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General Information

Give a brief (1-2 paragraphs) overview of the proposed credential, including its disciplinary foundations and connections, its focus and learning objectives for students, and the specific degree (e.g. bachelors, masters, doctorate) and/or credentials (e.g. major, certificate, minor, concentrations) to be offered. This should be based largely on your descriptions in the following sections, but it should be shorter than their combined length. Moreover, it should use language that is capable of communicating your ideas to audiences increasingly distant from your academic field as your proposal moves through the review process.

We propose a new BS undergraduate degree in bioengineering to capitalize upon substantial new investments being made at the University of Oregon.

Establishment of the Phil and Penny Knight Campus for Accelerating Scientific Impact (Knight Campus) creates a unique moment in time for the University of Oregon. The initial $500 million gift from the Knights, together with additional support from the state, allows the creation of new world class research and teaching facilities. Even more importantly, the Knight Campus is bringing an entirely new group of faculty to the UO campus (five in just the first year of the program), which greatly expands our capacity for teaching in the sciences—particularly within more applied areas of science.

The new executive director of the Knight Campus, Robert Guldberg, was previously the director of one of the top bioengineering research institutes in the country at Georgia Tech. Georgia Tech also has the top-rated bioengineering program at a public US university. The Knight Campus has already hired a number of new bioengineers into its faculty and will continue to do so over the next several years. Together with existing expertise on campus (e.g., the Departments of Biology, Human Physiology, and Chemistry), it is an ideal time to create a new degree program to capture this new talent and translate it into a new growth area for the UO with real-world impacts on the training of our students.

Based in a new program within the College of Arts and Sciences, the bioengineering program curriculum is designed to exemplify the goal of the Knight Campus to engage students in discovery-driven learning. Students will be immersed in problem- and design- based learning, starting in the first quarter they enroll. This will continue with the "Fundamentals of Bioengineering" series during students' sophomore year, where foundational engineering concepts are presented to students through a combination of lectures, small team problem solving, and experimental and design-based lab work in the state-of-the-art educational facilities at the Knight Campus. This hands-on learning approach will continue throughout the upper-division coursework, which integrates multiple bioengineering laboratory courses, a bioengineering design course, and culminates with a senior capstone design series.

Specific courses that constitute the degree program were selected through a combination of ABET accreditation requirements and a comprehensive curriculum survey of top-ranked bioengineering programs in the Pacific Northwest and nationwide. The curriculum is multidisciplinary, featuring extensive coursework in mathematics, chemistry, biology, and physics during the lower division component of the education. This foundation in the natural sciences prepares students for a focused concentration of engineering work at the upper-division level.

Primary Proposer: Mike Hahn

Is there a co-proposer for this proposal?

Name	Home Unit
Jim Hutchison	Knight Campus
Robert Guldberg	Knight Campus

Home department: Bioengineering

College: Arts and Sciences

Additional Department Affiliations: No

Level: Undergraduate

Program Type: Degree

Degree Type: Bachelor of Science

By default, the program will be approved for the Bachelor of Arts and Bachelor of Science. If you are only requesting one of these, please indicate below:

Bachelor of Science

Primary Location: UO main campus

Additional Location(s): No

Program Delivery Format: Traditional classroom/lab

Does the program represent a collaboration of two or more university academic units? No

Proposed Identification

Full Title: Bioengineering

What's your desired effective date? 2021

Relationship to Institutional Mission and Statewide Goals

How is the program connected with the UO's mission, signature strengths and strategic priorities?

A new bioengineering program will leverage the recent investments in research and intellectual capital gained from new faculty to engender an educational impact for the UO and the state of Oregon. This objective is highly aligned with the UO's mission to be "a comprehensive public research university committed to exceptional teaching, discovery, and service". The program will prepare students for success and professional advancement in a critical and fast-growing segment of Oregon's economy. The broad, interdisciplinary education will equip graduating students to participate across a wide range of specialties in the life sciences – e.g. medical devices, pharmaceuticals, imaging, clinical and academic research. The synergy of Knight Campus research and talent with the educational efforts of the proposed program will continue to elevate the UO, its students, and the state of Oregon.

How will the proposal contribute to meeting UO and statewide goals for student access and diversity, quality learning, research, knowledge creation and innovation, and economic and cultural support of Oregon and its communities?

Bioengineering faculty leaders will partner with UO's Division of Equity and Inclusion to implement best practices for advancing access and diversity. Recruitment efforts will focus on building a diverse student body and increasing enrollment of underrepresented and nontraditional students.

The bioengineering program has been developed within the framework of the Knight Campus goal to transform student education through discovery-driven learning. This focus is woven throughout the core curriculum, in which students will engage in real-world design and research problems in the life sciences and explore ethical implications of bioengineering practices and decisions.

Motivated students will have the opportunity to partner with world-class research faculty in the Knight Campus through the Undergraduate Research Opportunity Program and independent research projects.

How will the proposal meet regional or statewide needs and enhance the state's capacity to:
• improve educational attainment in the region;
• respond effectively to social, economic and environmental challenges and opportunities; and
• address civic and cultural demands of citizenship?

Innovation in life sciences has become an important high-growth driver to Oregon's economy. The most recent report commissioned by the Oregon Bioscience Association[1] found that in 2014 the bioscience industry contributed 14,000 jobs to Oregon, an increase of 68% from 2002. Furthermore, these jobs were high paying and diverse. The average annual wage of $67,081 was well over Oregon's average of $52,000[2] and women and minorities accounted for 47% and 22% of employment, respectively.

In addition to job creation, the industry was responsible for bringing nearly $289 million in NIH funding to Oregon institutions in 2015 alone. Thus, while some in the state might raise concerns about potential redundancy across institutions, the state as a whole is best served by capitalizing upon the unique

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[1] See https://www.oregonbio.org/wp-content/uploads/2017/04/2016-Annual-Report.pdf

[2] as reported by the US Bureau of Labor Statistics - May 2018

resources and pool of students available at each university to provide a well-educated workforce that will allow Oregon to operate at the forefront of this rapidly developing area of economic activity.

The Knight Campus is well positioned to harness this growth in life sciences. A strategic component of the Knight Campus vision is to catalyze entrepreneurship and foster the creation and development of new companies arising from university research. The Knight Campus aims to create a synergy of collaborations across multiple institutions throughout the state, establishing Oregon as a life sciences hub that bridges existing centers in the Seattle and Bay areas.

Program Description

Is there a core set of required courses? Yes

What is the core set of required courses and what is the rationale for giving these courses this prominent role? What are the central concepts and/or skills you expect students to take from the core?

The core set of required courses are listed below. The courses in mathematics and the natural sciences provide a foundational framework upon which advanced engineering concepts can be built and are necessary in order for the degree to satisfy ABET accreditation requirements.

Each of the bioengineering courses that are designated as part of the core curriculum have a focus on experiential-, problem- and design- based learning, which is at the heart of the pedagogy for the new degree.

Core Courses:

Math: 251, 252, 253, 256, 343 or MATH/DSCI 345

Chemistry: 221+227 or 224H+237, 222+228 or 225H+238, 223+229 or 226H+239, 331

Physics: 251, 252, 253

Biology: 211 or 281H

CIS 122 or 210 (210 recommended)

Bioengineering Core Courses:

112 – Interdisciplinary Approaches to Bioengineering

113 – Research Methods in Bioengineering

251, 252, 253 - Fundamentals of Bioengineering I, II, III

321, 322 – Bioengineering Lab I, II

421, 422, 423 – Bioengineering Design, Bioengineering Capstone Design I, Bioengineering Capstone Design II

What is the relationship between upper-division courses and the lower-division curriculum? For example, are fundamental principles introduced in the lower division and then applied to increasingly complex problems at the upper-division? This vertical architecture is common in the sciences but is by no means universal. In the humanities, a more horizontal structure is often appropriate. For example, students might read and analyze literature at each level (100-400) but do so with increasing sophistication and the capacity to draw on a widening array of literary forms and ideas.

Upper-division and lower-division courses follow a standard vertical architecture where fundamental principles are introduced in the lower division and then applied to increasingly complex problems at the upper-division

Are there specific course-to-course prerequisites that help students extend or link ideas or are the intellectual connections among courses in your major more general?

The lower-division curriculum relies heavily on specific course-to-course prerequisites, especially within the mathematics, chemistry, and physics series as well as the newly proposed 200-level Fundamentals of Bioengineering series. Upper-division coursework focuses on general intellectual connections and most can be taken in any order once upper-division status is achieved.

Specific prerequisites and course sequences are outlined below.

MATH 251, 252, 253, 256 must be taken in order. MATH 343 must be taken after MATH 252.

CH 221, 222, 223, 331 must be taken in order

PHYS 251, 252, 253 must be taken in order

BI 211 has CH 221 as a prerequisite

BIOE 251, 252, 253 must be taken in order.

BIOE 251 requires that MATH 251 be completed and PHYS 251 be taken concurrently

BIOE 421, 422, 423 must be taken in order

Are there tracks or concentrations within the credential? If so, do these start from a common core or are they differentiated from the beginning?

No tracks or concentrations will be offered at this time. As the program matures, concentrations may develop, particularly within the areas of imaging, biomechanics, cell and tissue engineering, and bioinformatics. Any concentrations that are offered in the future would proceed via usual approval processes.

Course of Study

Describe the course of study – proposed curriculum, including course numbers, titles, and credit hours.

Specific courses and program learning outcomes that constitute the course of study were selected through a combination of ABET accreditation requirements and a comprehensive curriculum survey of top-ranked bioengineering programs in the Pacific Northwest and nationwide.

Major Requirements

Key:

* Should be completed prior to Upper-Division BIOE Status (BIOE 300- or 400-level courses)
399: 300-level course that is yet to be regularized.
410: 400-level course that is yet to be regularized.

Mathematics – 20 Credits

Course #	Course Title	Credits	Prerequisites
*MATH 251	Calculus I	4	MATH 112 or test placement
*MATH 252	Calculus II	4	MATH 251
*MATH 253	Calculus III	4	MATH 252
*MATH 256	Intro to Differential Equations	4	MATH 253
MATH 343 or	Statistical Models and Methods	4	MATH 252
MATH / DSCI 345	Probability and Statistics for Data Science	4	MATH 342, CIS 211

Natural Sciences – 38 Credits

Course #	Course Title	Credits	Prerequisites
*CH 221+227	General Chemistry I + Lab	6	MATH 111 Coreq: 112
-or-			
CH 224+237	Advanced General Chemistry I + Lab		High school chemistry, MATH 112, coreq: one from MATH 241, MATH 246, MATH 251, MATH 261
*CH 222+228	General Chemistry II + Lab	6	CH 221, MATH 112
-or-			
CH 225+238	Advanced General Chemistry II + Lab		CH 221 or CH224H; one from MATH 241, MATH 246, MATH 251, MATH 261; coreq: one from MATH 242, MATH 247, MATH 252, MATH 262
*CH 223+229	General Chemistry III + Lab	6	CH 222, MATH 112
-or-			
CH 226+239	Advanced General Chemistry III + Lab		CH 222 or CH 225H; one from MATH 242, MATH 247, MATH 252, MATH 262 with grades of C- or better. coreq: one from MATH

			243, MATH 247, MATH 253, MATH 263
CH 331	Organic Chemistry I	4	CH 223 or CH226H
*PHYS 251	Foundations of Physics I	4	MATH 112 or equiv. Coreq: MATH 251
*PHYS 252	Foundations of Physics II	4	PHYS 251 Coreq: MATH 252
*PHYS 253	Foundations of Physics III	4	PHYS 252 Coreq: MATH 253
*BI 211	General Biology I: Cells	4	CH 111 or CH 113 or CH 114 or CH 221 or CH 224H
Or			
BI 281H	Honors Biology I: Cells, Biochemistry and Physiology		Prereq: MATH 111 or equivalent with B– or better or minimum AP/IB mathematics score of 4/5, and CH 221, CH 222, CH 223 or CH 224H, CH 225H, CH 226H with B– or better in all courses.

Computer and Information Science – 4 Credits

Course #	Course Title	Credits	Prerequisites
CIS 122	Intro to Programming and Problem Solving	4	MATH 101
-or-			
CIS 210	Computer Science I	4	MATH 112. Prior programming experience strongly encouraged

Bioengineering Core – 36 Credits

Course #	Course Title	Credits	Prerequisites
*BIOE 112	Interdisciplinary Approaches to Bioengineering	2	
*BIOE 113	Research Methods in Bioengineering	2	
*BIOE 251	Fundamentals of Bioengineering I	4	MATH 251, Coreq PHYS 251
*BIOE 252	Fundamentals of Bioengineering II	4	BIOE 251
*BIOE 253	Fundamentals of Bioengineering III	4	BIOE 252
Upper-Division			
BIOE 321	Bioengineering Lab I	4	Upper-Division BIOE Status
BIOE 322	Bioengineering Lab II	4	Upper-Division BIOE Status
BIOE 421	Bioengineering Design I	4	Upper-Division BIOE Status
BIOE 422	Bioengineering Capstone Design I	4	Upper-Division BIOE Status
BIOE 423	Bioengineering Capstone Design II	4	Upper-Division BIOE Status

Bioengineering Electives – Select 32 Credits

Course #	Course Title	Credits	Prerequisites
BIOE 331	Biomaterials	4	Upper-Division BIOE Status
BIOE 332	Biomedical Signals	4	Upper-Division BIOE Status
BIOE 333	Systems in Bioengineering	4	Upper-Division BIOE Status
BIOE 341	Quantitative Physiology	4	Upper-Division BIOE Status
BIOE 342	Quantitative Cell & Molecular Biology	4	Upper-Division BIOE Status
BIOE 399	Biomechanics	4	Upper-Division BIOE Status
BIOE 432	Biomedical Imaging	4	Upper-Division BIOE Status
BIOE 442	Cell and Tissue Engineering	4	Upper-Division BIOE Status
BIOE 454	Biotransport	4	Upper-Division BIOE Status
BIOE 410	Advanced Tissue Engineering	4	Upper-Division BIOE Status
BIOE 410	Bioinstrumentation	4	Upper-Division BIOE Status
BIOE 410	Computational Modeling	4	Upper-Division BIOE Status

Expected Learning Outcomes for Students and Means of Assessment

Principle Learning Outcome (Concept or Skill)	Part of curriculum where this is introduced	Part of curriculum where this is developed	How students demonstrate mastery
Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	BIOE 113 Research Methods in Bioengineering BIOE 251, 252 Fundamentals of Bioengineering I, II	BIOE 253 Fundamentals of Bioengineering III BIOE 331 Biomaterials BIOE 399 Signals BIOE 399 Biomechanics BIOE 399 Cell and Tissue Engineering BIOE 410 Biomedical Imaging BIOE 454 Biotransport	BIOE 410 Computational Modeling BIOE 422 Capstone Design I
Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	BIOE 252 Fundamentals of Bioengineering II BIOE 253 Fundamentals of Bioengineering III	BIOE 399 Cell and Tissue Engineering BIOE 410 Biomedical Imaging BIOE 421 Bioengineering Design I	BIOE 422 Bioengineering Capstone Design I BIOE 423 Bioengineering Capstone Design II
Communicate effectively with a range of audiences.	BIOE 112 Interdisciplinary Approaches to Bioengineering BIOE 113 Research Methods in Bioengineering	BIOE 341 Quantitative Physiology BIOE 421 Bioengineering Design I	BIOE 422 Bioengineering Capstone Design I BIOE 423 Bioengineering Capstone Design II
Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic,	BIOE 112 Interdisciplinary Approaches to Bioengineering BIOE 113 Research Methods in Bioengineering	BIOE 253 Fundamentals of Bioengineering III BIOE 341 Quantitative Physiology BIOE 399 Cell and Tissue Engineering BIOE 421 Bioengineering Design I	BIOE 422 Bioengineering Capstone Design I BIOE 423 Bioengineering Capstone Design II

Principle Learning Outcome (Concept or Skill)	Part of curriculum where this is introduced	Part of curriculum where this is developed	How students demonstrate mastery
environmental, and societal contexts.			
Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	BIOE 112 Interdisciplinary Approaches to Bioengineering BIOE 113 Research Methods in Bioengineering BIOE 252 Fundamentals of Bioengineering II	BIOE 253 Fundamentals of Bioengineering III BIOE 321 Bioengineering Lab I	BIOE 322 Bioengineering Lab 2 BIOE 421 Bioengineering Design I BIOE 422 Bioengineering Capstone Design I BIOE 423 Bioengineering Capstone Design II
Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	BIOE 113 Research Methods in Bioengineering BIOE 252 Fundamentals of Bioengineering II	BIOE 253 Fundamentals of Bioengineering III BIOE 331 Biomaterials BIOE 341 Quantitative Physiology BIOE 342 Quantitative Cell & Molecular Biology BIOE 399 Signals BIOE 399 Biomechanics BIOE 321 Bioengineering Lab I BIOE 410 Bioinstrumentation	BIOE 322 Bioengineering Lab II
Acquire and apply new knowledge as needed, using appropriate learning strategies.	BIOE 113 Research Methods in Bioengineering	BIOE 253 Fundamentals of Bioengineering III BIOE 331 Biomaterials BIOE 341 Quantitative Physiology BIOE 399 Biomechanics BIOE 321 Bioengineering Lab I BIOE 410 Biomedical Imaging	BIOE 322 Bioengineering Lab II BIOE 421 Bioengineering Design I BIOE 422 Bioengineering Capstone Design I BIOE 423 Bioengineering Capstone Design II

Principle Learning Outcome (Concept or Skill)	Part of curriculum where this is introduced	Part of curriculum where this is developed	How students demonstrate mastery
Apply principles of engineering, biology, human physiology, chemistry, calculus-based physics, mathematics (through differential equations) and statistics.	BIOE 251 Fundamentals of Bioengineering I	BIOE 331 Biomaterials BIOE 341 Quantitative Physiology BIOE 342 Quantitative Cell & Molecular Biology BIOE 399 Signals in Bioengineering BIOE 399 Biomechanics BIOE 399 Systems in Bioengineering BIOE 321 Bioengineering Lab I BIOE 399 Cell and Tissue Engineering BIOE 410 Biomedical Imaging BIOE 454 Biotransport	BIOE 410 Computational Modeling BIOE 322 Bioengineering Lab II BIOE 421 Bioengineering Design I BIOE 423 Bioengineering Capstone Design II
Solve bio/biomedical engineering problems, including those associated with the interaction between living and non-living systems.	BIOE 251 Fundamentals of Bioengineering I	BIOE 253 Fundamentals of Bioengineering III BIOE 342 Quantitative Cell & Molecular Biology BIOE 399 Signals in Bioengineering BIOE 399 Systems in Bioengineering BIOE 321 Bioengineering Lab I BIOE 399 Cell and Tissue Engineering BIOE 410 Biomedical Imaging BIOE 410 Bioinstrumentation	BIOE 454 Biotransport BIOE 410 Computational Modeling BIOE 322 Bioengineering Lab II
Analyze, model, design, and realize bio/biomedical engineering devices, systems, components, or processes.	BIOE 251 Fundamentals of Bioengineering I	BIOE 252 Fundamentals of Bioengineering II BIOE 331 Biomaterials BIOE 342 Quantitative Cell & Molecular Biology BIOE 399 Signals in Bioengineering BIOE 410 Biomedical	BIOE 421 Bioengineering Design I

Principle Learning Outcome (Concept or Skill)	Part of curriculum where this is introduced	Part of curriculum where this is developed	How students demonstrate mastery
		Imaging BIOE 410 Bioinstrumentation	
Make measurements on and interpret data from living systems.	BIOE 252 Fundamentals of Bioengineering II	BIOE 253 Fundamentals of Bioengineering III BIOE 342 Quantitative Cell & Molecular Biology BIOE 399 Signals in Bioengineering BIOE 399 Biomechanics BIOE 321 Bioengineering Lab I	BIOE 410 Bioinstrumentation BIOE 410 Computational Modeling BIOE 322 Bioengineering Lab II

If needed, explain particular items in the grid:

N/A

If needed, describe your curriculum map in narrative form, as an alternate to the grid:

N/A

What is the nature and level of research and/or scholarly work expected of program faculty which will be indicators of success in those areas?

Appointments for tenure-track faculty will primarily be within the Knight Campus. As such, TTF will be expected to conduct innovative and impactful research demonstrated through a history of successfully awarded grants, journal publications, and conference presentations.

TTF and NTTF instructors will be expected to deliver high quality, engaging courses, as measured by student course evaluations, success of students, and peer evaluations when appropriate.

Explain the methods by which the learning outcomes will be assessed and used to improve curriculum and instruction.

Attainment of learning outcomes will be assessed through a variety of feedback mechanisms including course examinations, course projects, senior design and capstone projects, and student surveys and interviews. Instructor evaluations and student success will be used to ensure instruction is delivered in a high quality, engaging manner and to identify any areas of instruction needing improvement. Graduating students will also be followed in order to measure success in admission to graduate or professional education or gainful employment.

Accreditation

Is or will the program be accredited?

Yes

Name the accrediting body or professional society that has established standards in the area in which the program lies:

ABET

If accreditation is a goal, identify the steps being taken to achieve accreditation:

The bioengineering program's curriculum has been designed to satisfy the most recent set of ABET requirements (ABET 2020). Eligibility for ABET review and accreditation will occur once the first class of students has graduated. Currently, the bioengineering program is preparing for accreditation review by ensuring that the program's educational objectives, learning outcomes, and degree requirements are congruent with ABET requirements. Additionally, protocols for self-assessment and review and for evaluating the success of students in attaining the student outcomes are under development.

If the program does not or cannot meet those standards, the proposal should identify the areas in which it is deficient and indicate steps needed to qualify the program for accreditation and date by which it would be expected to fully accredited.

N/A

Need for this Credential

What are the expected degrees/certificates over the next five years?

Year 1	Year 2	Year 3	Year 4	Year 5
0	0	0	10	20

What are possible career paths for students who earn this credential? Estimate the prospects for success of graduates in terms of employment, graduate work, licensure, or other professional attainments, as appropriate.

The undergraduate degree in bioengineering will prepare students for success and professional advancement across a wide range of specialties in the life sciences – e.g. medical devices, imaging, pharmaceuticals, and clinical and academic research. Students will also be prepared to pursue graduate education in engineering, the natural sciences, law (especially patent law), and medicine.

Other Similar Programs

Are there similar or related programs currently offered at the University of Oregon?

No, bioengineering will be a new and unique program at UO

Attach your communications showing due diligence in consulting with other UO departments or areas

Please see the attached documentation of our due diligence with the following departments: Physics, Math, Chemistry, Biology, Human Physiology, CIS.

Describe the steps that have been taken to ensure that the proposed program(s) does not overlap other existing UO program(s) or compete for the same population of students. [Provide documentation that relevant departments or areas have been informed of the proposal and have voiced no objections.]

Please see the attached documentation of our due diligence regarding overlap and competition with the following departments: Physics, Math, Chemistry, Biology, Human Physiology.

Program Integration and Collaboration

Are there closely-related programs in other Oregon public or private universities?

Yes

List similar programs and indicate how the proposal complements them. Identify the potential for new collaboration.

Oregon State University offers BA, BS, HBA, and HBS degrees in bioengineering through their Chemical, Biological, and Environmental Engineering department.

Portland State University offers a BSME (Bachelor of Science in Mechanical Engineering) degree. The Mechanical Engineering Department has a research focus in biomaterials

OHSU offers a PhD in biomedical engineering through their School of Medicine.

Plans for the new UO degree have been developed in direct communication with deans and provosts at OSU, PSU, and OHSU. All agree that now is an opportune moment to grow strength in the area across the state, as each university has its own unique emphasis area within the broad field of bioengineering. Developing this degree at the University of Oregon is the first step of what is hoped to be a broader collaborative effort of multiple institutions across the state.

If applicable, explain why collaborating with institutions with existing similar programs would not take place.

N/A

Describe the potential for impact on other institution's programs.

The bioengineering program at the University of Oregon is expected to contribute to statewide efforts to increase Oregon's capabilities in applied life sciences. The program has been developed with a focus on areas of bioengineering that are complimentary to existing programs, rather than competitive and is therefore not expected to negatively impact other institution's programs.

Document your due diligence in consulting with other Oregon institutions.

Please see attached PDF of a proposal to the Oregon Provost's Council.

If the program's location is shared with another similar Oregon public university program, provide externally validated evidence of need.

N/A

Attach Corroborating Documentation:

N/A

Resources

List any additional faculty who will have a role in this this program as a result of the change(s), indicating those who will have leadership and/or coordinating roles. For each individual, indicate status with respect to tenure track (TT or NTT), rank, and full-time or part-time.

Because of the unique opportunity that this degree represents, the overall process departs slightly from the regular cycle. Many of the leadership and instructional roles involved in growing and sustaining the program will be filled by faculty that are part of current and future searches within the Knight Campus. Because faculty lines within the Knight Campus are self-funded, fulfilling the commitment to faculty recruitment is independent of other university constraints that may or may not emerge over the next several years. Thus, the path towards the degree is secure.

Initial Knight Campus faculty searches have been highly successful, resulting in three tenure track hires that will add to the scholarship and instructional capabilities of the bioengineering program. Dr. Tim Gardner (TT - associate professor), was previously a biology and biomedical engineering faculty member at Boston University. Dr. Keat Ghee Ong (TT – full professor), was previously the Portage Health Foundation Endowed Professor and Associate Chair of the Department of Biomedical Engineering at Michigan Technological University. Dr. Marian Hettiaratchi (TT – Assistant), will join in January 2020. She just completed a post-doctoral fellowship at the University of Toronto. Additional hiring is expected to continue at a rate of one to three tenure track faculty per year until approximately thirteen faculty are in place. As this process develops, NTTF lecturers can fill any programmatic gaps that might exist during the hiring process.

The bioengineering program is in an unusual situation in that it needs to establish an academic program before many of its core TTF are appointed. Therefore, a task force has been established to lead the initiative until such time as faculty and supporting administration are in place. The task force members are:

Robert Guldberg, Vice President and Robert and Leona DeArmond Executive Director for the Knight Campus

Patrick Phillips, Provost and Senior Vice President, Professor of Biology

Mike Hahn, Associate Professor of Human Physiology

Jim Hutchison, Associate Vice President and Lokey-Harrington Chair in the Department of Chemistry and Biochemistry

Nathan Jacobs, Curriculum Director ProTem

Describe how students will be advised in the new program.

The bioengineering program will follow the CAS-wide integration with Tykeson Hall advising. Additional advising support will be provided by the program through allocation of faculty FTE. As the program grows, the FTE allotment will be adjusted as needed to meet the needs of the students in the program. It is anticipated that as the program reaches full-scale (7-10 years), a dedicated advisor (1.0 FTE) will be provided by the program.

Additional Staffing and Needs/Resources

What other additional staff are needed to support this program?

Initial staff needs are expected to be minimal, as the program will start with small cohorts of students (15-25) and maintain controlled, stable growth until steady-state is reached. The table below outlines the current best projection of the year-by-year anticipated enrollment, program size, courses taught, and faculty and staffing needs from program launch (2021) until steady-state is reached (2025-2026). These figures are estimates and may change as the program evolves over time.

	Bioengineering Program Startup Projections				
	Year 1 2021-2022	Year 2 2022-2023	Year 3 2023-2024	Year 4 2024-2025	Year 5 2025-2026
Expected enrollment	15-25	40-50	50-75	75-100	100-125
Total students in the program	15-25	50-70	85-125	140-200	200-265
Which Program courses will be offered (BIOE)	112,113	112,113 251, 252,253	112, 113 251, 252, 253 321, 322 5 electives	112,113 251, 252,253 321,322 421,422,423 8 electives	112,113 251, 252,253 321,322 421,422,423 10 electives
Total # BIOE courses offered	2	5	12	18	20
Permanent faculty affiliated with program on campus	3	4	7	10	13
# Courses taught via bioengineering affiliated TTF	3	4	7	10	13
# Courses taught via NTTF Instruction	0	1	5	8	7
Student Program Manager/Advisor (FTE)	0.25	1	1	1	1
Program administration (FTE)*	2	3	4	5	5

* We have grouped the following roles under the label "Program administration (FTE)": student recruiter, business manager, administrative assistant, lab manager, and teaching lab preparator.

Are special facilities, equipment, or other resources required because of the change (e.g., unusual library resources, digital media support, etc.

The main facilities that will be needed to support the program are active learning classrooms and scientific teaching laboratories. Initially, the program will utilize spaces designated for the Knight Campus Internship Program (KCIP). These spaces are heavily utilized during the summer but are able to accommodate BIOE usage during fall, winter, and spring terms. As the program grows, facility usage may overflow into non-KCIP designated space, as needed. Details of Knight Campus facilities that will be available to the bioengineering program are outlined below.

If the program is highly successful and it becomes clear that program needs will eventually exceed the available capacity of current facilities, new educational and laboratory spaces will need to be built. Based upon the projected program launch date, small initial cohorts of incoming students, and the fact that bioengineering-specific labs are not taught in the first two years, the currently available space should satisfy needs through at least 2025.

Knight Campus facilities that will be available from summer 2020:

- Seminar room – 2900 NSF
- Three KCIP designated classrooms: 965NSF each
- Three additional classrooms (not designated to KCIP): 965 NSF each
- Three instructional laboratories = 4,000 NSF
- Three instructional lab support spaces = 1200 NSF

Attach your communication(s) showing due diligence in consulting with UO Libraries and any other resource area effected by the new program.

Correspondence with UO Libraries is documented in the Undergraduate Council feedback attached with this proposal.

Financial Sustainability

What financial resources are needed to support this proposal? Identify the resources currently available as part of existing UO programs or reallocations within existing budgets. Are additional resources needed?

Initial investments will be required to support the startup phase of the program. In particular, FTE for program administration, advising, and NTTF instruction will be necessary. Estimates of the FTE needed from startup through the 2025-2026 academic year are enumerated in the "Bioengineering Program Startup Projections" table above. As the program reaches steady-state, it is expected that these costs will be covered through tuition-return.

Provide a plan that shows how long-term financial viability of the program is to be achieved, addressing anticipated sources of funds, the ability to recruit and retain faculty, and plans for assuring adequate library support over the long term. (This is a header, no text needed)

Business Plan Description

The bioengineering program provides a unique mechanism to harness the significant philanthropic and statewide investments in the Knight Campus and across the UO. The program will leverage existing Knight Campus investments in bioengineering faculty who can contribute to the required undergraduate instruction. Additionally, the program will utilize Knight Campus facilities to provide instructional space and support. At steady-state, tuition-return will provide support towards remaining program needs, including administrational FTE and NTTF instruction.

Importantly, the program will recruit new students to the UO. This is expected to create a positive financial impact that will be spread across the university. More than 60% of credits will be taken outside of bioengineering, driving resources to other units.

We anticipate that several departments that will provide foundational instruction to bioengineering students, such as chemistry, biology, math, physics, and CIS, will require additional resources such as GE support to accommodate increased student enrollment.

Describe your plans for development and maintenance of unique resources (buildings, laboratories, technology) necessary to offer a quality program.

As noted above, the program is expected to enroll small initial cohorts and maintain controlled, stable growth. During this phase, no unique resources will need to be developed. If the program is highly successful and program needs exceed the available capacity of current facilities, new interactive educational and laboratory spaces will need to be built. The need for these types of space is expected to be shared amongst several UO initiatives and will likely converge with overall long-term university priorities.

What is the targeted student/faculty ratio? (student FTE divided by faculty FTE)

Bioengineering is a unique discipline as lower-division work consists largely of interdisciplinary studies in mathematics and the natural sciences. At the upper-division level, students will mainly enroll in bioengineering courses. The program expects to maintain 13 faculty FTE for approximately 150-200 upper-division students, roughly a 15/1 ratio.

What are the resources to be devoted to student recruitment?

The bioengineering program will work with Student Services and Enrollment Management and the UO Office of Admissions and Financial Aid to coordinate student recruitment efforts.

Attach supporting documentation for financial sustainability.

N/A

If grant funds are required to launch the program, what does the institution propose to do with the program upon termination of the grant?

N/A

Other Program Characteristics

Must courses be taken for a letter grade and/or passed with a minimum grade to count toward the proposed major? If so, please list the courses and the requirements of each. Although there is variation in detail, UO majors typically require that most of the courses be taken for a letter grade (not "pass/no pass") and that the grade be C- or better.

All courses taken to satisfy the bioengineering major requirements must be taken for a letter grade and passed with a grade of C- or better.

How much course overlap will be allowed to count toward both the major and some other credential a student might be earning (a minor, certificate, or another major)? If there are specific credentials with overlap limits, please list those and the limits.

There are no course overlap restrictions.

Does your proposal call for new courses, or conversion of experimental courses into permanent courses? If so, please list courses in the text box below and indicate when they will be submitted to UOCC for approval:

New courses are listed below, separated into lower-division and upper-division status. All of the new lower-division courses are currently submitted for review with the CAS Curriculum Committee (CASCC) and/or UO Committee on Courses (UOCC). The upper-division curriculum consists of 4 courses that are currently submitted for review, 10 courses that have been initiated in CourseLeaf but not sent for committee review, and 3 courses that will be developed during the 2019-2020 AY. The 5 upper-division BIOE Core courses (BIOE 321, 322, 421, 422, 423) will initially be offered as experimental and regularized after two cohorts have completed them. Please note, upper-division courses will not be offered until Fall 2023.

Lower-Division

BIOE 112	Interdisciplinary Approaches to Bioengineering – In CASCC/UOCC review
BIOE 113	Research Methods in Bioengineering – In CASCC/UOCC review
BIOE 251	Fundamentals of Bioengineering I – In CASCC/UOCC review
BIOE 252	Fundamentals of Bioengineering II – In CASCC/UOCC review
BIOE 253	Fundamentals of Bioengineering III – In CASCC/UOCC review

Upper-Division

Note: upper-division courses will not be taught until the Fall 2023 term.

BIOE 321	Bioengineering Lab I – Placeholder created in CourseLeaf – this course will initially be offered as experimental then regularized
BIOE 322	Bioengineering Lab II – Placeholder created in CourseLeaf – this course will initially be offered as experimental then regularized
BIOE 331	Biomaterials – In CASCC/UOCC review

BIOE 332	Biomedical Signals – placeholder created in CourseLeaf - submission planned 2019-2020 AY
BIOE 333	Systems in Bioengineering – placeholder created in CourseLeaf - submission planned 2019-2020 AY
BIOE 341	Quantitative Physiology – In CASCC/UOCC review
BIOE 342	Quantitative Cell Biology – In CASCC/UOCC review
BIOE 421	Design I – Placeholder created in CourseLeaf – this course will initially be offered as experimental then regularized
BIOE 422	Capstone Design I – Placeholder created in CourseLeaf – this course will initially be offered as experimental then regularized
BIOE 423	Capstone Design II – Placeholder created in CourseLeaf – this course will initially be offered as experimental then regularized
BIOE 432	Biomedical Imaging – placeholder created in CourseLeaf - submission planned 2019-2020 AY
BIOE 442	Cell and Tissue Engineering – placeholder created in CourseLeaf - submission planned 2019-2020 AY
BIOE 454	Biotransport – In CASCC/UOCC review
BIOE 410	Advanced Tissue Engineering – submission planned 2019-2020 AY
BIOE 410	Bioinstrumentation – submission planned 2019-2020 AY
BIOE 410	Computational Modeling – submission planned 2019-2020 AY

Will admission to the program be limited?

Yes

Maximum enrollment:

400 (including pre-majors). Approximately 75-100 students per year will be admitted into the upper-division / "full-major") portion of the program.

Will students be required to apply for entry to this program?

Yes

What are the conditions for admission?

Students will be required to apply for entry to the program. Students must be admitted to the program in order to enroll in 300- and 400- level bioengineering courses. Lower-division courses will be open to all students that satisfy the individual course prerequisites.

There will be two admission pathways into the bioengineering program: direct admission and upper-division application. Direct admission will be available to incoming freshman students with outstanding high school academic records. Upper-division application will be available to students following completion of Math 253, Chem 223, PHYS 252 and BIOE 252. This will typically be spring of their sophomore year.

In order to provide the best access to the bioengineering program for as many students as possible, we plan to delay the adoption of direct admissions for freshmen until the program reaches a capacity-constrained state. At program launch, we desire to implement a program admission model that emulates the current College of Business pre-major model (students apply for full major status after completing a specific set of prerequisite courses and have completed around 90 total credits). We feel confident this model will be possible to implement from a Registrar standpoint as it currently exists at the UO. We plan to initiate conversations with the Registrar's office in the near future regarding the details of applying this type of pre-major option, as well as to inquire about the feasibility of a freshman direct admission process should the need arise.

We want to highlight that the freshman direct admission approach is not intended to be used as an exclusionary tool. Rather, it is meant to provide an assurance to freshman applicants that, should they decide to enroll at UO, they will be guaranteed a place in the bioengineering program and can earn a bioengineering degree as long as they remain academically qualified. This is likely to be of particular importance at UO, where alternative engineering programs are not available for a student to transition into if they are not accepted into the bioengineering program during the sophomore application window.

Additional Requirements (Will Appear in Catalog)

All courses counted towards the Bioengineering Major requirements must be taken for a letter grade and passed with a grade of C- or better.

Please describe admission procedures (Will Appear in Catalog)

Freshman applicants who meet UO admissions criteria and who list bioengineering as their first-choice major on their application will automatically be considered for Direct admission.

Upper-division applicants must have completed at least four quarters of equivalent college-level coursework, including Math 253, Chem 223, PHYS 252 and BIOE 252 and be on track to begin upper-division department curriculum in the fall quarter of their junior year. Applications (available from the program) can be submitted during spring term of the application year up until the 10^{th} week of the term. Admission decision will be based on GPA, average GPA in prerequisite bioengineering courses, letters of recommendation, and personal statement.

Residency Requirements (Will Appear in Catalog)

At least 34 credits of coursework applied to the major must be taken at the University of Oregon. The following courses must be completed at the University of Oregon and may count towards the 34-credit requirement:

BIOE 321 Bioengineering Lab I

BIOE 322 Bioengineering Lab II

BIOE 421 BIOE Design I

BIOE 422 BIOE Capstone Design I

BIOE 423 BIOE Capstone Design II