

The UNC Policy Manual
400.1.1.3[G]
Adopted 05/23/12¹

APPENDIX A

UNIVERSITY OF NORTH CAROLINA REQUEST FOR AUTHORIZATION TO PLAN A NEW DEGREE PROGRAM

THE PURPOSE OF ACADEMIC PROGRAM PLANNING: Planning a new academic degree program provides an opportunity for an institution to make the case for need and demand and for its ability to offer a quality program. The notification and planning activity to follow do not guarantee that authorization to establish will be granted.

Date: August 27, 2013

Constituent Institution:

University of North Carolina at Chapel Hill, College of Arts and Sciences

CIP Discipline Specialty Title:

Biomedical Engineering

CIP Discipline Specialty Number: 14.0541 Level: B X M _____ 1st Prof _____ D _____

Exact Title of the Proposed Program: Bachelor of Science in Biomedical and Health Sciences Engineering

Exact Degree Abbreviation (e.g. B.S., B.A., M.A., M.S., Ed.D., Ph.D.): B.S.

Does the proposed program constitute a substantive change as defined by SACS? Yes _____ No X

The current SACS Substantive Change Policy Statement may be viewed at:
<http://www.sacscoc.org/pdf/081705/Substantive%20Change%20policy.pdf>

If yes, please briefly explain.

Proposed date to establish degree: Month July Year 2015

1. Describe the proposed new degree program. The description should include:
 - a. a brief description of the program and a statement of educational objectives
 - b. the relationship of the proposed new program to the institutional mission
 - c. the relationship of the proposed new program to existing programs at the institution and to the institution's strategic plan
 - d. special features or conditions that make the institution a desirable, unique, or cost effective place to initiate such a degree program

¹This Appendix A supersedes the preceding Appendix A entitled, "Notification of Intent to Plan a New Baccalaureate or Master's Program," adopted May 6, 2009.

Description of the Proposed Degree Program:

The UNC/NCSU Joint Department of Biomedical Engineering (spanning the University of North Carolina at Chapel Hill (UNC-Chapel Hill) and North Carolina State University (NCSU)) proposes to create a B.S. degree in Biomedical and Health Sciences Engineering based at UNC-Chapel Hill. For simplicity, we refer to this as B.S. in BME for the rest of this document. The proposed degree is a continuation of the Biomedical Engineering track in the Curriculum in Applied Sciences and Engineering. This track has been in place at UNC-Chapel Hill since 1999 and was incorporated into the UNC/NCSU Joint Department of Biomedical Engineering on July 1, 2013. The Biomedical Engineering (BME) track has developed into a robust program. It continues to grow each year. From 2007-2012, the number of first year students in this track increased from 37 to 78 students.

As a discipline at the bachelor degree level, biomedical engineering has a strong and growing identity nationwide. There are currently 87 accredited programs around the country, and that number increases each year. In most cases, these B.S. BME degrees are offered within a standing BME department.

The UNC/NCSU Joint Department of Biomedical Engineering was launched in 2003, and was initially housed within the School of Medicine at UNC-Chapel Hill and the College of Engineering at NCSU. Since July 2013, the BME Department has also been housed in a third entity, the College of Arts & Sciences at UNC-Chapel Hill. Currently the BME Department supports a joint BME graduate degree program (MS, PhD) at UNC-Chapel Hill and NCSU, an ABET-accredited undergraduate program at NCSU offering a B.S. in BME, and an undergraduate curriculum at UNC-Chapel Hill offering a B.S. in Applied Sciences and Engineering (BME track).

With the UNC/NCSU BME Department spanning into the College of Arts and Sciences at UNC-Chapel Hill and assuming responsibility for the operation of its undergraduate program, this is an ideal time to transition the BME track to a B.S. degree within our Joint UNC/NCSU Department. In collaboration with the NCSU College of Engineering, the BME Department will also pursue accreditation of this degree program in 2016 from the Accreditation Board for Engineering and Technology (ABET) when the NCSU College of Engineering takes its full roster of programs through ABET accreditation. Accreditation by ABET provides “proof that a collegiate program has met certain standards necessary to produce graduates who are ready to enter their professions.” (<http://www.abet.org/why-accreditation-matters/>). Graduation from an ABET-accredited program is a prerequisite for employment by a large percentage of companies hiring biomedical engineers.

The BME track leading to the Applied Sciences degree at UNC-Chapel Hill has been ongoing for more than a decade. It has been supported by the Joint Department with a full roster of courses including laboratories (described below) and has had an increasing enrollment over this period. The proposed change in the degree, from a “track” to a stand-alone B.S. Degree program, entails no change in degree requirements, nor any additional courses, faculty, facilities or resources. While the program is constantly evolving, as is any engineering program, we are not proposing any substantive changes to the existing program at the current time. In the future, the UNC/NCSU Joint Department of Biomedical Engineering will seek to combine the two undergraduate BS programs (NCSU and UNC-Chapel Hill) into a single joint ABET accredited program. Granting of the BS degree in Biomedical and Health Sciences Engineering is viewed as a necessary first step in this process. Immediate fusion of the two undergraduate programs is not deemed feasible at present due to differences in the degree granted as well the current lack of ABET-accreditation for the program based at UNC-Chapel Hill.

A. Brief description of the program and statement of educational objectives.

In the biomedical engineering track, students learn to apply engineering principles to solve medical and biological problems. This is a discipline of great breadth that incorporates the fields of medical imaging, informatics, prosthetics, medical devices, tissue engineering and genomics, and applications of signal processing and control. Due to the rapid advances in the fields of medicine and technology, the

curriculum in biomedical engineering must necessarily be flexible and responsive to the changing needs of the community.

The curriculum, as for all sciences, is vertically structured, with experience and knowledge from each course serving as a foundation for subsequent courses. The first two years of study have many courses in common with B.S. programs in chemistry, physics, computer science, and mathematical sciences. In the last two years, students take advanced engineering courses in a variety of fields, and four elective courses in biomedical engineering. A unique aspect of our curriculum is a four course design sequence, taken during the last three years. This sequence culminates in a capstone design experience, in which the students develop custom technology for a clinic. The specific requirements are listed below in a year-by-year curriculum plan.

The educational objectives for Bachelor of Science in Biomedical and Health Sciences Engineering program are:

1. Our graduates will be prepared to pursue advanced studies in biomedical engineering or in other disciplines.
2. Our graduates will meet or exceed the expectations of their employers in the biomedical engineering workplace, or in other professional careers.
3. Our graduates will continue to learn and to adapt to evolving technology and changing career opportunities.

The courses for the new degree will be the same as those currently required for the BME track. A template course outline that allows completion of the degree within four academic years is shown below:

First two years

Fall:

APPL	160	Statics	3
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Spring:

APPL	150	Introduction to Material Sciences	3
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Either semester, or in the summer:

*APPL	210	BME Design and Manufacturing I	2
BIOL	101, 101L	Principles of Biology with Lab	4
BIOL	202	Molecular Biology and Genetics	4
CHEM	101, 101L	General Chemistry I and Lab	4
CHEM	102, 102L	General Descriptive Chemistry II and Lab	4
*COMP		Introductory Programming Elective (COMP 116 highly recommended, but you can choose from COMP 110, 116, 401, or PHYS 331)	3
ENGL	105 / 105i	English Composition and Rhetoric	3
		Foreign Language 3	3
MATH	231	Calculus of Functions of One Variable	3
MATH	232	Calculus of Functions of One Variable II	3
MATH	233	Calculus of Functions of Several Variables	3
*MATH	383	Linear Algebra and Differential Equations	3
PHYS	116	Mechanics	4
*PHYS	117	Electromagnetism and Optics	4
		Approaches class #1 (note #1)	3
		Approaches class #2 (note #1)	3

Approaches class #3 (note #1)	3
Lifetime Fitness	1

* It is particularly important to finish these classes in the first two years, as they are pre-requisites for several courses taken in the junior year.

Junior year

Fall:

MATH 528	Engineering Mathematics	3
PHYS 351	Introductory Electronics	4

Spring:

PHYS 352	Introductory Electronics II	4
APPL 465	Instrumentation, Undergrad Section	4
APPL 410	Signals and Systems	4

Either semester:

APPL 310	BME Design and Manufacturing II	2
BIOL 252	Fund. Of Hum. Anatomy and Physiol.	4
	BME Specialty Elective 1	3
	Approaches class #4 (note #1)	3

Senior year

Fall:

APPL 697	Senior Design Project	2
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Spring:

APPL 698	Senior Design Project	4
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Courses available either semester:

Choose one of the following (take more than one, and it counts as one of your BME electives):

APPL 341 Thermodynamics (fall)	3
BMME xxx Biofluid Mechanics (fall)	3
BMME xxx Transport Processes (spring)	3

You must take each of the following courses:

BME Specialty Elective 2	3
BME Specialty Elective 3	3
BME Specialty Elective 4	3
Statistics Elective (choose from STOR 435, 455 or BIOS 600)	3
Approaches class #5 (note #1)	3
Approaches class #6 (note #1)	3

Notes:

1. The 6 Approaches classes must satisfy all UNC-Chapel Hill General Education requirements in Social and Behavioral Sciences and Humanities/Fine Arts (the Physical and Life Sciences requirements will be satisfied by the other required courses in BME)
2. If you have completed prerequisites, you may take any class earlier than what is recommended here

BME electives offered fall (this list is subject to change):

BMME xxx: Biotechnology (Macdonald)
BMME xxx: Systems Neurosciences (Tommerdahl)
BMME 510 Biomaterials (Banes)
BMME 550 Medical Imaging (enrollment is limited, contact Dr. Gallippi)
BMME 580 Microcontroller Applications I (Goldberg)
PHYS 405 Biological Physics (Superfine)
PHYS 660 Fluid dynamics

BME electives offered spring (this list is subject to change):

APPL 450 Linear Control Systems (Favorov)
BMME 505 Biomechanics
BMME 490-030 Tissue Engineering (Macdonald)
BMME 490-050 Analytical Microscopy (Taylor)
CHEM 449 Microfabricated Chemical Measurement Systems
CHEM 441 Intermediate Analytical Chemistry
COMP 590-099 Introduction to Robotics (Alterovitz)

(note: the “xxx” for some course numbers is due to the fact that these existing courses have been recently submitted for approval with new course numbers)

B. The relationship of the proposed new program to the institutional mission and how the program fits into the institution's strategic plan and its response to UNC Tomorrow.

Since the UNC/NCSU Joint Department of Biomedical Engineering spans both the University of North Carolina at Chapel Hill and the North Carolina State University, the Department and its programs abide by the mission statement of both Universities.

The UNC-Chapel Hill **Mission** Statement is as follows (<http://www.unc.edu/ugradbulletin/mission.html>):

The University of North Carolina at Chapel Hill, the nation's first public university, serves North Carolina, the United States, and the world through teaching, research, and public service. We embrace an unwavering commitment to excellence as one of the world's great research universities.

Our mission is to serve as a center for research, scholarship, and creativity and to teach a diverse community of undergraduate, graduate, and professional students to become the next generation of leaders. Through the efforts of our exceptional faculty and staff, and with generous support from North Carolina's citizens, we invest our knowledge and resources to enhance access to learning and to foster the success and prosperity of each rising generation. We also extend knowledge-based services and other resources of the University to the citizens of North Carolina and their institutions to enhance the quality of life for all people in the State.

The NCSU **Mission** Statement is as follows (<http://upa.ncsu.edu/univ/miss>):

As a research-extensive land-grant university, North Carolina State University is dedicated to excellent teaching, the creation and application of knowledge, and engagement with public and private partners. By uniting our strength in science and technology with a commitment to excellence in a comprehensive range of disciplines, NC State promotes an integrated approach to problem solving that transforms lives and provides leadership for social, economic, and technological development across North Carolina and around the world.

The **Mission** of the UNC/NCSU Joint Department of Biomedical Engineering is:

Combine engineering and medicine to improve lives.

The new Bachelor of Science in Biomedical and Health Sciences Engineering will fit into the mission of the Department and the universities, in that this program will teach a diverse community of undergraduate students to become a next generation of leaders in the advancement of biomedical technologies to save lives in North Carolina, the USA, and throughout the world.

The **UNC-Chapel Hill Strategic Plan** specifically mentions biomedical engineering as a future focus area for investment. The plan specifically emphasizes pharmacoengineering, which is the newest of the five research strengths of the BME Department, and a collaboration with the UNC-Chapel Hill School of Pharmacy. Specifically, “Targeted investment in pharmacoengineering within the UNC system will build on the success of medicine and life science at UNC-Chapel Hill and engineering at NC State, and will leverage the success of the existing joint Department of Biomedical Engineering between those institutions. This investment will be focused on building collaborations among UNC-Chapel Hill’s Schools of Medicine and Pharmacy, and its College of Arts and Sciences, and NC State’s Colleges of Engineering, Agriculture and Life Sciences, Science, and Veterinary Medicine, as well as with private companies and nonprofits such as the NC Biotechnology Center.”(1) The new Bachelor of Science in Biomedical and Health Sciences Engineering degree will thus integrate precisely with the UNC-Chapel Hill Strategic Plan.

The **UNC-Chapel Hill Strategic Plan** also speaks to maximizing efficiencies and coordination between universities as Goal 4. By incorporating this degree within the UNC/NCSU Joint Department of Biomedical Engineering, significant efficiencies are created from the partnership between UNC-Chapel Hill and NCSU. The know-how, resources, and facilities within the combined Department can be brought to bear for curricula development as well as research and training experiences for the students without unnecessary duplication between the two universities. The Department is well positioned to develop synergistic experiences and programs for the undergraduates taking advantage of the best opportunities at both UNC-Chapel Hill and NCSU. The UNC/NCSU Joint Department of Biomedical Engineering is an exemplary collaborative effort between UNC-Chapel Hill and NCSU, and is well positioned to serve as a model for future cooperative efforts between North Carolina’s universities.

The new Bachelor of Science in Biomedical and Health Sciences Engineering is also directly in harmony with **UNC Tomorrow**. Specifically, the UNC Tomorrow plan states that:

4.4.1 “UNC should increase its capacity and commitment to respond and to lead economic transformation and community development.” And that UNC should “promote and educate communities and students in entrepreneurship and innovation to ensure that they can adjust to and compete in the knowledge-based global economy.”

Biomedical and Health Sciences Engineering is a highly entrepreneurial and innovative field. Current BME core faculty have been involved in 22 startup companies, and impart this experience to their students. The design series of classes, part of the Bachelor of Science in Biomedical and Health Sciences Engineering curriculum, are specifically structured around innovation, and promote entrepreneurship. These classes often lead to invention disclosures, and have led to several startup companies organized by the students themselves!

4.5.1 “UNC should lead in improving health and wellness in North Carolina” and UNC should “prioritize programs and interventions in UNCH’s healthcare systems...”

Biomedical and Health Sciences Engineers focus on applying engineering principles to medicine, improving healthcare in North Carolina – a clearly stated goal of **UNC Tomorrow**.

5.7 “UNC should encourage and facilitate interdisciplinary and inter-institutional collaboration among its institutions”.

As stated above, the B.S. in Biomedical and Health Sciences Engineering will be within the Joint UNC/NCSU Department of Biomedical Engineering, a unique inter-institutional and interdisciplinary collaboration between UNC-Chapel Hill and NC State University. As stated below a future goal for the Department is a combined NCSU/UNC undergraduate program in biomedical engineering. This application represents the first step in that process fulfilling goal 5.7 in **UNC Tomorrow**.

References

1) UNC Strategic Directions 2013-2018.

http://www.northcarolina.edu/strategic_direction/STRATEGIC_DIRECTIONS_2013-2018.pdf

C. The relationship of the proposed new program to other existing programs at the institution.

The field of biomedical engineering is concerned with the application of engineering principles to develop technologies and materials that enhance human health and health care. The BME curriculum does have some overlap with curricula in biology, chemistry, physics and mathematics, mostly at the introductory level with classes typically taken by first and second year students. For example, the BME curriculum has students taking core course sequences in biology, chemistry, physics, computer science, and mathematics.

As an engineering discipline, however, BME is distinct from the natural sciences in its emphasis on design and development of systems that have applications in medicine and biology. This specialization is accomplished partially through a set of four design courses in the curriculum. We also have design projects integrated in other courses throughout the curriculum, all with applications in medicine and biology. Finally, the BME degree demands a more rigorous and comprehensive mathematical background than the biological and chemical sciences, and a more extensive biological, medical, electrical circuit and materials background than the physics and mathematical sciences.

The only other engineering degree offered at UNC-Chapel Hill is in the Department of Environmental Sciences and Engineering. That program is distinct from BME, as there is little overlap between these fields.

D. Special features or conditions that make the institution a desirable, unique, or appropriate place to initiate such a degree program.

The inter-disciplinary and inter-institutional collaboration characterizing the joint BME Department is a model for responding to the need to provide highly trained biomedical engineers, to develop innovative research, and to commercialize cutting-edge technologies. The Department is deeply dedicated to its mission of excellence in teaching and research and continues to grow its national and international leadership in these areas. The Department's broad focus areas encompass 1) *Biomedical Microdevices*, including biomedical sensors and assay devices; 2) *Biomedical Imaging*, including ultrasound, CT, and MRI; 3) *Rehabilitation Engineering*, including gait analysis and stroke recovery; 4) *Pharmaco-engineering*, an emerging discipline focused on micro- and nanotechnologies for drug delivery; and 5) *Regenerative Medicine*, replacement of human organs and tissues. These areas are on the cutting edge of biomedical engineering and leverage the combined strengths of the three institutions collaborating in this cooperative endeavor to provide rich and extensive educational and research opportunities for undergraduates pursuing a BME degree. Based on the most recent national rankings of the U.S. News and World Report, the three schools rank highly among their peers as follows: UNC-Chapel Hill School of Medicine #22, NCSU College of Engineering #29, and UNC-Chapel Hill College of Arts & Sciences #30. While these entities are strong individually, they grow in strength in their collaboration. By virtue of the

diversity and stature of the combined faculty and the extent of capital resources, the Department is able to offer its undergraduates in-depth exposures in various fields of biomedical engineering *via* its position as a bridge across the UNC-Chapel Hill College of Arts and Sciences, the NCSU College of Engineering, and the UNC-Chapel Hill School of Medicine. The Joint UNC/NCSU Department by virtue of its positioning across all three entities will also be in a unique position to take the next step in creating a combined NCSU/UNC undergraduate program in biomedical engineering. This future combined endeavor will dramatically enhance the perception and standing of the BME Department and undergraduate program in the eyes of students, parents, alumni, and faculty.

2. *Provide documentation of student demand and evidence of the proposed program's responsiveness to the needs of the region, state, or nation.*

Biomedical engineers use engineering expertise to analyze and solve problems in biology and medicine with the goal of providing an overall enhancement in health care. A biomedical engineer often works with other health care professions, such as physicians, nurses, therapists, and technicians to design instruments, devices, and software, to bring together knowledge from many technical sources to develop new procedures or to conduct research needed to solve clinical problems. According to the Biomedical Engineering Society (BMES), many students choose the biomedical engineering field to be of service to people, to partake of the excitement of working with living systems, and to apply advanced technology to the complex problems of medical care.

The United States Department of Labor Occupational Outlook Handbook (2013) reports that the number of **biomedical engineering jobs is rapidly increasing and projected to increase at 62%** from 2010-2020 - substantially faster than all other occupations (projected at 14%).(2) This rapid rise in biomedical engineering jobs in part due to an aging U.S. population and the increasing demand for improved medical devices and systems.

Specific to North Carolina, between 2002 and 2012, North Carolina gained 21% in population, but only 0.3% in jobs.(3) Furthermore, data indicates that North Carolina suffered an 8.7% job loss for engineers as a whole between 2001 and 2011, with the exception of biomedical engineers. On the contrary, **biomedical engineering jobs increased** (3). Thus, there is an immediate need to provide a skilled labor force for this increasing job sector in North Carolina.

Nationally, BME student enrollment from 2000-2012 has grown steadily – with an increase of 9% cumulative annual growth for BME graduate students,(4) and **12% cumulative annual growth for BME undergraduates**.(5) In the past three years, we have had nearly 200 students who have declared their major as Applied Sciences – Biomedical Engineering track at UNC-Chapel Hill. This number has steadily grown since the program began just over a decade ago.

There has been massive growth of technology in medicine in the past four decades. While initially advances consisted largely of the application of existing technology to medical purposes, more recently medical applications have been a major driving force for the development of new technologies. Medical devices, bionics, signal and image processing, informatics, and telemedicine, as well as biocompatible materials and substrates are just a few of the numerous applications of engineering in medicine which comprise the field of biomedical engineering. This is a very young field that has experienced unprecedented expansion and has contributed significantly to the ongoing technological revolution in our society. It is reasonable to anticipate that biomedical engineering will be a major driving force in the economic development at the local (RTP), state and national level for many years to come. The undergraduate program in biomedical engineering prepares the graduate for a position in industry related to the applications of engineering in medicine, for graduate studies in biomedical and other engineering and applied science disciplines, and for entry into professional degree programs in the health sciences, such as medical or dental school.

It is thus an urgent necessity to implement this Bachelor of Science in Biomedical and Health Sciences Engineering degree to fulfill both an economic need and an educational desire for undergraduate students.

References

- 2) US Dept. of Labor, Bureau of Labor Statistics, Occupational Outlook Handbook
<http://www.bls.gov/ooh/architecture-and-engineering/biomedical-engineers.htm>
- 3) NC Biotech Center 2012 Report on STEM Occupations (EMSI) 2001-2011.
- 4) National Science Foundation Report on Students in Science and Engineering, Fall 2011
http://www.nsf.gov/statistics/nsf13331/content.cfm?pub_id=4290&id=2
- 5) American Society for Engineering Education, Engineering by the Numbers
<http://www.asee.org/papers-and-publications/publications/college-profiles/2011-profile-engineering-statistics.pdf>

3. List all other public and private institutions of higher education in North Carolina currently operating programs similar to the proposed new degree program. Identify opportunities for collaboration with institutions offering related degrees and discuss what steps have been or will be taken to actively pursue those opportunities where appropriate and advantageous.

At the undergraduate level, NCSU has an ABET-accredited undergraduate B.S. in BME based within the College of Engineering. This program is housed within the UNC/NCSU Joint Department of Biomedical Engineering. A future goal of the Department is the combination of this NCSU-based program with the currently requested degree to create a single BS degree in BME spanning UNC-Chapel Hill and NCSU. The Department views granting of the BS degree in Biomedical and Health Sciences Engineering as a necessary first step in this process with the next step being formal ABET accreditation of the UNC-Chapel Hill degree (in partnership with NCSU). The eventual goal would be the fusion of the two programs to create a combined UNC/NCSU, ABET-accredited BS degree in biomedical engineering.

Across the state of North Carolina, other universities that offer a BME degree at the B.S. level are Duke University, the Joint Department at Virginia Tech-Wake Forest University, and the Bioengineering program at NC A&T, which just established its undergraduate BME program this year. East Carolina University offers a B.S. in Engineering with a concentration in BME. Given the expansion of the biomedical sciences, their economic importance, and the need for a well-trained work force of North Carolina citizens, it is extremely important that we make every effort to expand the educational opportunities in this engine of economic growth to meet current and future demands.

4. Are there plans to offer all or a portion of this program to students off-campus or online?

There are no plans to offer the program off campus.

If so,

- a. Briefly describe these plans, including sites and method(s) of delivering instruction.
- b. Indicate any similar programs being offered off-campus or online in North Carolina by other institutions (public or private).
- c. What is the estimated percentage of courses in the degree program that will be offered/available off-campus or online: _____
- d. Estimate the number of off-campus or online students that would be enrolled in the first and fourth years of the program:

First Year Full-Time _____ *Part-Time* _____

Fourth Year Full-Time _____ *Part-Time* _____

Note: If a degree program has not been approved by the Board of Governors, its approval for alternative, online, or distance delivery is conditioned upon BOG program approval. (400.1.1[R], page 3)

5. Estimate the total number of students that would be enrolled in the program during the first year of operation: *Full-Time* 190 *Part-Time* _____

Estimate the total number of students that would be enrolled in the program during the fourth year of operation: *Full-Time* 210 *Part-Time* _____

6. Will the proposed program require development of any new courses: Yes _____ No x
If yes, briefly explain.
7. Will any of the resources listed below be required to deliver this program? (If yes, please briefly explain in the space below each item, and state the source of the new funding and resources required.)

We expect growth in faculty, resources, and staff to be commensurate to that needed for the expected growth in student enrollment and for an engineering degree.

- a. New Faculty: Yes _____ No x
- b. Additional Library Resources: Yes _____ No x
- c. Additional Facilities and Equipment: Yes _____ No x
- d. Additional Other Program Support: Yes _____ No x
(for example, additional administrative staff, new Master's program graduate student assistantships, etc.)
8. For graduate programs only:
- a. Does the campus plan to seek approval for a tuition differential or program specific fee for this new graduate program? Yes _____ No _____
- b. If yes, state the amount of tuition differential or fee being considered, and give a brief justification.
9. For doctoral programs only:

- a. Describe the research and scholarly infrastructure in place (including faculty) to support the proposed program.
 - b. Describe the method of financing the proposed new program (including extramural research funding and other sources) and indicate the extent to which additional state funding may be required.
 - c. State the number, amount, and source of proposed graduate student stipends and related tuition benefits that will be required to initiate the program.
10. List the names, titles, e-mail addresses and telephone numbers of the person(s) responsible for planning the proposed program.

Nancy Allbritton, M.D., Ph.D., Professor and Chair, Biomedical Engineering and Distinguished Professor of Chemistry, UNC Chapel Hill and NC State University. E-mail: nlallbri@unc.edu, phone: 919-966-2291.

Paul Dayton, Ph.D., Professor and Associate Chair, Biomedical Engineering, UNC Chapel Hill and NC State University. Email: padayton@email.unc.edu, phone 919-843-9521.

Richard Goldberg, Ph.D., Director of Undergraduate Studies, Biomedical Engineering, UNC Chapel Hill and NC State University. Email: r.goldberg@unc.edu, phone: 919-966-5768.

This request for authorization to plan a new program has been reviewed and approved by the appropriate campus committees and authorities.

Chancellor _____ **Date** _____