may specify a date before which the faculty will not consider a petition for readmission from the Respondent. A dismissal is an adverse action.

f. *Expulsion.* Permanent separation of the Respondent from the School of Medicine. An expulsion is an adverse action.

2. Any of the above sanctions that are "adverse" will be included on a Respondent's MSPE. Additionally, this information will be reported by the School of Medicine on any future license certifications and verifications for the Respondent, and/or in response to any official requests for information made from other entities. Respondent may also have an obligation to report sanctions on licensure or other applications.

3. In addition to imposing or not imposing a sanction, the Hearing Panel may require the Respondent to meet other requirements, such as education, mentoring, or counseling.

Section 5:

- (A) The Hearing Panel shall make a record of the hearing which shall include the recording of the hearing, the Notice of the Hearing, any Exhibits, and the final report and decision of the hearing panel (“Record of the Hearing”).
- (B) The Record of the hearing shall be filed in the permanent records of the Honor Council with copies provided to the Respondent, upon request, and the Associate Dean for Student Programs.

Section 6:

- (A) The Associate Dean for Student Programs must then forward the Record of the Hearing to the Dean of the School of Medicine or the Dean’s designee, who shall make the final decision to affirm, amend, or reverse the recommendation of the Hearing Panel, or remand the matter back to the Hearing Panel for further proceedings. In making the final decision, the Dean may consult with the Senior Associate Dean for Education, the Associate Dean for Student Programs, and the Office of the General Counsel. In making the final decision, the Dean may consider whether the procedural requirements of this Honor Code have been substantially complied with, and whether the recommended sanction is warranted by the facts.
- (B) Any change in the sanction, including no sanction, shall be communicated to the Hearing Panel and to the Honor Council in writing with an explanation of the basis for the change and the Dean or designee shall meet and discuss with the Honor Council the rationale for the change. This communication shall be maintained in the permanent records of the Honor Council but shall not become part of the Record of the Hearing.
- (C) The Dean shall notify the Respondent by University email of the final decision. Copies of the notice to the Respondent shall be sent to the Hearing Panel and will be placed in the Respondent’s file and become part of the Record of the Hearing.

Section 7:

- (A) Upon completion of any hearing, including any appeal if requested, where there has been found to be a violation of the Honor Code, the final decision will be reviewed by the Dean, or the Dean’s designee, to determine if the circumstances of the violation warrant an advisory statement to all enrolled students.
- (B) If such an advisory statement is determined to be needed, the language of that advisory statement shall be drafted in a manner to ensure the confidentiality of student information as required under the Family Educational Rights and Privacy Act (FERPA) and the confidentiality of any patient information as required under the Health Insurance Portability and Accountability Act (HIPAA).
- (C) Any advisory statement issued under this Section shall be submitted to the Honor Council for comment prior to distribution.

Article IV – Right of Appeal

Section 1:

The Respondent may appeal to the University, as set forth in Section 200.020 CRR, the final decision of the Dean if the sanction is for suspension, dismissal, or expulsion.

Section 2:

During the appeal proceedings, the Respondent may attend classes pending the final decision, if permission is granted as provided in Section 200.020 CRR.

Article V – Confidentiality of Honor Council Hearings

Section 1:

All proceedings of the Honor Council Hearing Panel are to be held in the strictest confidence by the persons involved.

Section 2:

The Record of the Hearing shall be maintained in the strictest security by the Chair of the Honor Council and shall be filed permanently in the Office of the Dean.

Article VI – Revisions to the Honor Code

Section 1:

Revisions to the Honor Code must be approved by the Office of the General Counsel followed by a simple majority of the students voting within a voting period of 30 days, followed by approval of a simple majority of the members attending the next Faculty Affairs Council meeting, and approved or rejected by the Dean of the SOM within 1 week after the Faculty Affairs Council meeting. Approved proposed revisions shall be presented to the Board of Curators at their next meeting.

Section 2:

All enrolled students are subject to the jurisdiction of the Honor Code upon and during enrollment to the School of Medicine. All accepted students upon request, and all accepted students at the time of notification of acceptance, shall be sent a copy of the Honor Code. In addition, the presentation of the Honor Code shall be an integral part of the orientation of new students to the School of Medicine.

No. 7

Recommended Action – Resolution for Executive Session of the Board of Curators Academic, Student Affairs, Research and Economic Development Committee Meeting, November 16, 2023

It was moved by Curator _____ and seconded by Curator _____, that there shall be an executive session with a closed record and closed vote of the Board of Curators Academic, Student Affairs, Research and Economic Development Committee Meeting, November 16, 2023 for consideration of:

- **Section 610.021(1), RSMo**, relating to matters identified in that provision, which include legal actions, causes of action or litigation, and confidential or privileged communications with counsel; and
- **Section 610.021(3), RSMo**, relating to matters identified in that provision, which include hiring, firing, disciplining, or promoting of particular employees; and
- **Section 610.021 (13), RSMo**, relating to matters identified in that provision, which include individually identifiable personnel records, performance ratings, or records pertaining to employees or applicants for employment.

Roll call vote of the Committee: YES NO

Curator Blitz

Curator Graves

Curator Layman

Curator Sinuefield

The motion _____.