

Request for Authorization to Establish a Master of Biomanufacturing and a Master of Science in Biomanufacturing at NC State University

North Carolina State University requests authorization to establish a Master of Biomanufacturing and an M.S. in Biomanufacturing degree program (CIP 26.1201).

Program Description

Biomanufacturing is the application of fundamental biotechnology and engineering principles to produce human medicines, foods, fuels, and novel materials. Commercial application of this knowledge will not be successful, however, without leaders also trained in safety, regulatory compliance, and sound business decision-making skills. The non-thesis Master of Biomanufacturing and the thesis-option Master of Science in Biomanufacturing (both degrees to be designated BIOM) will bridge this gap and create the first Professional Science Masters degrees in Biomanufacturing integrating hands-on technical, scientific, research, and selected life science business and project management components. This 41 graduate semester credit hour degree program will be supported by a recently awarded three-year \$699,998 NSF grant and the new Golden LEAF Biomanufacturing Training and Education Center (BTEC) located on the Centennial Campus of NC State University. The curriculum is an integrated multidisciplinary program consisting of lecture plus hands-on laboratory courses using state-of-the-art industrial biomanufacturing equipment. Coursework in FDA regulatory compliance, industrial internships, industry case studies, bioscience-focused MBA topics, ethics, technical communication, project management, and a research experience will be required.

UNC Tomorrow Relevance

This proposed program would address several Recommendations within the UNC Tomorrow Report including the components to enhance our Global Readiness (Recommendation 4.1), Our Citizens and Their Future: Access to Higher Education (Recommendation 4.2), and Our Communities and Their Economic Transformation (Recommendation 4.4).

Highlights from UNC-GA Data Template

There are no public or private institutions of higher education in North Carolina currently offering a graduate biomanufacturing program similar to the proposed BIOM degree program. In the past three years, NC State University has established seven masters and two baccalaureate programs, and has discontinued eighteen masters and one baccalaureate program.

Outcome of Consultation with Disciplinary Panels

The panel included faculty members from ECU, NCA&T State, and WCU in addition to the NCSU faculty presenter. Panel members asked questions about the curriculum of the program and about the content of some of the courses. The active and helpful role of the Industrial Advisory Board at BTEC in making recommendations to improve the programs offered at BTEC was discussed. The differences between the thesis and non-thesis options of the proposed program were addressed as

were the employment opportunities for program graduates. Overall discussion was positive, with consensus on the desirability of offering this degree program.

Student Demand

There is demonstrated strong student demand for this proposed program. Currently, 75 graduate students are enrolled in graduate courses at BTEC, either taking selected courses for career advancement or enrolled in BTEC's biomanufacturing graduate minor program. Many of these students have requested the establishment of an entire masters degree program in biomanufacturing. Also, several local biotechnology companies have requested the establishment of this program, as they would like their employees to become graduate level credentialed in this area. For this proposed Master of Biomanufacturing and M.S. in Biomanufacturing degree program, NCSU projects full enrollment in its fourth year will be twelve full-time and four part-time students.

Opportunities for Graduates of the Program

Biomanufacturing is a thriving industry in the state as is seen by the fact that North Carolina ranks third nationwide for bioprocess manufacturing. More than 50 companies manufacturing biologics, biopharmaceuticals, and diagnostics operate in the state, and several well-known companies operate large and specialized facilities here. The North Carolina Biotechnology Center's strategic plan predicts creation of an additional 125,000 biomanufacturing-related jobs in North Carolina by 2023.

Resource Implications

Resource needs: No new faculty, courses, facilities, equipment, library resources, or information technology services are needed to implement the proposed degree program.

Resources allocated: The \$699,998 NSF grant will help support the new program during the first three years. BTEC and The Graduate School at NCSU will also contribute administrative and financial support from existing budgets. Funding after the first three years will be linked to enrollment. NCSU has developed and implemented a campus-wide plan for evaluating the "productivity and efficiency" of all new and existing degree programs which will be used to make funding decisions on this new degree program.

Estimated cost to the State: Based on the University funding formula, when the program reaches full enrollment, NCSU would receive additional state appropriations of approximately \$128,000 if fully funded by the General Assembly.

Recommendation

It is recommended that the Board of Governors approve North Carolina State University's request to establish a Master of Biomanufacturing and an M.S. in Biomanufacturing degree program (CIP 26.1201) subject to the availability of funding.

General Information Template for Academic Program Review

Degree Area and Level:

Master of Biomanufacturing and Master of Science in Biomanufacturing (CIP 26.1201) at NCSU

Addressing UNC Tomorrow:

This proposed program would address several Recommendations within the UNC Tomorrow Report including the components to enhance our Global Readiness (Recommendation 4.1), Our Citizens and Their Future: Access to Higher Education (Recommendation 4.2), and Our Communities and Their Economic Transformation (Recommendation 4.4).

Role of Program in Relation to State and Regional Needs:

According to the proposal, "Biomanufacturing is a thriving industry in North Carolina. In fact, North Carolina ranks third nationwide for bioprocess manufacturing. More than 50 companies manufacturing biologics, biopharmaceuticals and diagnostics operate here. Biogen Idec, GlaxoSmithKline, Novozymes, Pfizer (formerly Wyeth), Pfizer Animal Health, and Talecris operate some of the largest and most unique facilities in North Carolina."

US Labor Department Analysis:

- Summary – N/A

Availability of Program Statewide (Enrollment and Degrees Awarded in Last 3 Years):

- Public universities – Not available.
- Private universities – Not available.

Available or not from Academic Common Market:

Not available.

NCSU Campus enrollment and degrees awarded in similar programs at the Masters level:

(Based on two CIP digits – 26 CIP is the summary group for Biological and Biomedical Sciences under which Biomanufacturing is a program)

Enrollment			Academic Year						
			Fall 07	Spr 08	Fall 08	Spr 09	Fall 09	Spr 10	Fall 10
NCSU	Biochemistry	M	0	0	0	0	2	1	3
		MS	5	5	4	2	1	0	0
	Botany/Plant Biology	M	0	0	0	0	0	0	0
		MS	10	11	13	12	14	10	8
	Plant Pathology/Phytopathology	M	0	0	0	0	0	0	1
		MS	12	12	13	9	13	13	12
	Microbiology, General	M	0	0	0	0	10	7	8
		MS	13	11	8	6	0	1	3
	Immunology	M	0	0	0	0	0	0	0
		MS	3	2	2	2	4	4	3
	Zoology/Animal Biology	M	0	0	0	0	2	3	4
		MS	20	15	18	18	19	15	14
	Entomology	M	0	0	0	0	0	1	1
		MS	13	16	19	17	24	21	19
	Genetics, General	M	0	0	0	0	6	5	6
		MS	6	4	3	3	3	2	3

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Genetics, Other	M	0	0	0	0	2	3	0
	MS	1	1	0	1	1	1	4
Physiology, General	M	0	0	0	0	17	18	29
	MS	14	13	14	15	4	5	7
Toxicology	M	0	0	0	0	5	6	3
	MS	12	8	9	7	2	1	0
Biometry/Biometrics	M	0	0	0	0	0	0	0
	MS	3	3	1	1	1	0	0
Bioinformatics	M	5	7	6	7	7	6	5
Biotechnology	M	25	23	21	21	21	20	27

Number of Degrees Awarded			Academic Year		
			2007-2008	2008-2009	2009-2010
NCSU	Biochemistry	M	0	1	0
		MS	0	1	1
	Botany/Plant Biology	M	2	0	0
		MS	1	1	5
	Plant Pathology/Phytopathology	M	0	0	1
		MS	1	5	4
	Microbiology, General	M	5	5	3
		MS	0	1	0
	Immunology	M	0	0	0
		MS	2	0	0
	Zoology/Animal Biology	M	2	1	4
		MS	5	6	1
	Entomology	M	0	0	0
		MS	1	4	7
	Genetics, General	M	5	0	1
		MS	0	0	0
	Genetics, Other	M	0	0	1
		MS	0	0	0
	Physiology, General	M	7	4	5
		MS	1	1	2
	Toxicology	M	3	4	0
		MS	3	4	2
	Biometry/Biometrics	M	2	0	3
		MS	2	0	1
	Bioinformatics	101	2	2	4
	Biotechnology	M	9	13	8

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Campus Average of enrollment and degrees awarded per degree program in this area at the Masters level over the over the last 3 Academic Years, Fall 2007-Fall 2010:

(Based on two CIP digits – 26 CIP is the summary group for Biological and Biomedical Sciences under which Biomanufacturing)

Campus Average			
	Number of Active Programs	Enrollment per Semester	Degrees Awarded per Year
ASU	1	33	11
ECU	2	34	9
ECSU	1	3	1
FSU	1	8	3
NCA&T	1	26	5
NCCU	2	30	6
NCSU	14	10	4
UNCC	2	20	6
UNC-CH	13	5	4
UNCG	3	16	7
UNCW	2	23	8
WCU	1	31	6
Campus Average:		20	6

NCSU Campus Degree Programs added in the past three years:

- *Bachelor*
 - BS Genetics (11/13/2009)
 - BS Soil and Land Development (04/09/2010)
- *Master*
 - Master Environmental Assessment (02/12/2012)
 - MA Foreign Language and Literature (02/11/2011)
 - Master of Environmental Engineering (04/09/2010)
 - MS Environmental Engineering (04/09/2010)
 - Master Geospatial Information Science and Technology (02/12/2010)
 - MAT - Master of Arts in Teaching (10/17/2008)
 - MGIM - Master of Global Innovation Management (01/11/2008)
- *Doctoral*
 - N/A

NCSU Campus Degree Programs discontinued in past three years:

- *Bachelor*
 - BS Health Occupations Education (03/20/2009)
- *Master*
 - MEd Middle Grades (02/11/2011)
 - MS Middle Grades (02/11/2011)
 - MEd Curriculum and Instruction, English Education (02/11/2011)
 - MS Curriculum and Instruction, English Education (02/11/2011)
 - MEd Curriculum and Instruction, Reading (02/11/2011)
 - MS Curriculum and Instruction, Reading (02/11/2011)
 - MEd Curriculum and Instruction, Social Studies Education (02/11/2011)

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- MS Curriculum and Instruction, Social Studies Education (02/11/2011)
- MA French Language and Literature (02/11/2011)
- MA Spanish Language and Literature (02/11/2011)
- Master Chemistry (08/13/2010)
- MS Agricultural and Resource Economics (03/20/2009)
- MEd in Special Education, Behavior Disorders (03/20/2009)
- MS Behaviorally/Emotionally Handicapped (03/20/2009)
- MEd Mentally Handicapped (03/20/2009)
- MS Mentally Handicapped (03/20/2009)
- MEd Specific Learning Disabilities (03/20/2009)
- MS Specific Learning Disabilities (03/20/2009)
- *Doctoral*
 - N/A