

University of Louisville

New Academic Program Proposal Template

Undergraduate, Graduate, and Professional Programs

After approval of the Letter of Intent, undergraduate, graduate, and professional programs are to complete this New Academic Program Proposal template. There is a separate template for certificate credentials.

All templates and forms are available at:

<http://louisville.edu/oapa/new-academic-program-approval-page/new-academic-program-approval>

To avoid unnecessary delays, please ensure that all questions are addressed clearly and completely and that all necessary forms are completed and submitted.

Some questions may seem repetitive, but they reflect CPE questions and must be answered exactly in the format requested. CPE readers won't have access to previous information submitted. Responses to the questions in this template are needed exactly in the format requested in each question.

If the question asks for a description, you must provide a description rather than referencing information provided elsewhere in a different format (such as a table). As well, if you decide to provide additional information in tables (such as assessment rubrics, data, etc.) you must also describe the material. We are unable to copy tables into the CPE online portal.

Questions about the template and process can be directed to the Office of Academic Planning and Accountability through the Program Approval Service Account (PROGAPPR@louisville.edu).

NOTE: All unit approval processes must be completed and documented before submitting this proposal.

Send the following materials, as well as any questions or concerns, to the **Program Approval Service Account** (PROGAPPR@louisville.edu). The program approval process will not begin until all of the above documents are received. Please submit all materials listed below at the same time.

- This Completed Proposal Template
- Proposed Program Curriculum
- Course syllabi for any new course offerings
- SACSCOC Faculty Roster Form
- Gray Associates Program Evaluation System Regional Scorecard
- CV for Program Director/Coordinator
- Course Template Form
- Proposal Budget Form
- Letter of Support from the UofL Libraries
- Letter of Support from the unit Dean
- Letter(s) of Support from any units, departments, or internal or external entities that have indicated their support for the program

General Program Information	
Program Name:	Biochemistry
Degree Level:	B.S.
Date:	September 30, 2022
Department and Department Chair:	Chemistry, Richard Baldwin
School/College:	College of Arts and Sciences
Program Director and Contact (if different); (please also include title):	Craig Grapperhaus, Department of Chemistry Director of Undergraduate Studies
CIP Code:	26.0202
Program Type (collaborative, joint, or single institution):	Single Institution
Is this program an advanced practice doctorate?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Number of Credit Hours required:	114 – 118
Method of Delivery (online, face-to-face):	Face-to-face
Is an approval letter from the Education Professional Standards Board (EPSB) required for this program? If so, attach a copy to this proposal.	No
(Tentative) Institutional Board Approval Date:	
Proposed Implementation Date (semester and year):	Fall 2023
Anticipated Date for Granting First Degree:	Spring 2025 for current students in B.S. Chemistry – Biochemistry Track transitioning to new program. Spring 2027 for first cohort of new students.
Have all unit approval processes been completed?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Please provide a list of unit approval processes with approval dates:	

A. Overview

- Provide a brief description of the program with its estimated date of implementation.** (250 words or less; program’s purpose/focus, primary areas of study, intended audience, academic level—undergraduate, graduate, or professional, length of the program, goals/objectives, rationale for program, skills or knowledge that students will acquire, relationship of program to general field). This description will be used for external reporting and should provide a concise programmatic overview.

CPE Instructions: *The succinct program description should be readily understandable to a constituent who is not familiar with the proposed discipline.*

The B.S. Biochemistry program is a rebranding of the B.S. Chemistry – Biochemistry Track program. This four-year undergraduate program will continue the interdisciplinary nature of the current Biochemistry Track with altered Chemistry and Biology course requirements to give students more options than the current B.S. Chemistry program. Course requirements will also be modified to include additional writing, statistics, and ethics requirements in line with American Society for Biochemistry and Molecular Biology (ASBMB) guidelines. The ultimate goal is to establish a Biochemistry degree accredited by the (ASBMB). The new program will be attractive to pre-professional (pre-med, pre-dental, pre-pharmacy) students and students interested in careers in biochemistry and biotechnology. The standalone Biochemistry program will be more visible, distinctly marketable, and more attractive to students wanting a Biochemistry degree than the current Biochemistry track. This is a STEM+H degree with excellent growth potential. In a 2021 report by Gray & Associates for CPE, the recommendation for the Chemistry (B.S.) program was “fix to grow”. Specifically, it was noted to “consider the demand for "Biochemistry" and the lack of competition” and raised the question of a CIP code (26.0202) with additional investment in Biochemistry for growth potential.

2. Describe how the new program is consistent with the mission and goals of the institution.

CPE Instructions: *Describe how the program will address the institution’s mission and strategic goals. Highlight which areas of the institutional plan will be furthered through implementation of this program.*

As with the current B.S. Chemistry—Biochemistry track that it replaces, the proposed B.S. Biochemistry program clearly falls within the UofL mission by “1. teaching diverse undergraduate . . . students in order to develop engaged citizens, leaders, and scholars, 2. practicing research [and]scholarship.” The latter portion is encompassed by the required undergraduate research and opportunity to participate in the weekly departmental seminar series of distinguished visiting researchers.

The proposed B.S. Biochem fits the *Great Place to Learn* component of the 2019–2022 Strategic Plan. The curriculum modifications from the current B.S. Chemistry—Biochemistry track were targeted to informal feedback from students who have left the program in the past few years (changing the math requirement from a third semester of calculus to a statistics class and reducing the load of physical chemistry) in order better to “[a]ttract and enroll a capable, diverse, and engaged student body responsive to . . . workforce needs of the future” (L1.A1). These changes should also improve retention *within* the major (L1.A2), but nearly all students who transfer from the current Biochemistry track complete another degree, so the impact on overall UofL retention will likely be modest. The two semester biochemistry sequence (CHEM 545 and 547) are taught in the evening to make them more accessible to nontraditional students (L1.A2.3). The undergraduate research component and the ability to substitute an appropriate internship for it implement the structured experiential learning goal (L2.A1) and all aspects of pillar L3 because undergraduate research opportunities are both in Chemistry and allied departments, which may easily involve work on the Grand Challenges (L3.A1).

Similarly, the program is consonant with the draft 2022–2025 Strategic Plan. Strategy L1 recapitulates attracting and retaining an engaged student body, and the B.S. Biochemistry fulfills Action 1 as a program at the intersection of chemistry and biology. The curriculum changes “remove

barriers to improve retention and persistence to graduation” (Action 3), and the evening key biochemistry courses in the evening reduces scheduling barriers (Action 3) by particularly making them more accessible to non-traditional student populations (Action 2). The B.S. Biochemistry will strongly emphasize application and extension of principles to new situations over memorization (as do all degree programs in the Department of Chemistry), so our graduates will be among the most trained to think critically and well-positioned to learn by extension of their knowledge base throughout their careers (Strategy L2, both Action 1 and Action 2).

Workforce market considerations will be treated in their own sections but recommend the B.S. Biochemistry because of the technical capabilities of the graduates to enter immediately biomedical and analytical laboratories in industries ranging from distilling to molecular diagnostics (Strategy L1 Action 1).

3. Is there a specialized accrediting agency related to this program? Yes No

- a. If yes, please identify the agency.
- b. If yes, will the program seek accreditation?

- a. American Society for Biochemistry and Molecular Biology (ASBMB)
- b. The program intends to seek accreditation after the program is established and has graduated its first cohort of new students in Spring 2027.

4. Does this program have a clinical component? Yes No

If yes, discuss the nature, appropriateness, and availability of clinical sites.

5. 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?)
- b. Describe the primary target audience.
- c. Describe the instructional delivery methods to be used.
- d. Describe the strength of the institution to undertake this new program.

- a. The program is intended as a permanent rebranding of the current B.S. Chemistry – Biochemistry track program.
- b. The primary target audience includes students in Kentucky and region interested in careers in biochemistry and biotechnology. The program will also be attractive to pre-professional (pre-med, pre-dental, pre-pharmacy) students. According to the 2021 report by Gray & Associates for CPE, Biochemistry has a total PES+ score of 6 (91 percentile) nationally with the highest score (10) in Student Demand and a score of -3 (69 percentile) regionally with the highest score (1) in Employment. The report further suggested that “marketing initiatives will drive enrollment” and that “none of U of L's major competitors have a full major in Biochemistry.”
- c. Instructional delivery methods include face-to-face lecture and laboratory courses and experiential learning via undergraduate research or co-op/internships.
- d. The new program is a rebranding of the existing B.S. Chemistry – Biochemistry track. This track has been offered at the University of Louisville for more than twenty years and

currently has 19 majors and 49 intended majors. The 49 intended majors are current UofL students that have declared B.S. Chemistry – Biochemistry as their intended major, but have not yet completed the requirements to officially be a chemistry major. It has averaged 10 graduates per year over the past four years and 17 graduates per year as recently as AY12/13.

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

In a 2021 report by Gray & Associates for CPE, the recommendation for the Chemistry (B.S.) program was “fix to grow”. Specifically, it was noted to “consider the demand for "Biochemistry" and the lack of competition” and raised the question of a CIP code (26.0202) with additional investment in Biochemistry for growth potential. In response to this suggestion, the Chemistry department initiated a committee to evaluate the current B.S. Chemistry – Biochemistry track to consider the rebranding of that degree as a standalone B.S. Biochemistry program. The committee concluded that rebranding with a revision of program requirements to align to with ASBMB guidelines was the best option to provide students with a modern and interdisciplinary Biochemistry degree.

B. Program Quality and Student Success

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

7. Provide specific programming goals (objectives) and specific student learning outcomes for the program in the areas that are required for SACSCOC.

For UNDERGRADUATE programs, that would be:

- Competency Related to Major
- Competency which Builds upon the Cardinal Core Curriculum (Choose either Cultural Diversity or Effective Communication)
- Competency Related to the Culminating Undergraduate Experience (CUE)
- Competency Related to Critical Thinking

For GRADUATE programs, that would be:

- Competency Related to Content Knowledge
- Competency Related to Engagement in Research -OR-
- Competency Related to Professional Practice and Training Experiences

Goal 1: Students will achieve content **Competency Related to Major** in divisions of chemistry (Analytical, Organic, Physical and Biochemistry) and biology (Genetics, Cellular and Molecular) and be able to make conceptual connections across these divisions. This includes competency in laboratory courses that demonstrate **Critical Thinking**.

Goal 2: Students will demonstrate **Critical Thinking** through their ability to understand and process biochemistry in new contexts by analogy to class/textbook content—whether or not they can use information acquired in the introductory biochemistry class to continue learning. Because of the centrality to biochemistry and the myriad of pathways, metabolism provides an ideal vehicle for this assessment. The report also requires that students demonstrate **Effective Communication** in writing.

Goal 3: All students demonstrate Competency Related to the Culminating Undergraduate Experience through participation in one or more of the Chemistry Department's eight designated CUE courses. These courses all require a written report that will demonstrate the student's competence in **Effective Communication**.

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

If you wish to attach any SLO documents you may do so, but you still need to provide a narrative response to this question.

CPE Instructions: Explain which student learning outcome(s) will be assessed by each assessment method and how frequently each assessment method is administered. Include both direct and indirect methods. Explain how assessment results will be used to make improvements to the program. Note that this item refers to a program-level, not course-level, assessment and thus course grades are not an appropriate source of data for program-level assessment.

SLO 1: Students exiting the B.S. Biochemistry program will demonstrate a deeper grasp of key concepts in biochemistry and demonstrate proficiency in laboratory applications.

Measure 1: Student performance on the Enzyme Kinetics Project, which includes: 1) rational experimental design, 2) data collection and organization, 3) quantitative treatment and graphical presentation of data, 4) discussion of experimental results with an emphasis on data-driven evidence, 5) connections to and understanding of biochemical principles related to enzyme kinetics is made apparent in interpretation of analytical results.

Target 1: 75% of students will score a C (140/200 pts) or better on the two-week Enzyme Kinetics Project lab report.

SLO 2: Students will be able to identify similarity in the steps of a metabolic pathway *not* covered in CHEM 545 by analogy to metabolic pathways that were covered in class and provide chemical mechanisms for two of the analogous steps in the pathway.

Measure 2: A set of questions in the comprehensive final exam will cover 1) the identification of steps in a 'new' pathway to those in the covered pathways of central metabolism and 2) the chemical mechanisms by which metabolic intermediates are converted to the next one in the pathway. The pathways will encompass at least four steps analogous to those in covered pathways, and the students will be asked to provide mechanisms for two of them.

1) Students will be given multiple choices (including distractors) to identify four or more analogous steps. 2) Two analogous steps will be chosen for students to write out a detailed chemical mechanism for the enzyme-catalyzed reaction. Correct identification of over half of the analogous steps will indicate general competency for point 1. Mechanisms that include key reaction intermediates in each chemical transformation and convey them according to conventions of mechanistic exposition will indicate general competency for point 2.

Target 2: Point 1) Correct identification of over half of the analogous steps. Point 2) write detailed chemical mechanisms for two of the steps. Inclusion of key reaction intermediates and use of conventional notation to indicate the mechanistic steps. Students will show over half of the key intermediates and score over half of the points for denoting the mechanistic steps.

SLO3: Students in undergraduate research (CHEM 390WR, CHEM 391, CHEM 392, CHEM 492) will demonstrate their understanding of the scientific process (including understanding of the research project, familiarity with the methods used, clarity of writing, precision with chemical terminology, and appropriate referencing) and their ability to perform independent research.

Measure 3: Students in the undergraduate research courses will score a C (75% of total points) or better based on end-of-semester lab reports.

Target 3: 75% of students will score a C or better on the end-of-semester lab report.

9. Highlight any distinctive qualities of the proposed program.

CPE Instructions: Note any factors that make the program unique (e.g. whether any faculty are nationally or internationally recognized for expertise in this field; the program builds on the expertise of an existing locally, nationally or internationally recognized program at your institution; etc).

The program builds upon the success of the current B.S. Chemistry – Biochemistry track program. Biochemistry faculty from the existing chemistry faculty that will be participating in the B.S. Biochemistry program include Prof. Muriel Maurer (53 publications, 15 H-index), Prof. Eugene Mueller (30 publications, 19 H-index) and Prof. Richard Wittebort (22 publications, 10 H-index).

10. Describe the admission and graduation requirements for the program.

This information will be viewed by an external audience, so please be clear and specific.

CPE Instructions: Be as detailed as possible and address all three components – admission, retention, and completion.

Admissions to the B.S. Biochemistry program will be the same as the current admissions requirements to the B.S. Chemistry program – Biochemistry track. Specifically, admission to the major in Biochemistry will require completion of the second semester of general chemistry (CHEM 202 or equivalent course from another institution) with a grade of C or better.

Graduation requirements include both university-wide requirements and the requirements of the Biochemistry degree program. To meet university-wide requirements, the student must:

- Complete an application for and be accepted for admission into a major program.
- Satisfy all Cardinal Core requirements.
- Complete all required courses and program requirements listed in the degree program section of this catalog.
- Have a cumulative university GPA of at least 2.00.
- Have a cumulative program GPA of at least 2.00.
- Complete a minimum of 120 hours applicable to the program, or more if required by the program.
- Complete at least 60 hours at an accredited four-year institution.
- Complete at least 25-percent of the total credit hours required for the degree in residence at the University of Louisville.
- Complete 30 of the last 36 hours in residence at the University of Louisville.
- Have neither missing nor outstanding I or X grades.
- Satisfy any additional requirements specified by the major program and unit.
- Complete an online degree application by the specified date at the beginning of the semester of graduation.
- Be discharged of all financial obligations to the University.
- Be formally recommended for the baccalaureate degree by the unit faculty and dean and approved by the Board of Trustees.

To meet biochemistry program requirements, the student must:

- Complete all College of Arts and Sciences requirements (13 – 15 credit hours) including GEN 100 or GEN 101, 6 – 8 credit hours of Foreign Language, 6 credit hours of Electives in Humanities or Social Sciences at the 300-level or above, and two writing requirement (WR) courses at the 300 level or above.

- Complete supporting courses in English (ENGL 303), Mathematics (MATH 205 and MATH 206), Philosophy (PHIL 321, 323, 325, or 328), and Physics (PHYS 221, 222, 223, 224 or PHYS 295, 296, 298, 299).
- Complete 36 credit hours of core Chemistry content (CHEM 201, 202, 207, 208, 209, 210, 341, 342, 343, 344, 425, 441, 470, 545, 546, 547).
- Complete 28 credit hours of core Chemistry content (CHEM 201, 202, 207, 208, 209, 210, 341, 342, 343, 344, 425, 441, 470).
- Complete 8 credit hours of core Biochemistry content (CHEM 545, 546, 547).
- Complete 17 credit hours or core Biology content (BIOL 240, 242, 329, 330, 331, 350).
- Complete 8 credit hours of advanced electives in Chemistry (CHEM 430, 515, 527, 528, 529, 555, 557) or Biology (BIOL 400, 457 or 485, 458, 465, 541, 542) with at least three hours in Chemistry.
- Complete 3 credit hours of undergraduate research in Chemistry or Biology or complete 3 credit hours of co-op/internship in Chemistry or Biology.
- Complete a Culminating Undergraduate Experience (CUE) course.
- Have a cumulative GPA of at least 2.0 overall.
- Have a cumulative GPA of at least 2.0 in major courses (Chemistry and Biology).

The B.S. Biochemistry curriculum does not require the development of new courses. The curriculum consists of the following existing courses:

General Education Requirements

General Education Requirements* 31

The following courses are required by the program and can satisfy the respective General Education Requirement:

CHEM 201 General Chemistry I - S
 CHEM 207 Introduction to Chemical Analysis I - SL
 MATH 205 Calculus I - QR
 PHYS 221 Fundamentals of Physics I - S
 or PHYS 295 Introductory Laboratories I - SL

*All degrees require the completion of the University-wide General Education Program (link provided above). Some General Education requirements may be met in the requirements for the major or supporting coursework, in which case additional electives may be required to complete the minimum hours for the degree. To complete the Business track in the minimum number of hours listed, some hours from the General Education Requirements must be satisfied by courses defined by the unit and/or program.

College/School Requirements

Arts & Sciences Requirements

GEN 100 Student Success Center First Year Experience 1
 or GEN 101 Arts & Sciences First Year Experience
 Foreign Language¹ 6-8
 ENGL 303 - WR^{2,3} 3
 PHIL 321, 323, 325, or 328² 3
 WR—two approved courses at the 300 level or above³
 Minimum Total Hours 13-15

Program/Major Requirements

Departments of Chemistry and Biology

CHEM 201 General Chemistry I - S⁴ 3

CHEM 202	General Chemistry II - S	3
CHEM 207	Introduction to Chemical Analysis I - SL ⁴	1
CHEM 208	Introduction to Chemical Analysis II - SL	1
CHEM 209	Introduction to Chemical Analysis III	1
CHEM 210	Introduction to Chemical Analysis IV	1
CHEM 341	Organic Chemistry I	3
CHEM 342	Organic Chemistry II	3
CHEM 343	Organic Chemistry Laboratory I	2
CHEM 344	Organic Chemistry Laboratory II	2
CHEM 425	Instrumental and Statistical Analysis	3
CHEM 441	Elements of Physical Chemistry	3
or CHEM 465	Physical Chemistry I	
CHEM 470	Physical Chemistry Laboratory - WR3	2
CHEM 545	Biochemistry I	3
CHEM 546	Biochemistry Laboratory	2
CHEM 547	Biochemistry II	3
Undergraduate Research or Cooperative Internship ⁵		3
BIOL 240	Unity of Life - S ⁴	3
BIOL 242	Diversity of Life - S	3
BIOL 329	Cellular and Molecular Biology	3
BIOL 330	Genetics and Molecular Biology	3
BIOL 331	Genetics and Molecular Biology: Laboratory	2
BIOL 350	Biostatistics	3
CHEM/BIOL electives – see table below (at least 3 hours in CHEM)		8
Minimum Total Hours		64
Supporting Courses		
MATH 205	Calculus I – QR ⁴	4
MATH 206	Calculus II	4
Complete one of the following sequences:		8-10
Sequence 1:		
PHYS 221	Fundamentals of Physics I - S	
PHYS 222	Fundamentals of Physics II - S	
PHYS 223	Fundamentals of Physics Lab I - SL	
PHYS 224	Fundamentals of Physics Laboratory II - SL	
Sequence 2:		
PHYS 295	Introductory Laboratories I - SL	
PHYS 296	Introductory Laboratories II - SL	
PHYS 298	Introductory Mechanics, Heat and Sound - S	
PHYS 299	Introductory Electricity, Magnetism and Light	
Minimum Total Hours		16-18
Culminating Undergraduate Experience (Graduation requirement)		
Requirement fulfilled by completing one of the following:		
CHEM 390	Undergraduate Research - CUE, WR	
CHEM 391	Undergraduate Research - CUE	
CHEM 392	Undergraduate Research - CUE	
CHEM 420	Cooperative Internship in Chemistry - CUE, WR	
CHEM 430	Practicum in Chemistry Education - CUE	
CHEM 491	Undergraduate Research - CUE	

CHEM 528	Contemporary Methods of Organic Synthesis and Analysis – CUE
BIOL 405	Undergraduate Research - CUE
BIOL 406	Undergraduate Research - CUE, WR
BIOL 430	Undergraduate Teaching Assistant – CUE
BIOL 485	Microbial Physiology - CUE, WR
BIOL 541	Medicinal Plant Biochemistry - WR, CUE

¹ Completion of the second semester of a single foreign language; hours will vary depending on language taken

² Satisfies 3 credit hours of electives in Humanities or Social Sciences at the 300-level or above requirement; requirement is in addition to courses counted toward General Education.

³ ENGL 303 and CHEM 470 satisfy the WR course requirements.

⁴ Satisfies General Education requirement.

⁵ Select from CHEM 390, 391, 392, 420, 491, or 492 or BIOL 405, 406, or 490

Table of CHEM/BIOL electives (at least 3 hours must be in CHEM)

CHEM 426	Instrumental and Statistical Analysis Laboratory – WR	2
CHEM 430	Practicum in Chemistry Education - CUE	1-3
CHEM 515	Inorganic Chemistry	3
CHEM 527	Spectroscopic Identification of Organic Compounds - WR	3
CHEM 528	Contemporary Methods of Organic Synthesis and Analysis - CUE	2
CHEM 529	Contemporary Methods of Inorganic Synthesis and Analysis - WR	2
CHEM 555	Theory and Application of Computational Chemistry	3
CHEM 557	Bio-Organic Phenomena	3
BIOL 400	Histology	4
BIOL 430	Undergraduate Teaching Assistant – CUE	3
BIOL 457	Microbiology	3
or BIOL 485	Microbial Physiology - CUE, WR	
BIOL 458	Microbiology Laboratory	1
BIOL 465	Principles of Physiology	3
BIOL 541	Medicinal Plant Biochemistry - WR, CUE	3
BIOL 542	Gene Structure and Function - WR	3

The B.S. Biochemistry program strengthens the long-standing collaboration between Chemistry and Biology established in the B.S. Chemistry – Biochemistry Track. The proposed rebranding increases the number of credit hours in Chemistry + Biology from 62 to 64. Credit hours in Chemistry would change from 45-48 to 39-47 with hours in Biology changing from 14-17 to 17-25 providing for a more interdisciplinary experience. The increase in Biology credit hours includes the addition of BIOL 350 Biostatistics as a program requirement, which allows the program to meet ASBM guidelines for statistics without the creation of a new course. Additionally, the Biochemistry program would introduce program requirements in ethics (PHIL 321, 323, 325, or 328) and scientific and technical writing (ENGL 303) through collaborations with Philosophy and English in order to meet ASBM guidelines without the creation of new courses.

The Chemistry department has also recently adopted outreach events focused on retention that will also been employed for the Biochemistry program. These include early semester events for courses with high DFW rates to bring students together with faculty, peers, and university resources through social interactions. The first of these events are planned for General Chemistry (in collaboration with the Biology Department) and Organic Chemistry for Fall 2022. Additionally, students in the Biochemistry program will have the opportunity to conduct research with faculty in Chemistry and

Biology. Chemistry recently established the position of Undergraduate Research Coordinator. This faculty member provides students with information on research openings, funding opportunities, and avenues to present research. The coordinator is a resource for students that need assistance finding a research mentor. Through this coordinator, the Chemistry and Biochemistry programs will seek to increase the number of Biochemistry/Chemistry students in the Louis Stokes Alliance for Minority Participation (LSAMP), which has a mission to help diversity the STEM industries through efforts aimed at increasing the number of students earning baccalaureate degrees in these disciplines.

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

CPE Instructions: A guided elective is any elective that is part of a major. A free elective is an elective from any academic area not required for a major or minor.

Program/Track, Concentration, or Specialization	Total number of hours required for degree	Number of hours in degree program core	Number of hours in track	Number of hours in guided electives	Number of hours in free electives
Biochemistry	120	64	N/A	11	2-6

12. Describe administrative oversight to ensure the quality of the program.

Who will oversee the program and how do their credentials/qualifications align with that role?
How does program oversight include curriculum review and approval to ensure program integrity and rigor?

The program will reside in the Department of Chemistry. The administrative oversight will follow the same plan currently in place for the B.S. Chemistry – Biochemistry track that is replacing. The positions required for the proposed program are already in place for the current programs in the Chemistry department and the workloads are not expected to increase as a result of the proposed changes. The Chemistry Department Chair is primarily responsible for the oversight of the program including curriculum, admissions, retention, degree requirements, course scheduling, faculty assignments, budget, and student concerns. The chair appoints a department Director of Undergraduate Studies (DUGS), a department Coordinator of Undergraduate Research, a department Coordinator of Co-op/Internship, and departmental undergraduate advisors. Academic advising will be provided by the Advising Office in the College of Arts and Sciences. The DUGS works with the advising office and departmental advisors on advising, retention, progress towards degree, student concerns, and degree requirements. The DUGS works with the research and internship coordinators to provide experiential learning opportunities for all majors in the program. Program integrity and rigor will be ensured by focusing on ASBMB guidelines for Biochemistry programs. The Chair and DUGS will cooperatively prepare and application for ASBMB accreditation following the graduation of the first new cohort in the program in Spring 2027.

13. 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.)

The program offers no compressed timeframe components.

14. Please answer the following:

a) Will this be a 100% distance learning program? Yes No

CPE Instructions: This is defined as an academic program in which all of the required courses in a program occur when students and instructors are not in the same place. Instruction may be synchronous or asynchronous.

b) Will this program utilize alternative learning formats (e.g. distance learning, technology-enhanced instruction, evening/weekend classes, accelerated courses)? Yes No

If yes, please check all that apply below.

NOTE: If you check "yes" to this question, you must check at least one of the items listed below.

- Distance Learning
- Courses that combine various modes of interaction, such as face-to-face, videoconferencing, audio-conferencing, mail, telephone, fax, e-mail, interactive television, or World Wide Web
- Technology-enhanced instruction
- Evening/weekend/early morning classes
- Accelerated courses
- Instruction at nontraditional locations, such as employer worksite
- Courses with multiple entry, exit, and reentry points
- Courses with "rolling" entrance and completion times, based on self-pacing
- Modularized courses

15. Will this program replace or enhance any existing program(s) or tracks, concentrations, or specializations within an existing program? Yes No

The program replaces the B.S. Chemistry – Biochemistry track program.

16. 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 field of biochemistry sits at the interface of biology and chemistry. This program will provide students with an interdisciplinary experience that will prepare them for professional school (medicine, dental, pharmacy), graduate school (biochemistry, chemistry, biology, medicine), or a career as a scientist or technician in a biochemistry or related disciplines. The program will provide course instruction and hands on laboratory experience in chemistry, biology, and physics.

The B.S. Biochemistry program strengthens the long-standing collaboration between Chemistry and Biology established in the B.S. Chemistry – Biochemistry Track. The proposed rebranding increases the number of credit hours in Chemistry + Biology from 62 to 64. Credit hours in Chemistry would change from 45-48 to 39-47 with hours in Biology changing from 14-17 to 17-25 providing for a more interdisciplinary experience. The increase in Biology credit hours includes the addition of BIOL 350 Biostatistics as a program requirement, which allows the program to meet ASBM guidelines for statistics without the creation of a new course. Additionally, the Biochemistry program would introduce program requirements in ethics (PHIL 321, 323, 325, or 328) and scientific and technical writing (ENGL 303) through collaborations with Philosophy and English in order to meet ASBM guidelines without the creation of new courses.

17. Are new or additional faculty needed? Yes No

- a) If yes, please explain, indicating the number and role of each new faculty member and whether they will be part-time or full-time. Specify if part-time faculty or graduate assistants are included in the additional faculty resources needed.
- b) If yes, please provide a plan to ensure that appropriate faculty resources are available, either within the institution or externally, to support the program.

The program will require PTL support that is independent of the proposed rebranding. To meet the needs of the current B.S. Chemistry – Biochemistry track, the Chemistry department requires PTL support due to the instructor shortages within the biochemistry division of the chemistry department. Currently, Chemistry has three tenured biochemistry faculty of which two have substantial teaching loads in service courses (organic chemistry and introductory chemistry). The Chemistry PTL would assist in covering biochemistry course and/or service courses for years 1 – 3. It is anticipated that enrollment increases will warrant hiring of a full-time Biochemistry faculty in year 4. In that case, the PTL would likely not be needed.

18. a. Describe the library resources available to support this program.

Please also submit a letter of support from the UofL Libraries.

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.

No new library resources are required. The library resources in place to meet the needs of the B.S. Chemistry – Biochemistry track are sufficient to meet the needs of the B.S. Biochemistry program.

b. 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.

No new physical facilities are required. The facilities in place to meet the needs of the B.S. Chemistry – Biochemistry track are sufficient to meet the needs of the B.S. Biochemistry program. Funds are required to update the Biochemistry teaching laboratory to introduce replace aging equipment and purchase state-of-the instrumentation. These needs are independent of the program change. Budgeted amount is based on projected tuition increases.

C. Demand

Student Demand

19.a. 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. Please use the [PES+](#) platform from Gray Associates in your response.

CPE Instructions: Explain how faculty and staff systematically gathered data, studied the data and estimated student demand for the program. Anecdotal evidence is not sufficient. If student surveys have been collected, provide information regarding sample size, sampling methodology, and response rate.

Over the past four years, Chemistry has averaged 10 B.S. Biochemistry-track degrees and 17 B.A./other B.S. track degrees and Biology has averaged 130 B.A./B.S. degrees. In a 2021 report by Gray & Associates for CPE, the recommendation for the Chemistry (B.S.) program was “fix to grow”. Specifically, it was noted to “consider the demand for "Biochemistry" and the lack of competition” and raised the question of a CIP code (26.0202) with additional investment in Biochemistry for growth potential. In the Gray report, Biochemistry has a total PES+ score of 6 (91 percentile) nationally with the highest score (10) in Student Demand. The report further suggested that “marketing initiatives will drive enrollment” and that “none of U of L's major competitors have a full major in Biochemistry.” With accreditation, the program would be distinct regionally as there is only one accredited program in Kentucky (B.S. Chemistry – Biochemistry track at EKU) and only eight ASBMB accredited programs in the surrounding states of OH (3), TN (3), IN (2) IL (0), and MO (0).

At the beginning of Fall 2022, B.S. Chemistry – Biochemistry Track has 19 majors and 49 intended majors for a total of 68 students. The high ratio of intended to declared majors 49:19 reflects a number of eligible, but undeclared returning students (~25) and first-year students (~25). The data also suggests that we are only retaining ~58.6% (44 of 75) students beyond the first year.

The data in the table below is based on the current number of majors in the B.S. Biochemistry track with an increase in retention rate to of 2.5% per year (~2 additional students per year) as result of changes in program requirements and intervention strategies along with 3 additional new majors per year (~10%). The degrees conferred in AY 23/24 include students switching from the current Biochemistry track to the new program. The projected growth is a doubling of graduates to ~20

degrees/year over five years relative to our current Biochemistry track. *This estimate includes a net increase in the total number of degrees in chemistry, biology, and biochemistry.* This is not an unrealistic goal as the Biochemistry track had 17 degrees awarded as recently as AY12/13 when there was also 28 other B.S./B.A Chemistry.

b. Project estimated student enrollment and degrees conferred for the first five years of the program.

Academic Year	Degrees Conferred	Majors (Headcount) Fall Semester
23/24	15	72
24/25	16	77
25/26	17	85
26/27	19	93
27/28	21	103

Employer Demand

20. If the program is designed for students to enter the workforce immediately, please complete Appendix A.

Academic Disciplinary Needs

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.

No academic disciplinary changes are required.

D. Cost and Funding

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.

22. Will this program require additional resources? Yes No

If so, please provide a brief summary of new or additional resources that will be needed to implement this program over the next five years.

No new physical facilities are required. The facilities in place to meet the needs of the B.S. Chemistry – Biochemistry track are sufficient to meet the needs of the B.S. Biochemistry program. Funds are also included to update the Biochemistry teaching laboratory to introduce replace aging equipment and purchase state-of-the instrumentation based on projected tuition increases. These costs are independent of the proposed rebranding.

23. Will this program impact existing programs and/or organizational units within your institution? Yes No

If so, please describe the impact. (Examples: reallocation of resources, faculty or staff reassigned, changes to other programs and/or course offerings or other programs, reduction or increase in students served, any other possible impact.)

This is a rebranding of the B.S. Chemistry – Biochemistry track degree program. This track will be eliminated as part of the rebranding. There will be no negative impact on faculty or students; because all courses required for the current Biochemistry track will continue to be offered, no explicit 'teach out' plan is required. Students that began their studies prior to the rebranding will have the option to complete the requirements for the B.S. Chemistry – Biochemistry track degree or seamlessly transfer to the new B.S. Biochemistry degree.

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

CPE Instructions: Note whether the program is predicted to increase retention rates, and, therefore, generate tuition dollars; increase revenue by attracting a new pool of students; meet employment needs in the state; feed into graduate that have been shown to be beneficial to the economic needs of the state, etc. If no new costs are anticipated, please explain.

There are no new costs associated with the proposed program. The proposed costs in this proposal for faculty support and instrumentation are independent of the rebranding and would be required to keep the current program operational. These costs are considered a reallocation of resources from the existing program to the proposed program. The proposed increase in tuition revenue associated with the rebranding would provide revenue to cover these costs.

25.a. Complete the New Program Budget Spreadsheet.

Found at: <http://louisville.edu/oapa/new-academic-program-approval-page/new-academic-program-approval>

Notes for completing the Budget Spreadsheet:

- Provide an estimate of the level of new and existing resources that will be required to implement and sustain the program.
- Any existing resources reallocated to support this new offering should be estimated as an “internal reallocation” in both the Funding Sources and Expenses sections of the budget.
- Any new resources for which the unit/department plans to allocate funding should be listed as an internal “allocation” in the Funding Sources section of the budget.
- The program proposal is to be developed without the expectation of tuition-sharing or recovery agreements with the Provost. This approach ensures that the “cost” of operating the program is somewhat reflective of reality.
- For every place you add numbers (in both the Funding Sources and Expenses spreadsheet) provide a written explanation for the numbers, including how they were calculated. The CPE system won't let us submit the proposal without explanations for the budget numbers.

- The budget for the proposed program is to be in alignment with the latest budget assumptions (provided below as of 10/7/19) from the Budget Model Workgroup.

Undergraduate*

70% (net of mandatory student fees) of resident per credit hour tuition rate (i.e., the listed rate on the bursar's website) charged to undergraduate students is allocated to the academic unit where the instruction takes place. Every credit hour is treated the same under the model.

Graduate/Professional*

Graduate: 75% (net of mandatory student fees) of tuition revenue allocated according to a student's home academic program.

Professional: 85% of tuition revenues generated from professional degree (law, dentistry, medicine) programs allocated to the student's home academic program.

Note: The new budget model will allocate resources to the academic unit based on where the credit hour is instructed. The unit dean will decide how to distribute funds within the college.

*These definitions of the Budget Model are as of 10/7/19 and are subject to change.

- Note that there are three tabs to the Budget spreadsheet.

Funding Sources tab:

- Indicate funding to be supplied by the unit (include direct funding & In-kind support):
- Internal allocation and reallocation are those estimated dollars needed to fund the start-up and support the new academic program – typically defined as faculty, administrative/staff, and operational expenses.
- When calculating funding, consider the impact on current faculty workloads.
- Include the expected tuition revenue generated by anticipated student enrollment.
- If the program will use existing faculty or other existing resources, the amount of funding represented by those resources are to be listed in the Funding Sources table as reallocation of funds.
- If reallocation of “existing” funds are included in the Funding spreadsheet, the numbers should also be reflected in the Expenses spreadsheet.
- If the unit has allocated funds for any new expenses in the Funding Sources spreadsheet, the numbers should also be added to the Expenses spreadsheet.

Expenses tab:

- You do not have to estimate classroom space unless you believe that existing space is not sufficient to support the academic program.
- Any expenses identified as “existing” funds in the expenses spreadsheet should also be added to the Funding Sources spreadsheet as either internal reallocation or internal allocation.

Funding Source/Expenses Combined tab:

- This spreadsheet will pre-populate based upon the numbers entered into the Funding Sources and Expenses spreadsheets. The program must have more funding than expenses.

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

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.

26. Provide a brief description of institutional assessment processes.

The Office of Institutional Effectiveness has prepared an institutional response to this CPE question. Please review the response and edit as needed.

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 completed 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

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

The Office of Institutional Effectiveness has prepared an institutional response to this CPE question. Please review the response and edit as needed.

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.

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

New Academic programs undergo an interim program review after five years for undergraduate programs, four years for masters programs, and three years for doctoral programs. After the interim review, all programs are placed on the university's regular program review schedule.

The program review template requires that programs provide feedback from graduates, alumni, and employers. In your response to this question consider how you will collect satisfaction feedback from these groups.

CPE Instructions: Explain how the program will identify graduate schools and employers and what questions will be asked in order to assess graduate school and/or workforce success.

Tracking alum success will follow the established protocol used by the Department of Chemistry. Upon graduation, most of our majors go to 1) professional school, 2) graduate school, or 3) private sector positions in the chemistry/biochemistry field. The Department of Chemistry hosts an annual Senior Awards Banquet. Prior to that event, graduating seniors are contacted by department academic advisors inquiring about post-graduation plans. Responses are collected and tabulated by the Chemistry Department Director of Undergraduate Studies and disseminated to department faculty. At this time, graduating seniors are also encouraged to join the Department of Chemistry LinkedIn group if they have not already done so. The LinkedIn site was initiated in March 2022 and currently has 61 members. For the program review, we will begin by contacting graduates in the LinkedIn group for current employment information and permission to contact their employers to receive their feedback and to determine their satisfaction with the graduate. We will also use the LinkedIn site to search for program graduates that are not part of our LinkedIn group so that we can request the same information from them and encourage them to join our group. The LinkedIn group also provides a resource to contact alumni of the Chemistry Department that graduated before the programmatic change to collect their feedback on the new B.S. Biochemistry Program. If response through LinkedIn is insufficient for a thorough program review, we will utilize the University Development Office to contact program alumni.

NOTE: All actions in the approval of new programs for public institutions are subject to a stipulation regarding the program's ability to attain specified goals that have been established by the institution and approved by the Council on Postsecondary Education (the Council). At the conclusion of an appropriate period of time, the program's performance shall be reviewed by Council staff following criteria established in the Council's Academic Programs Policy. For more information on the program review process see <http://louisville.edu/oapa/academic-program-review-process>.

Appendix A. Employer Demand.

1. If the program is designed for students to enter the workforce immediately, please complete the following table (see resources below the table)
2. Please provide source of employer demand information and time frame for the projections:

Type of Job	Regional Avg Wage	Regional # of openings	Regional Growth Projections (%)	State Avg Wage	State # of openings	State Growth Projections (%)	National Avg Wage	National # of openings	National Growth Projections (%)
Biological Technicians	44,020	140	7.7	43,150	550	9	48,140	84,300	9
Agriculture and Food Science Technicians*	34,908	30	-2.5	45,540 55,710	190 190	3.2 3.2	44,700	31,600	9
Clinical Laboratory Technologists and Technicians	35,405 (entry)	1,140	8.17	54,350	4,700	947	57,800	329,200	7
Forensic Science Technicians	—	—	—	50	43,870	15	61,930	17,600	11
Chemical Technicians (Chemists in regional)	46,119 (entry)	200	5	53,600†	1,040	4.5	48,990†	60,400	4
Biochemists & Biophysicists	47,309 (entry)	50	—	includes M.S. and PhD	130	6.3	includes M.S. and PhD	37,500	15

Employer Demand Resources:

Most of the current Bureau of Labor Statistics projections are for 2016-2026. If additional sources are used, please note the time frame for the projections. Other sources include:

- [PES+](#) Platform from Gray Associates
- [Bureau of Labor Statistics' Occupational Outlook Handbook](#)
- [Kentucky Center for Statistics](#)
- Kentucky, Bridging the Talent Gap
Document - <https://www.bridgingthetalentgap.org/wp-content/uploads/2017/05/KY-Statewide.pdf>
Interactive website: <https://bridgingthetalentgap.org/dashboards/>