In Workflow

1. **SSBE Chair**
2. **Provost Program Proposal Review Committee Chair**
3. **SSBE Chair**
4. **Patricia Soucy**
5. **SSBE Chair**
6. **SS Associate Dean**
7. **SS Curriculum Committee Chair**
8. **Faculty Senate Academic Programs Committee Chair**
9. Faculty Senate Chair
10. AAP Program Approval Coordinator
11. OAPA Program Implementation

Approval Path

1. Thu, 11 Jan 2024 20:57:04 GMT
   Ayman El-Baz (aselba01): Approved for SSBE Chair
2. Fri, 12 Jan 2024 19:36:00 GMT
   Leslie Harper (lafren01): Approved for Provost Program Proposal Review Committee Chair
3. Fri, 12 Jan 2024 19:37:20 GMT
   Ayman El-Baz (aselba01): Approved for SSBE Chair
4. Thu, 25 Jan 2024 16:55:42 GMT
   Leslie Harper (lafren01): Rollback to Initiator
5. Mon, 29 Jan 2024 15:22:16 GMT
   Krista Young (k0youn08): Approved for SSBE Chair
6. Mon, 29 Jan 2024 15:24:02 GMT
   Krista Young (k0youn08): Approved for Provost Program Proposal Review Committee Chair
7. Mon, 29 Jan 2024 15:27:16 GMT
   Krista Young (k0youn08): Approved for SSBE Chair
8. Sun, 03 Mar 2024 20:29:06 GMT
   Patricia Soucy (psarau01): Approved for psarau01
9. Sun, 03 Mar 2024 21:02:36 GMT
   Ayman El-Baz (aselba01): Approved for SSBE Chair
10. Tue, 12 Mar 2024 20:16:11 GMT
    Erin Gerber (eljack04): Approved for SS Associate Dean
11. Wed, 10 Apr 2024 14:57:51 GMT
    Katherine Markuson (klmark01): Approved for SS Curriculum Committee Chair
12. Mon, 15 Apr 2024 18:48:30 GMT
    Derek Hottell (dlhott01): Rollback to Provost Program Proposal Review Committee Chair for Faculty Senate Academic Programs Committee Chair

13. Mon, 15 Apr 2024 19:59:13 GMT
    Derek Hottell (dlhott01): Approved for Provost Program Proposal Review Committee Chair
14. Wed, 22 May 2024 16:02:58 GMT
    Ayman El-Baz (aselba01): Approved for SSBE Chair
15. Wed, 22 May 2024 16:04:06 GMT
    Patricia Soucy (psarau01): Approved for psarau01
16. Wed, 22 May 2024 16:05:35 GMT
    Ayman El-Baz (aselba01): Approved for SSBE Chair
17. Thu, 23 May 2024 12:47:21 GMT
    Erin Gerber (eljack04): Approved for SS Associate Dean
18. Thu, 23 May 2024 19:16:24 GMT
    Katherine Markuson (klmark01): Approved for SS Curriculum Committee Chair
19. Wed, 24 Jul 2024 18:21:32 GMT
    Derek Hottell (dlhott01): Rollback to psarau01 for Faculty Senate Academic Programs Committee Chair
20. Fri, 26 Jul 2024 02:01:12 GMT
    Patricia Soucy (psarau01): Approved for psarau01
21. Fri, 26 Jul 2024 16:19:40 GMT
    Ayman El-Baz (aselba01): Approved for SSBE Chair
22. Fri, 26 Jul 2024 18:31:14 GMT
    Erin Gerber (eljack04): Approved for SS Associate Dean
23. Fri, 26 Jul 2024 18:47:04 GMT
    Katherine Markuson (klmark01): Approved for SS Curriculum Committee Chair

New Program Proposal

Date Submitted: Mon, 29 Jan 2024 15:06:32 GMT

Viewing: 400 : Translational Bioengineering (PhD)

Last edit: Fri, 26 Jul 2024 02:00:22 GMT

Changes proposed by: Krista Young (k0youn08)

Letter of Intent (LOI)

The Letter of Intent (LOI) is the initial stage of new program development for all proposed programs (undergraduate, graduate, doctoral, professional, certificates).

Contact Information

Contact Name	Title	Email	Work Phone
Patricia Soucy	Associate Professor	tricia.soucy@louisville.edu	852-8321

Program Title
Translational Bioengineering (PhD)

Affiliated Departments

Department(s)
Bioengineering

Affiliated Colleges

College(s)
Speed School of Engineering

Is an approval letter from the Education Professional Standards Board (EPSB) required for this program?

No

Attach a copy to this proposal.

Proposed Start Date
Spring 2025

Effective Catalog Edition
2024-2025

Program Level
Graduate

Degree or Certificate Type
Doctor of Philosophy (PHD)

Current Method of Delivery (Check all that apply).

In-Person

Program Credential (If appropriate)

Is there a specialized accrediting agency related to this program?

No

Does this program have a clinical component?

No

Program Abstract/Overview

The Translational Bioengineering PhD program is designed to provide multidisciplinary training in translational bioengineering preparing students to lead research and development in academia, industry and governmental agencies and/or to advance bioengineering technologies through start-up companies as entrepreneurs or within established biomedical companies. The intended audience includes applicants interested in a PhD degree in Bioengineering that have a minimum of a Bachelor's Degree in Engineering from an accredited program, or similar field such as Medical Physics.

In this program, students will have the opportunity to customize their graduate-level training by selecting one of four concentration areas and one of three tracks (12 possible options in total). The concentration areas offered include:

- Bioelectronics and Biomedical Devices
- Bioimaging and Biocomputational Modeling
- Biomechanics and Rehabilitation
- Molecular and Tissue Engineering

The three tracks offered are:

- Traditional Bioengineering Research
- Clinical Translational Research
- Entrepreneurship of Bioengineering Technologies

Students who successfully complete the program will demonstrate excellence in designing and conducting research leading to an intellectual contribution to the field; demonstrate in-depth knowledge of their concentration area and associated scientific literature; have an understanding of the clinical relevance and ethical implications of their research; have the ability to critically analyze, evaluate and interpret research methods and findings; and have the ability to effectively communicate knowledge of their concentration area.

Program Quality and Student Success

The curriculum should be structured to meet the stated objectives and student learning outcomes of the program.

Will any of these outcomes differ by track?

No the outcomes will not differ by track in the program

Explain how the curriculum achieves the program-level student learning outcomes by describing the relationship between the overall curriculum or the major curricular components and the program objectives.

The core classes will provide an introduction, practice, or assessment of the student learning outcomes (see curriculum map attachment). Additionally, the elective courses will support these outcomes but the courses will vary based on each student. In addition to coursework development of these student learning outcomes, students will continue to practice and be assessed on these student learning outcomes at their preliminary exam, dissertation proposal, and annual Bioengineering Seminar Series presentations. The program curriculum will prepare students to demonstrate mastery of the student learning outcomes at their dissertation defense.

Mastery of the student learning outcomes will translate to successful achievement of the program goals, which prepare each student for future success in the Bioengineering field as leaders of research and development in academia, industry, and governmental agencies. The bioengineering field is described as the use traditional engineering skills and tools to analyze and solve problems in biology and medicine. Bioengineers collaborate with an interdisciplinary team to design, develop, or manufacture biomedical products or new procedures to solve clinical problems. Bioengineers may also objectively evaluate the efficacy of therapeutic interventions intended to advance healthcare and/or improve quality of life.

Program-Level Learning Outcomes

Program-level Student Learning Outcome	Program Goal/Objective	Outcome addressed in courses or curricular components
Students will be able to critically evaluate the literature in the field of Bioengineering and be able to synthesize that information in a manner that represents a multidisciplinary perspective toward research.	Upon graduation, students will have a comprehensive, authoritative knowledge base in Translational Bioengineering.	Students must pass a dissertation proposal demonstrating comprehensive knowledge of the multidisciplinary nature of research within Bioengineering.
Students will demonstrate the impact of their independent research in Translational Bioengineering through the formulation of research questions, testable hypotheses, and oral and written communication.	Students will be able to independently carry out research and/or creative activities that contribute to the advancement of the field of Bioengineering.	Students in candidacy will successfully write a dissertation and pass an oral dissertation defense.
Students will author scholarly work for dissemination at professional conferences and in publication in a peer-reviewed journal.	Students will acquire the skills to disseminate independent research in both oral and written forms in professional venues.	Students in candidacy will successfully write a dissertation and pass an oral dissertation defense. As a component of the dissertation,

Program-level Student Learning Outcome	Program Goal/Objective	Outcome addressed in courses or curricular components
		the student is expected to have submitted 3 journal articles and presented their research at professional conferences.

Attach Curriculum Map
BE Phd- CM Map 7-25-24.docx

Describe administrative oversight to ensure the quality of the program.

The administrative oversight of the program will be the responsibility of the program coordinator and director. The program director will hold a meeting with all students each Spring and Fall semester. Additionally, for students to register for courses they will update a flight plan document and get it approved by their dissertation mentor and the program director. The program director will also request, collect, and review annual evaluations for each PhD student from their dissertation mentor to help ensure all students are appropriately progressing to degree completion.

For a program offered in a compressed timeframe (e.g., with 8-week courses), describe the methodology for determining that levels of knowledge and competencies comparable to those required in traditional formats have been achieved. (You must provide an entry.)

N/A

Admission Requirements

Applicants must meet Graduate School admission requirements along with additional program requirements. Applicants must, as a minimum, have completed a Bachelor's Degree in Engineering from an accredited program or a similar field such as Medical Physics with a 3.25 cumulative GPA to be considered for admission. Applicants with an undergraduate GPA of 3.0 will be considered for provisional acceptance; however, they must maintain a 3.25 GPA at a minimum in their first year of study or they will not be allowed to continue in the program. The ideal applicant will have completed or in the process of completing either a Master's (MS or MEng) Degree in Engineering at the time of application. Applicants must submit: 1) a graduate application; 2) an official transcripts of all college-level courses; 3) three letters of recommendation; 4) a written statement by the applicant describing previous experience related to bioengineering and how the PhD in Translational Bioengineering will allow them to fulfill their career goals as identified by their focus area of interest; 5) Resume/ CV; 6) Students whose native language is non-English or degree is from a non-US accredited institution are required to submit TOEFL scores (administered by the Educational Testing Service). A minimum TOEFL score of 79 or higher on the internet-based test is required. Alternatively, a minimum of 6.5 on the International English Language

Testing System will be accepted or Duolingo score of 105; and 7) Optional Graduate Record Exam (GRE)

Graduation Requirements

To earn the Doctor of Philosophy in Translational Bioengineering, students are required to successfully complete the following: 1) 47 credit hours of course work beyond their bachelor's degree (18 Core credit hours, nine (9) Specialty area credit hours, and 20 Guided elective credit hours); 2) Participate in the Bioengineering Seminar Series (75 percent attendance rate and one presentation/year as a Doctoral Candidate); 3) Pass the Preliminary Examination; 4) Pass the Dissertation Proposal; 5) Successfully defend a dissertation; 6) Submit three or more peer-reviewed journal papers representing their original dissertation research

Curriculum

Course Template Form
Form-KPPPS Course Template_Translational BE 5-20-24-final.xlsx

List of new courses to be developed

Potential for collaboration with other units at UofL and/or articulation with other institutions

There is a strong bioengineering community at the University of Louisville; this community is built upon established collaborations between Bioengineering Department faculty and faculty in the Schools of Medicine, Dentistry, Business, and Public Health, along with faculty in other departments within the Speed School of Engineering. These programs currently support our current PhD students in Interdisciplinary Studies with Specialization in Translational Bioengineering (ISSTBE) by allowing our students to enroll in classes offered in their school (when course pre-requisites are met) and their faculty to participate on dissertation committees for our students. Deans from these collaborating units at UofL have also provided letters of support for this proposed program (attached).

Linkage with the Mission and Strategic Plan

Describe how the proposed program supports the university and unit mission/strategic plans.

Establishing a PhD in Translational Bioengineering will address a number of goals of the University 2023-2025 Strategic Plan (https://louisville.edu/strategic-plan). Specifically, as related to the relevant goals stated in this initiative , the PhD in Translational Bioengineering will address:
Learn Strategic Goal: The University of Louisville is a great place to learn because it prepares students for success now and into the future. We accomplish this by supporting the whole

student through transformative purpose-driven and engaged learning.
Strategy L1: Attract, retain, and graduate a talented, diverse student body through meaningful and structured commitment to student success.
Strategy L2: Prepare critical thinking, global citizens capable of lifelong, self-directed learning to lead, serve and shape the future.

Discover Strategic Goal: The University of Louisville is a great place to discover new knowledge that improves lives. We accomplish this through impactful research, innovation, scholarship, and creative activity.
Strategy L1: Increase efforts and support in innovation, research, scholarship, and creative activities.
Strategy D2: Develop strong translational research, innovation, and entrepreneurship programs to maximize societal impact of university research.

In addition to these university-wide goals, this Translational Bioengineering PhD program will also specifically address several goals outlined in the JB Speed School of Engineering 2023- 2026 Strategic Plan (https://engineering.louisville.edu/about/strategic-plan/):
Discover Strategy D3: Grow the number of graduate students in Speed School.
Discover Strategy D4: Increase Speed School's USNWR Graduate Program ranking by: growing the research and graduate program metrics.

Diversity, Equity, and Inclusivity

The program will promote accessibility and equity for strategic populations through outreach of the departments' faculty and staff to engage potential rising undergraduates and graduate students to make them aware of the opportunities available for advanced degrees in Bioengineering. This includes annual outreach sessions at local high schools in underserved communities, departmental representation in the Brown Forman Engineering Academy, and participation in Diversity Week at the University. We also plan outreach to present the program to Identity-based student organization chapters such as the American Society of Engineers of Indian Origin (ASEI), National Society of Black Engineers (NSBE), Society of Hispanic Professional Engineers (SHPE), Society of Women Engineers (SWE), and Speed Spectrum chapters at UofL. Additionally, all faculty and staff involved in the program are expected to attend University trainings such as Green Dot, Implicit Bias, and Microaggressions training.

Market Demand

Program Need

The proposed PhD in Translational Bioengineering represents an endeavor at the University of Louisville (U of L) to move the current ISSTBE PhD program offered through the Graduate

School to Speed School of Engineering. The Translational Bioengineering PhD program will replace the ISSTBE program.

A bioengineer uses traditional engineering skills and tools to analyze and solve problems in biology and medicine. Bioengineers collaborate with physicians, biologists, biochemists, chemists, clinicians, dentists, physiologists, therapists, and virologists to design, develop and manufacture instruments, devices, materials, prophylactics, software, and therapeutics, or to develop new procedures to solve clinical problems. Bioengineers also are trained to objectively evaluate the efficacy of therapeutic interventions intended to advance healthcare and/or improve quality of life. The aging of the population and focus on health issues will increase the demand for improved medical devices, equipment and therapeutics designed by bioengineers working on interdisciplinary teams. In 2012, the President's Council of Advisors on Science and Technology – an advisory group of the nation's leading scientists and engineers – set forth a goal, based on economic forecasts, to produce one million additional graduates with degrees in science, technology, engineering and mathematics. Employment opportunities for bioengineers are predicted to grow at a faster than average pace through 2032 as reported by the Bureau of Labor Statistics with a 10-year national job growth projections of 5%[1], 12.6% state of Kentucky job growth projection[2], and 6.2% Louisville job growth projection[3] . Combined with a growing job market and attractive compensation (2023 median pay: $100,730)[1], bioengineers have the gratification that comes from working to meet the needs of society and improve quality of life.

With regards to societal impact, premature death rate is a surrogate indicator for overall health status, with high rates suggestive of decreased work productivity and economic development. Unfortunately, the premature death rate in Kentucky exceeds the national average.[4] Closer evaluation reveals that Kentucky has a higher incidence of cancer, heart disease, Alzheimer's Disease, asthma, kidney disease, and other diseases than most states.[2] Another major health challenge facing Kentuckians is obesity[2], which leads to an increased incidence of cardiovascular disease, diabetes, stroke and other health disorders. Currently U of L bioengineering faculty, students and trainees are collaborating with their clinical counterparts to address many of these daunting health-related problems challenging Kentuckians. Advancing the health status and providing safe environments for Kentuckians is key to improving the productivity and economic viability of our Commonwealth.

[1] https://www.bls.gov/ooh/architecture-and-engineering/biomedical-engineers.htm

[2] https://www.bls.gov/oes/current/oes_ky.htm

[3] https://www.bls.gov/oes/current/oes_31140.htm

[4] State Health Assessment, KY Dept. for Public Health, 2023

Academic Demand

Skills/Programs/Employment

Will this program replace or enhance any existing programs(s) or tracks, concentrations, or specializations within an existing program? If yes, please specify.

Yes

Specify
This program will replace Graduate School's Interdisciplinary Studies with Specialization in Translational Bioengineering program.

Attach Similar Programs Table
Template_Program-Duplication-Table.docx

Student Demand

Specify evidence of student demand and projected enrollments for the first five years of the program.

Full-Time

Year 1
9
Year 2
13
Year 3
16
Year 4
19
Year 5
21

Part-Time

Year 1
0
Year 2
0
Year 3
0
Year 4
0

Year 5
0

Projected Tuition Revenue ($$)

Year 1
20,333
Year 2
97,721
Year 3
114,934
Year 4
132,960
Year 5
151,799

Provide a description of how the tuition projections were calculated.

For the Translational Bioengineering PhD program, we assumed each student will be in full time coursework for 2 years (24 hrs total in a year) and 3 years of doctoral candidacy for the student's dissertation research. For year 1, tuition revenue was calculated using the FY 24 rate units receive per credit hour ($564.73/ hr) with a 3% increase for each following year. The candidacy tuition was not incorporated in the calculation as it is not part of tuition revenue. We anticipate 4 new students in year 2, 4 new students in year 3, 5 new students in year 4, 5 new students in year 5. These numbers are based on data from current ISSTBE program enrollment with last year enrolling 4 new students in the ISSTBE program with anticipated continued growth in the future. Additionally, the program projected enrollment assumes that 75% of the students in the current ISSTBE program will transfer to the Translational Bioengineering Program. This represents 9 students in year 1 with 4 of them taking full time courses in Spring of year 1 (9 hrs total), 9 students in year 2 with 3 of them taking full time courses (24 hrs total), and none of the transfer students taking courses in years 3-5 (they will be in doctoral candidacy).

Employer Demand

Attach Employer Demand Table
Template_Employer-Demand-Table_4-29-24 final.docx

Funding Sources

Additional Faculty

None are requested because the proposed PhD in Translational Bioengineering represents an endeavor at the University of Louisville (U of L) to move the current Interdisciplinary

Studies with Specialization in Translational Bioengineering (ISSTBE) PhD program offered through the Graduate School to Speed School of Engineering.

Faculty Workload

Initially no change in the current faculty workload is anticipated because the courses are already offered through the ISSTBE program. However, increases in course enrollment is anticipated and may require additional sections of core courses to be offered, leading an increase in faculty workload. To offset increases in faculty workload and provide an avenue for PhD student teaching experiences, we are requesting the 2 GTA lines. We will monitor growth of the program and reassess course enrollment if program demand increases beyond initial estimates.

Estimate of Marketing and Outreach Expenditures

None are requested because the proposed PhD in Translational Bioengineering represents an endeavor at the University of Louisville (U of L) to move the current Interdisciplinary Studies with Specialization in Translational Bioengineering (ISSTBE) PhD program offered through the Graduate School to Speed School of Engineering. We will continue to advertise this program with the current departmental approaches for marketing and outreach.

Budgetary Rationale

There is an expected financial benefit of the PhD in BE program. Graduate teaching assistants (GTAs) are the new resources requested from Speed School administration funds to support this proposed program. We are requesting for 2 new GTA lines in Year 3, continuing thereafter. Additionally, Speed school will provide Bioengineering with 1 new Grosscurth Fellowship, a 2- year fellowship, each year for the Translational Bioengineering PhD program. Graduate school is matching the Speed school fellowship with 1 new University Fellowship for Translational Bioengineering each year for the Translational Bioengineering PhD program. This agreement is in the corresponding letters of support from the Deans of graduate School and Speed School.

Financial Resources and Program Impact

Projected Revenues

Projected Revenues	Year 1	Year 2	Year 3	Year 4	Year 5	Five-Year Total
General Funds (internal reallocation)	0	103,016	212,212	218,580	225,136	758,944
Other revenues, list each one	20,333	97,721	114,934	132,960	151,799	517,744

New Resource Requirements

Describe your other revenue sources

Other revenue source is the tuition revenue- See the justification above for student demand. The general funds (internal reallocation) values represent the 1 new University fellowship each year (which lasts for 2 years) from Graduate School (estimated at the resident rate) and 1 new Grosscurth fellowship each year (which lasts for 2 years) from Speed school (estimated at the resident rate)

Upload Projected Expenses
Template_New-Resource-Requirements-Table (1)-4-27-24.docx

Library Resources.

Please also submit a letter of support from the UofL Libraries.
library- Bioengineering letter of support.pdf

Graduate-level programs will require the GRE, GMAT or other standardized tests for admission.

No

The unit's lead fiscal officer has reviewed the budget calculations for this proposal.

Yes

The unit dean has approved this proposal and its related financial commitments and endorses the creation of this program as described.

Yes

Proposal

Classification of Instructional Program (CIP) Code
14.0501 - Bioengineering and Biomedical Engineering.

Number of Credit Hours required:
47

Anticipated Date for Granting First Degree:
Spring 2026

A. Overview

A program will adhere to the role and scope of the institution as set forth in its mission statement and as complemented by the institution's strategic plan.

Identify where the program will be offered.

a. Indicate the projected life of the program. (Is the institution intending to offer it for a limited timeframe, or will it be ongoing?)

This program will be ongoing.

b. Describe the primary target audience.

The primary audience is students with a minimum of a Bachelor's degree in Engineering or similar field with an interest of earning PhD in Bioengineering.

c. Describe the instructional delivery methods to be used.

All courses in this program are offered in face to face format. Some classes may additionally have an online option, but courses in that format are not required for the program.

d. Describe the strength of the institution to undertake this new program.

The University of Louisville is already offering this PhD program through Graduate School's Interdisciplinary Studies Program and this is a proposal to move this successful program to Speed School.

Additionally, the University of Louisville has a rich history of scientific research and discovery. "The Carnegie Classification of Institutions of Higher Education, recently finalized, once more has designated UofL a "Research 1" doctoral university with very high research activity. UofL is one of only 146 universities – roughly 4% of those considered – to receive this designation. In the past fiscal year, 2022-2023, UofL was awarded $153.8 million in competitive research funding. This funding supported groundbreaking research to address the biggest global problems of our time, including climate change and providing robotic solutions for manufacturing, health care and logistics. In addition to being a Research 1 institution, UofL, also holds the Carnegie community-engaged designation, which recognizes institutions that work with community partners to exchange knowledge and resources for public benefit. UofL is one of just 79 U.S. institutions to hold both designations."*
* https://louisville.edu/oapa/institutional-research-and-planning/quick-facts/2023JusttheFactsADAfinal.pdf

Describe the rationale and need for the program to include how the institution determined need.

A bioengineer uses traditional engineering skills and tools to analyze and solve problems in biology and medicine. Bioengineers collaborate with physicians, biologists, biochemists, chemists, clinicians, dentists, physiologists, therapists, and virologists to design, develop and manufacture instruments, devices, materials, prophylactics, software, and therapeutics, or

to develop new procedures to solve clinical problems. Bioengineers also are trained to objectively evaluate the efficacy of therapeutic interventions intended to advance healthcare and/or improve quality of life. The aging of the population and focus on health issues will increase the demand for improved medical devices, equipment and therapeutics designed by bioengineers working on interdisciplinary teams.

The proposed PhD in Translational Bioengineering represents an endeavor at the University of Louisville (U of L) to move the current ISSTBE PhD program offered through the Graduate School to Speed School of Engineering. The Translational Bioengineering PhD program will replace the ISSTBE program. Graduate School's Interdisciplinary Program was always intended as a starting point for a Translational Bioengineering PhD program. The ISSTBE has been successful. The program enrolled 4 new students in Fall 2023 and had 6 students complete their degrees in the 2022-2023 academic year. The program also had 53% of its students publish in peer reviewed journals and 5 IP disclosures in the 2022-2023 academic year. The program has 100% of its students publishing multiple peer reviewed journal articles when they have completed their degree. The graduates of the program have earned positions in industry, government (FDA), and academic post-doc positions.

Describe how each program-level student learning outcome will be assessed.

The dissertation proposal and the dissertation defense will both have the student's dissertation committee evaluate the student's performance using a program rubric. The number of peer reviewed abstract conference presentations and publications will be tracked on the students flightplan document. These documents will be submitted to the program director, who will review them and prepare the data from the rubrics for the annual report to UofL's Office of Institutional Effectiveness.
This data and other metrics of the program will be presented at the Bioengineering Department's annual curriculum meeting to review Bioengineering programs, as well as faculty meetings and Bioengineering administrations meetings as deemed appropriate. Student performance, exit survey feedback, and student feedback through course evaluations will be used to inspire program and course level improvements.

Specify/highlight any distinctive qualities of this proposed program.
There is a strong Bioengineering community at the University of Louisville; this community is built upon established collaborations between Bioengineering Department faculty and faculty in the Schools of Medicine, and Dentistry, along with faculty in other departments within the Speed School of Engineering. These multidisciplinary collaborations have led to extensive federal and private foundation research funding targeting the development of bioengineering solutions to improve patient outcomes and quality of life. The proposed PhD in Translational Bioengineering will continue help to accelerate the development and growth of clinical translational research at the University of Louisville.

The extensive bioengineering community at U of L will provide a rich multidisciplinary training environment for students in the proposed program, enabling them to receive extraordinary hands-on experience in laboratories directed by Bioengineering faculty.

Students in the program will have a unique opportunity to conduct their research while functioning on multidisciplinary teams that are based upon established engineer-clinician collaborations and an associated track record of successful development and translation of medical innovations. This unique environment has helped students currently enrolled in the current ISSTBE program to have success in receiving federal funding from Sigma Xi Grant, NSF (INTERN Award), NIH (SBIRs funding from NHLBI), and NIJ Graduate Research Fellowship. In addition, our students have received awards for their work at national conferences, such as American Society for Artificial Internal Organs and COMSOL Conferences.

The clinical translation research track and entrepreneurial track of our program embody our highly innovative and novel educational paradigm, which will place the University of Louisville at the forefront of bioengineering programs nationally. The students in the PhD program in Translational BE program will have the option to complete a Traditional Bioengineering Research, Clinical Translational Research or Advancing Bioengineering Technologies through Entrepreneurship track within their doctoral degree. Doctoral students will be provided unique and extraordinary learning opportunities that include a customizable curriculum, practical hands-on experience in a fast-paced environment, participation on multidisciplinary teams, and specialized training in clinical and entrepreneurial translational research. Our proposed PhD in Translational Bioengineering program is unique to the Commonwealth providing students with opportunities to focus on Clinical Translation Research or Advancing Bioengineering Technologies through Entrepreneurship.

Will this be a 100% distance learning program?

No

Will this program utilize alternative learning formats (e.g. distance learning, technology-enhanced instruction, evening/weekend classes, accelerated courses)?

No

Are new or additional faculty needed?

No

How will the program support or be supported by other programs and/or units within the institution? Please also describe potential for collaboration with other programs within the institution.

The strong Bioengineering community at the University of Louisville is built upon established collaborations between Bioengineering Department faculty and faculty in the Schools of Medicine, Dentistry, and Business, along with faculty in other departments within the Speed School of Engineering. These schools currently support our current ISSTBE PhD students by allowing our students to enroll in classes offered in their school and their faculty to

participate on dissertation committees for our students. Letters of support from Dean's of other units are attached to this proposal.

Will this program replace or enhance any existing program(s) or track(s) within an existing program?

Yes

Describe:

This program will replace the current programs in Graduate School called Interdisciplinary Studies with Specialization in Translational Bioengineering.

Faculty resources shall be demonstrated to be adequate and appropriate for the proposed program. The number of faculty should meet external standards where appropriate. The qualifications of faculty will support the objectives and curriculum of the proposed program.

Attach the SACS Faculty Roster Form.
Form-Faculty Roster 7-18-19-Translational BE_tas.docx

Describe the library resources available to support this program. Access to the qualitative and quantitative library resources must be appropriate for the proposed program and should meet recognized standards for study at a particular level or in a particular field where such standards are available. Adequacy of electronic access, library facilities, and human resources to service the proposed program in terms of students and faculty will be considered.

The Translational Bioengineering PhD program will be supported by the Ekstrom (Main) and Kornhauser Libraries which house over 2.1 million volumes, approximately 16,000 current journal subscriptions, special collections, media and microforms. In addition, the library has an on-line virtual library that provides faculty, staff and students access to over 20,000 full text electronic journals, inter-library loan services, electronic books and databases, reference materials and other library resources. The library resources are more than adequate to support the needs of the faculty and students in the proposed Translational Bioengineering PhD program.

A letter from the Dean, University Libraries is included, indicating that the University's collection of journals, electronic resources and special collections is adequate to support the Translational Bioengineering PhD program.

Describe the physical facilities and instructional equipment available to support this program. Physical facilities and instructional equipment must be adequate to support a high quality program. The proposal must address the availability of classroom, laboratory, and office space as well as any equipment needs.

Offices - The Bioengineering Department is located on the University of Louisville Belknap campus in Lutz Hall, which contains the department office, two teaching classrooms, three instructional laboratories, a conference room, and faculty research laboratories. Offices for faculty and staff are located in various buildings across the Belknap Campus (Lutz Hall and Shumaker Research Building) and Health Sciences Campus (Cardiovascular Innovation Institute, Clinical Translation Research Building and Health Sciences Research Tower).

Classrooms and Instructional Laboratories – The proposed bioengineering-specific courses are offered primarily in Lutz Hall, and the additional program courses are offered in classrooms across both the Belknap and Health Sciences Campuses including Belknap Academic Building, Duthie Center, Ernst Hall, HSC A Building, and J.B. Speed Building. All classrooms have adequate lighting, climate control and acoustic characteristics, and are equipped with interface to projectors. All buildings on the Belknap and Health Sciences Campuses are equipped with wireless internet access.

Lutz Hall contains Bioengineering's three instructional laboratories equipped for courses related to Bioinstrumentation, Tissue and Cell culture, Biomeasurements and 3D printing. Many Bioengineering undergraduate and graduate courses utilize these teaching labs. In addition to the laboratories described above, the Speed Engineering garage is available to all engineering students that help support design projects.

The software used in various courses including LabVIEW, MATLAB, C+, MATHCAD and SolidWorks are available free of charge via the University's Speed School network server. Students have access to a Cannon Workstation that combines a printer, scanner, copier and fax machine located in the Bioengineering department suite on the 4th floor of Lutz Hall and many other places on campus.

Computing Resources - The University of Louisville central research computing or Cardinal Research Cluster (CRC) is housed in the UofL Information Technology Data Center located in the Miller IT Center on the university's Belknap campus. This facility provides over 5000 square feet of secure, environmentally controlled data center space including a FM200 fire suppression system. The data center is fed by 1000kVA electrical service with backup power provided by a large UPS and an 1125 kVA diesel generator. The research cluster is equipped with its own dedicated in-row cooling systems, and utilizes cold aisle containment to improve cooling efficiency. The facility is physically secure with limited keycard access and is monitored 24 hours a day. The UofL CRC infrastructure became available in spring 2009 and was upgraded in spring 2011. This infrastructure includes multiple systems serving the research needs of the entire university, including a general-purpose high-performance distributed-memory computation cluster, a high-memory SMP system and several general-purpose web and software servers. The general-purpose compute cluster is composed of 312 IBM iDatplex nodes each equipped with two Intel Xeon L5420 2.5 GHz quad-core processors for a total of 2496 processor cores. Each node has 16 or 32 GB of memory, and the node interconnects are a mixture of Gigabit Ethernet (1Gbps) and InfiniBand (16 Gbps) technology. The cluster is estimated to have a peak performance rating of 20+ TFLOPS. The

University of Louisville's campuses are served by a 40 Gigabit per second (Gpbs) campus backbone network. This backbone is comprised of over 80 miles of fiber in a dual ring configuration. The wired network can provide 100Mbps and 1Gbps Ethernet service for faculty and staff communications needs. With the recently completed Pervasive Wireless Project, the U of L campus wireless network provides 802.11n wireless connectivity to wireless devices at speeds up to 300Mbps. This wireless connectivity is available across all of U of L's campuses, classrooms and buildings. The University of Louisville is connected to the Internet2 node via dedicated 10Gbps optical fiber backbone network. The Internet2 connection gives the University of Louisville direct, high bandwidth, access to national research and education networks such as XSEDE/Teragrid. The University of Louisville is also a member of the Kentucky Regional Optical Network (KyRON). This regional optical network is managed and operated through a consortium including the University of Louisville, the University of Kentucky and the Kentucky Council on Postsecondary Education. Participating universities are interconnected using 10Gbps optical links. The Kentucky RON extends the research data sharing capabilities of the University of Louisville with other participating universities throughout the state, and provides new opportunities for collaboration.

Multi-Disciplinary & Core Research Facilities - To support the training of students in state-of-the-art research methodologies and techniques, Translational BE PhD students will have access to a number of multidisciplinary and core research facilities at UofL.

Provide the following information for the program and for each track, concentration, or specialization (some categories may not apply to all programs).

Track
Track A: Traditional Bioengineering Research PhD

a. Total number of hours required for degree:
47

b. Number of hours in degree program core:
18

c. Number of hours in concentration/track:
20

d. Number of hours in guided electives:
9

e. Number of hours in free electives:
0

Track
Track B: Clinical Translation Research PhD

a. Total number of hours required for degree:
47

b. Number of hours in degree program core:
18

c. Number of hours in concentration/track:
20

d. Number of hours in guided electives:
9

e. Number of hours in free electives:
0

Track
Track C: Advancing Bioengineering Technologies through Entrepreneurship PhD

a. Total number of hours required for degree:
47

b. Number of hours in degree program core:
18

c. Number of hours in concentration/track:
20

d. Number of hours in guided electives:
9

e. Number of hours in free electives:
0

C. Program Demand/Unnecessary Duplication

Provide evidence of student demand. Evidence of student demand is typically in the form of surveys of potential students or enrollments in related programs at the institution, but other methods of gauging student demand are acceptable.

Since this program is currently offered in Graduate School's Interdisciplinary Studies program, the evidence of student demand is based on the interest in the current program. Since the program began in 2016, our program records indicate that there has been about

55 applications. According to Card Analytics, the program's enrollment peaked in Fall 2020 at 15 students and is currently at 12 students. The program has 9 alumni as of Fall 2023, who have earned competitive positions in industry, government (FDA), and academic post-doc positions.

Project estimated student demand for the first five years of the program.

Academic Year	Degrees Conferred	Majors (Headcount) - Fall Semester
2024-2025	0	9
2025-2026	1	13
2026-2027	2	16
2027-2028	3	19
2028-2029	3	21

If the program proposal is in response to changes in academic disciplinary need, as opposed to employer demand, please outline those changes. Explain why these changes to the discipline necessitate development of a new program.

D. Cost and Funding of the Proposed Program

The resource requirements and planned sources of funding of the proposed program must be detailed in order to assess the adequacy of the resources to support a quality program. This assessment is to ensure that the program will be efficient in its resource utilization and to assess the impact of this proposed program on the institution's overall need for funds.

Will this program require additional resources?

Yes

Provide a brief summary of additional resources that will be needed to implement this program over the next five years.

Graduate teaching assistants (GTA) are new resources requested from Speed School administration funds to support this proposed program. We are requesting for 2 new GTA lines in Year 3, continuing thereafter. Additionally, Speed school will provide Bioengineering with 1 new Grosscurth Fellowship, a 2- year fellowship, each year for the Translational Bioengineering PhD program. Graduate school is matching the the Speed school fellowship with 1 new University Fellowship for Translational Bioengineering each year for the Translational Bioengineering PhD program. Deans from these collaborating units at UofL have also provided letters of support for this proposed program (attached).

Will this program impact existing programs and/or organizational units within your institution?

Yes

Please describe the impact.
This program will replace the current program in Graduate School called Interdisciplinary Studies with Specialization in Translational Bioengineering (ISSTBE) PhD program. Students in this program will be given the option to complete their degree in their current program or transfer to the Translational Bioengineering PhD program in Speed School. Once all students have transferred out of the ISSTBE program or have graduated, then the ISSTBE program will close.

Provide adequate documentation to demonstrate sufficient return on investment to the state to offset new costs and justify approval for the proposed program.

Attach Budget Spreadsheet.
Template_Form--Budget 2023-5-2-2024.xlsx
2d KPPPSRevenueExpenseSheet-tas 5-21-24.xlsx

Budget Justification

See attached excel file with justifications.

Please provide contingency plans in the event that required resources do not materialize.

We feel confident in our budget given that the program is currently available and successful. One option for a contingency plan in the event that the required resources do not materialize would be to utilize externally funding for research for Bioengineering faculty to support PhD students. This external support already occurs with many of our students in the ISSTBE program. Additionally, the Bioengineering Department plans to submit a proposal for an NIH training grant in the future that if awarded would provide financial support for multiple PhD students in this program.

E. Program Review and Assessment

Describe program evaluation procedures for the proposed program. These procedures may include evaluation of courses and faculty by students, administrators, and departmental personnel as appropriate. Program review procedures shall include standards and guidelines for the assessment of student outcomes implied by the program objectives and consistent with the institutional mission.

What are the plans to evaluate students' post-graduate success?

Short-term post-graduate success will be defined based upon placement in academic, industry and/or government agency positions. Additionally, establishment of start-up companies by students graduating from the program will be viewed as post-graduate

success. Intermediate and long-term success will be characterized by contributions to the field of bioengineering as evidenced by scientific publications, patents issued, honors, start-up companies established, and professional attainment by alumni. The PhD in Translational BE program will survey alumni at degree completion and 5 years thereafter.

Provide a brief description of institutional assessment processes.

UofL is committed to institutional effectiveness and continuous quality improvement of all academic programs. The university's mission and strategic planning processes are supported by regular, annual outcomes assessment reporting for academic programs in the form of Student Learning Outcomes (SLO) reports. These reports document that UofL is engaged in evaluative processes that (1) result in continuing improvement in institutional quality and (2) demonstrate the institution is effectively accomplishing its mission. In their SLO reports programs identify student learning outcomes and measures and targets for the outcomes. Programs review data surrounding their student learning outcomes to determine if their set targets were met and then use this assessment to plan for future improvement in student learning. Course syllabi include course objectives that feed into SLOs and program goals. The SLO process begins in May when templates and instructions for completing SLO reports are sent to department chairs/heads. The SLO process lags behind by one academic year to enable programs to utilize and report assessment results from the previous academic year. Academic programs submit their competed reports by early November. The provost's office reviews all SLO reports and returns feedback to assist programs with further development and assessment of their learning outcomes. The feedback suggests changes needed to the SLO process and areas for improvement. The expectation is that these revisions be fully incorporated into the SLO reporting process for the next data collection reporting cycle. Training, workshops, and resources on student learning outcome development are provided to faculty and staff to support their efforts and to assist them in continuous improvement of their SLO reports and assessment process.

Describe how the institution will incorporate the change (program, site, distance education, or other change) into the institution-wide review and assessment processes.

When a new program is created, an "Academic Alert" is sent to responsible parties. This alert is used by the Office of Institutional Effectiveness (IE) to add the new program to the SLO reporting process. With the creation of the new program, IE reaches out to the department head with information about the annual SLO reporting process and to set up an orientation session to familiarize them with the reporting requirements and provide whatever support is needed.

A letter of support from the Dean outlining the rationale or need for the program and affirming any financial commitments listed in the proposal.

Dean's Letter
Dean letters-all 7-25-24.pdf

Syllabi

Program Director's CV
P_Soucy CV 2-26-24.pdf

Have all unit approval processes been completed?

Yes

Please provide a list of unit approval processes with approval dates:

Unit Approval Process	Approval Date
Speed Graduate Education Committee	4/5/24
Speed AP&P	4/9/24

NEW PROGRAM TO DO SECTION - FOR PROVOST OFFICE USE ONLY (Academic unit faculty/staff: do not enter information below this line.)

AAP Program Approval Coordinator

IRP Executive Director

Type of Proposal
Letter of Intent

ADMIN PROGRAM TO DO SECTION - FOR PROVOST OFFICE USE ONLY (Academic unit faculty/staff: do not enter information below this line.)

Program Admin

Catalog Admin

Reviewer Comments
Leslie Harper (lafren01) (Fri, 12 Jan 2024 19:31:47 GMT): This program is currently a track in the IS PHD program. An LOI was approved in 2020 to make this an independent program in the Speed School. On 12-12-24 Bob Goldstein said the LOI did not need to be re-approved, though it should be entered into CIM so that the proposal can be entered into CIM.

Leslie Harper (lafren01) (Thu, 25 Jan 2024 16:55:42 GMT): Rollback: I am rolling this back so that you can complete the proposal. Thanks!
Krista Young (k0youn08) (Mon, 29 Jan 2024 15:22:12 GMT): Approving to open up proposal form.
Krista Young (k0youn08) (Mon, 29 Jan 2024 15:23:55 GMT): This LOI was approved by the PPPRC on 02/11/2020; updating approval in system to open up proposal section of CIM form.
Krista Young (k0youn08) (Mon, 29 Jan 2024 15:26:37 GMT): Moving forward to allow Dr. Soucy to edit the proposal.
Derek Hottell (dlhott01) (Mon, 15 Apr 2024 18:48:30 GMT): Rollback: As requested.
Derek Hottell (dlhott01) (Wed, 24 Jul 2024 18:21:32 GMT): Rollback: Rolling back to Dr. Soucy to make requested revisions from Faculty Senate. Please note that the SSBE Chair, SS Associate Dean, and SS Curriculum Committee Chairs will need to sign-off on the revisions in the workflow to re-route it to faculty senate.

Key: 400

Select any proposals you would like to bundle together for approval. Only proposals you have saved are available to bundle.

Bundle Title:

Course:
Proposal A
Program:
Proposal B