UNIVERSITY FACULTY SENATE FORMS

Academic Program Approval

This form is a routing document for the approval of new and revised academic programs. Proposing department should complete this form. Detailed instructions for the proposal should be followed. A checklist is available to assist in the preparation of a proposal. For more information, call the Faculty Senate Office at 831-2921.

Submitted by: __Melinda K. Duncan_____phone number__X0533_____

Department: __Biological Sciences_____email address__duncanm@udel.edu___

Date: _____October 31, 2014_____

Action: __**Request Permanent status for Professional Science Masters in Biotechnology**_____
(Example: add major/minor/concentration, delete major/minor/concentration, revise major/minor/concentration, academic unit name change, request for permanent status, policy change, etc.)

Effective term_____**15J**_____
(use format 04F, 05W)

Current degree___PSM in Biotechnology_____
(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

Proposed change leads to the degree of: _____
(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

Proposed name:_____
Proposed new name for revised or new major / minor / concentration / academic unit (if applicable)

Revising or Deleting:

Undergraduate major / Concentration:_____
(Example: Applied Music – Instrumental degree BMAS)

Undergraduate minor:_____
(Example: African Studies, Business Administration, English, Leadership, etc.)

Graduate Program Policy statement change:_____
(**Must attach** your Graduate Program Policy Statement)

Graduate Program of Study:_____
(Example: Animal Science: MS Animal Science: PHD Economics: MA Economics: PHD)

Graduate minor / concentration:_____

Note: all graduate studies proposals must include an electronic copy of the Graduate Program Policy Document, either describing the new program or highlighting the changes made to the original policy document.

List new courses required for the new or revised curriculum. How do they support the overall program objectives of the major/minor/concentrations)?
(Be aware that approval of the curriculum is dependent upon these courses successfully passing through the **Course Challenge** list. If there are no new courses enter "None")

none

Supply support letter from the Library, Dean, and/or Department Chair if needed
(all new majors/minors will need a support letter from the appropriate administrator.)

See body of application

Supply a resolution for all new majors/programs; name changes of colleges, departments, degrees; transfer of departments from one college to another; creation of new departments; requests for permanent status. See example of resolutions.

See body of application

Explain, when appropriate, how this new/revised curriculum supports the 10 goals of undergraduate education: http://www.ugs.udel.edu/gened/

Not applicable, this is a graduate program

Identify other units affected by the proposed changes:
(This would include other departments/units whose courses are a required part of the proposed curriculum. Attach permission from the affected units. If no other unit is affected, enter "None")

Accounting, Animal and Food Sciences, Bioinformatics, Biomedical Engineering, Business Administration, Chemical Engineering, Chemistry and Biochemistry, Computer and Information Sciences; Electrical Engineering, Entrepreneurship, Entomology and Wildlife Conservation, Kinesiology and Applied Physiology, Marine Studies, Mechanical Engineering, Management Information Systems, Nursing, Physical therapy, Plant and soil sciences, Statistics, Urban affairs and public policy

Describe the rationale for the proposed program change(s):
(Explain your reasons for creating, revising, or deleting the curriculum or program.)

Program was due for Permanent status consideration

Program Requirements:
(Show the new or revised curriculum as it should appear in the Course Catalog. If this is a revision, be sure to indicate the changes being made to the current curriculum and **include a side-by-side comparison** of the credit distribution before and after the proposed change.) **See example of side by side.**

See body of application for current curriculum and graduate program policy

ROUTING AND AUTHORIZATION: (Please do not remove supporting documentation.)

Department Chairperson _____ Date _____

Dean of College _____ Date _____
(By signing above, the Dean confirms that their college policies and bylaws have been followed correctly during consideration of the request described in this form.

The approval actions that were taken at the college level were (check all that apply) :
_____college faculty vote; _____college curriculum approval _____college senate approval

Chairperson, College Curriculum Committee _____ Date _____

Chairperson, Senate Com. on UG or GR Studies _____ Date _____

Chairperson, Senate Coordinating Com. _____ Date _____

Secretary, Faculty Senate _____ Date _____

Date of Senate Resolution _____ Date to be Effective _____

Registrar _____ Program Code _____ Date _____

Vice Provost for Academic Affairs & International Programs _____ Date _____

Board of Trustee Notification _____ Date _____

Revised 10/27/2014/khs

B: Faculty Senate resolution granting provisional status

WHEREAS, the proposed Professional Science Master's (PSM) in Biotechnology is an interdisciplinary graduate course of study covering the scientific underpinnings of the biotechnology revolution, the management of the interdisciplinary teams necessary to bring biotechnology advances to the marketplace and the ethical/regulatory issues pertinent to these technological advancements and

WHEREAS, there has been much interest over several years from individuals with diverse backgrounds and interest in pursuing advanced graduate studies in biotechnology relevant to the business environment, and

WHEREAS, the experience of the Department of Biological Sciences with graduate level training in the life sciences in collaboration with Departments ranging over all seven Colleges of the University of Delaware provide existing courses and a foundation for the program, and

WHEREAS, the proposed program contributes to three milestones on the University's "path to prominence": to become a premier research and graduate university; to achieve excellence in professional education; and the engaged university, be it therefore

RESOLVED, that the Faculty Senate recommends approval provisionally, for five years, the establishment of a new major leading to the Professional Science Master's in Biotechnology, effective June 1, 2010.

C: Original Program Proposal submitted for Provisional Status October 2010

Please see this in Appendix 1

D: Current Program Policy Document as of Fall 2014

Please see this in Appendix 3

UNIVERSITY OF DELAWARE
University of Delaware Library
OFFICE OF THE VICE PROVOST
& MAY MORRIS UNIVERSITY LIBRARIAN

Newark, DE 19717-5267
Phone: 302-831-2231
Fax: 302-831-1046

October 15, 2014

Memorandum

To: Melinda K. Duncan
Professor, Department of Biological Sciences
and Graduate Program Director

From: Susan Brynteson
Vice Provost and May Morris University Librarian

I am responding to your request to supply information about the capability of the University of Delaware Library to support the proposed permanent status for the Professional Science Master's degree in Biotechnology.

The University of Delaware Library with its strong scientific, interdisciplinary and electronic collections is well able to support the proposed permanent status for the program. Enclosed is a description of collections, resources and services available for this purpose.

I would be pleased to respond to any questions.

SB/nb
Enclosure

c: Department of Biological Sciences
Robin W. Morgan, Interim Chair, Department of Biological Sciences

University of Delaware Library
Meghann R. Matwichuk, Associate Librarian and Coordinator, Film and Video Collection
Shelly L. McCoy, Head, Multimedia Collections and Services Department
Sandra K. Millard, Associate University Librarian for Services, Outreach and Assessment
Deb Morley, Head, Reference and Instructional Services Department
William S. Simpson, Associate Librarian, Reference and Instructional Services Department
Catherine W. Wojewodzki, Librarian and Scholarly Communication Officer

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October 15, 2014

Report on Library Services and Collections in Support of the Professional Science Master's Degree in Biotechnology

General Description

The University of Delaware Library includes the Hugh M. Morris Library, where the main collection is housed; two branch libraries located on the Newark campus, the Chemistry Library and the Physics Library; and a third branch library, the Marine Studies Library, located in Lewes, Delaware. The Library collections parallel the University's academic interests and support all disciplines. The Professional Science Master's degree program in Biotechnology is directly supported with the Library's strong collections in Animal and Food Sciences, Biological Sciences, Chemical and Biomolecular Engineering, Chemistry and Biochemistry, Cognitive Science, Computer and Information Sciences, Electrical and Computer Engineering, Environment, Government Information, Law and Intellectual Property, Marine Science and Policy, Materials Science and Engineering, Patents, Physics and Astronomy, Public Policy and Administration, and Sustainability, and various interdisciplinary resources.

Books, periodicals, microforms, government publications, databases, full-text electronic journals and other electronic resources, maps, manuscripts and media provide a major academic resource for the University of Delaware, the surrounding community, the state of Delaware and the nation. Library staff members provide a wide range of services, including reference assistance, circulation, interlibrary loan, instructional programs, multimedia design, and assistance to the visually impaired.

The University of Delaware Library is a U.S. depository library, a U.S. patent depository library, a repository for State of Delaware publications, and contains a complete file of every patent the U.S. Office of Patents and Trademarks has issued.

The online catalog, DELCAT, provides access to millions of items by author, title, subject and keyword.

Library collections number over 2,800,000 and are broadly based and comprehensive. In 2013/2014, the Library Web <library.udel.edu/> received over 1,000,000 virtual visits.

The University of Delaware Library collects and makes available electronic resources (e.g., electronic journals, electronic books and databases) to support the instructional and research needs of University of Delaware students, faculty and staff. Providers of electronic resources employ licenses as a legal means of controlling the use of their products. The University of Delaware Library abides by legally binding license agreements for the use of the electronic resources.

The University of Delaware Library is a member of ARL (the Association of Research Libraries), OCLC (including the OCLC Research Partnership), CRL (the Center for Research Libraries), LYRASIS, CIRLA (the Chesapeake Information and Research Library Alliance), NERL (NorthEast Research Libraries), ACSC (the Association of Centers for the Study of Congress), Portico, the HathiTrust, and NDSA (the National Digital Stewardship Alliance).

Specific Support for Professional Science Master's Degree in Biotechnology

Funds are designated at the beginning of each fiscal year for the support and strengthening of the collections including those related to Biotechnology. Support for the Department of Biological Sciences is supplemented by funds used to purchase materials in other related areas as well as funds for the licensing of electronic resources.

The Library subscribes to hundreds of electronic and print journals which support the Department of Biological Sciences. A list of electronic journals by subject is available by clicking on "E-Journals" on the Library Web page <library.udel.edu/>, "Physical Sciences and Mathematics," or "Health and Biological Sciences." The Library makes available several electronic databases which support the Department of Biological Sciences. These databases are enhanced further by an array of reference sources, films and video (see "Research Guides" on the Library Web page).

Among the web resources available for Biotechnology are AgBiotechNet, Biosafety, Computational Molecular Biology at NIH, Glossary of Biochemistry and Molecular Biology, Human Genome Project Primers, Life Sciences World, Microbiology Microbes Bacteria Information and Links, National Center for Biotechnology Information, Synthetic Biology Resources, and USDA. The links to these Web resources are found at <guides.lib.udel.edu/biotechnology?p=548534/>.

The Library also subscribes to RefWorks, a web-based bibliographic and database management system that can be used with most databases.

A full list of databases is available on the Library Web (see: <library.udel.edu/>). Census information and other demographic data are available as is a wide range of printed and electronic reference sources.

The Library also maintains an Institutional Repository (see: <udspace.udel.edu/>), which archives research reports and documents and other resources produced by University of Delaware faculty.

The Library has a nationally recognized Student Multimedia Design Center located in the Multimedia Collections and Services Department on the Lower Level of the Morris Library which provides University of Delaware students, faculty and staff access to technology and training related to the creation of multimedia programs. The Student Multimedia Design Center includes over 70 workstations, six studios, and two classrooms focused on multimedia creation, and is open all hours the Library is open. University of Delaware users also may borrow a wide variety of multimedia equipment. The Student Multimedia Design Center also provides assistance to students and faculty related to multimedia literacy skills to help integrate multimedia into instruction. Shelly L. McCoy is Head of the Multimedia Collections and Services Department. More information is available at: <www.lib.udel.edu/multimedia/>.

An experienced librarian, Catherine W. Wojewodzki, Librarian and Scholarly Communication Officer, serves as the liaison to the faculty in the Department of Biological Sciences. Suggestions for purchases received by the Library for materials related to Biological Sciences are directed to

Ms. Wojewodzki who also regularly consults faculty about priorities and the direction the collections should take. Ms. Wojewodzki is also available for instruction in the use of the Library for students and faculty in the Department of Biological Sciences.

Ms. Wojewodzki maintains a subject website for Biological Sciences which can be accessed from the Library Web <library.udel.edu/> via the "Research Guides" search box on the main Library Web page or directly by the URL <guides.lib.udel.edu/biology/>. In addition to electronic resources, it contains detailed descriptions of selected primary resources including printed collections; visual material; and manuscripts and archival materials.

An additional experienced librarian, William S. Simpson, Associate Librarian, Reference and Instructional Services Department, serves as the liaison to the Biotechnology faculty. Suggestions for purchases received by the Library for materials related to Biotechnology are directed to Mr. Simpson who also regularly consults faculty about priorities and the direction the collections should take. Mr. Simpson is also available for instruction in the use of the Library for students and faculty in Biotechnology.

Mr. Simpson maintains a subject website for Biotechnology which can be accessed from the Library Web <library.udel.edu/> via the "Research Guides" search box on the main Library Web page or directly by the URL <guides.lib.udel.edu/biotechnology/>. In addition to electronic resources, it contains detailed descriptions of selected primary resources including printed collections, visual material, and manuscripts and archival materials.

Susan Brynteson
Vice Provost and May Morris University Librarian

Self Study report
Permanent Status Review
Professional Science Masters in Biotechnology (PSM-Biotech)

1. General information about the program:

a. Brief introduction and history of the program - include dates.

Professional Science Master's (PSM) degrees have been developed by the Council of Graduate Schools in conjunction with the Sloan Foundation to fill a need for workers trained at an advanced level in the Sciences whose background is broader than that found in the graduate of a traditional MS program. PSMs are designed as terminal degrees serving a similar role to the MBA degree for business graduates, by providing a comprehensive science curriculum that trains graduates to work in interdisciplinary teams that are expected to function in a business setting. The Professional Science Master's in Biotechnology seeks to train students in the advanced biological topics necessary to have a comprehensive understanding of modern life science research, provides exposure to related fields such as bioengineering, statistics, chemistry and bioinformatics and trains students to think about business/organizational management issues. The course work requirements of the degree are integrated by a "capstone" experience, which in most cases is expected to consist of an internship in a business setting. The target audience for this degree is expected to be diverse and will include both full-time students and part-time students who currently hold full-time employment in the field.

The program was provisionally approved by the University Senate in Spring 2010 and matriculated its first two students starting in Fall of 2010.

b. Explain how the program is compatible with the academic priorities of the University.

The PSM in Biotechnology was developed, in part, as a response to the University's Path to Prominence goal "to achieve excellence in professional education". It is currently one of only a few professional graduate programs offered in STEM disciplines at UD and is highlighted on the Path to Prominence web site as progress towards achieving this goal. Please see http://www.udel.edu/prominence/pepe-implementation.html

c. Explain how the program will help students meet the general education requirements of the University, specifically the ten (10) general education goals for undergraduate education (please note that this section applies only to undergraduate programs).

Not applicable; the PSM in Biotechnology is a graduate degree

d. Curricular requirements, including fulfillment of University, college and departmental requirements.

See current approved program curriculum in appendix 3 of this document

e. Results of assessments or evaluations regarding the quality of the program; must indicate policies and procedures, how the assessment was used, and how the program changed because of it. What has the program accomplished in order to enhance assessment, particularly focusing on student learning outcomes?

Assessment plan from original application for provisional status:

Assessment plan PSM in biotechnology				
Objectives	**Strategic Activities**	**Measures**	**Short-term Outcomes**	**Long-term Impact**
1. Train students in life science disciplines pertinent to biotechnology	recruit excellent applicants and matriculate students with credentials similar to those in the existing departmental graduate programs	Number and demographic data of student applicants and matriculated students.	Retention and time to degree statistics	Students gain employment in biotechnology related fields
	Course work covering the disciplines of cell biology, molecular biology, genetics, microbiology, physiology	Faculty evaluation of student progress in course work Survey of internship mentors Surveys of graduate students in the program and post-graduation	Course work for the PSM degree helped students secure biotechnology related internships and initial employment	Graduates enjoy long term success in biotechnology careers
	Course work covering biotechnology related disciplines including agriculture, chemistry, engineering, health sciences, statistics, lab science	Surveys of students focusing on their experiences in these classes Surveys of graduates to determine the utility of these classes to their career Faculty evaluation of student progress in course work Interviews and surveys of internship mentors	Course work for the PSM degree helped students secure biotechnology related internships and initial employment Students and graduates report applying knowledge from courses to work settings	Graduates enjoy long term success in biotechnology careers
2. Provide training in science related business, organizational management, legal issues, project management and ethics	course work addressing these issues and industrial internship experience	Surveys of students focusing on their experiences in these classes Surveys of graduates to determine the utility of these classes to their career Faculty evaluation of student progress in course work Interviews and surveys of internship mentors	Course work for the PSM degree helped students secure biotechnology related internships and initial employment Students and graduates report applying knowledge from courses to work settings s	Graduates enjoy long term success in biotechnology careers
3. Provide experiential	Internships in biotechnology related	Surveys of students	Internship prepares	Graduates enjoy long term success in

training in biotechnology industry to prepare students for the expectations of the workplace	industrial settings	focusing on their experiences in their internship Surveys of graduates to determine the utility of their internship experience to their career Faculty and internship mentor evaluation of both the internship work and the written products Interviews and surveys of internship mentors	students for the biotechnology workplace and helps them secure their first post-graduation position	biotechnology careers

We constantly seek feedback on our program from all constituencies including course professors, students, internship supervisors, and our industrial advisor board which represents industry leaders working at local companies.

Alumni assessment

All six alumni from the program were contacted in the Fall of 2014 for feedback about their experiences in the program now that they have completed degrees and all replied. Five of the six graduates obtained full time employment in fields relevant to the degree immediately upon graduation (working at the following companies; duPont, QPS, Ashland Chemical, Air Liquide and ICON plc) while the sixth entered the Ph.D. program in Medical Sciences at UD. Four of the five graduates who chose to enter the workforce are currently still employed in the profession. The fifth was laid off recently when Ashland Chemical moved his division (market research) overseas and he is currently seeking new employment.

All graduates spoke highly about their program preparation. One graduate summed up the comments as follows "*As for the utility of the program, I think it was invaluable for a few reasons. Firstly, it was important because it allowed me to get a taste for the business world and what is important there. It also gave me an opportunity to study science alongside the PhD and Masters students who will pursue careers in developing advancements in their areas of interest. In hindsight this helped me understand where real products come from, and why some do/don't make it. Finally, it pushed me to recognize (even if I didn't have to master them) skills that are transferable to nearly any professional career. A few examples of what I mean: quant bio showed me the importance of statistics and manipulating data (this has come in HUGE for me here), the business 101 course helped me get into a habit of reading and understanding the current events in the business world, entrepreneurship helped show me some of the most important things to think about when launching a new product, and finally, the PhD level biology courses kept my interest in biology while making me learn how to learn quickly, and are also the reason I'll probably try to enter into the biotech industry at some point in my life* (this person works in the chemicals division of duPont, so does not do "biotechnology" per se) . *There are countless other areas that I grew in during the PSM (presentation skills, scientific writing and reading, the list goes on) as well, but I think you get the picture.* "

The only negative expressed is held in common by assessments by the current students and faculty, and that is the difficulty in finding biotechnology industry internships. All students

who have completed the program did obtain internships eventually that met their goals, however, the search for an internship is a stressful undertaking. We are currently in discussions with the University of Delaware Career Services center about working with their office on a central UD resource for internships.

The alumni experience with the program demonstrates that the program meets the original assessment goals of "students gain employment in biotechnology related fields" and indications are promising that the goal of "graduates enjoy long term success in biotechnology careers" will be met, although even the first graduate is only 2.5 years post-degree at this point, so long term success cannot be measured as yet.

Assessment by current students:

The students currently matriculated in the program (7 as of fall 2014) were surveyed in regard to their satisfaction with the program via face to face meetings during regular advising sessions as well as a Qualtrics survey in October 2014. The current students expressed general satisfaction with the program and note that advantages to the program include 1) flexibility with full-time work schedules 2) the amalgamation of business and science and 3) the flexibility to choose their own courses. The only negatives mentioned in the Qualtrics survey are that this is a self paying program so students do not receive assistantships, and students would also like to see increased availability of laboratory courses which have diminished since the Department's undergraduate biotechnology major was disestablished. In response to this feedback, we are planning on reinstituting the graduate level laboratory course in molecular biology and will cross list this with our undergraduate capstone molecular biology laboratory which is typically taken by senior biological sciences majors. This will ensure that the course will have sufficient enrollments to be viable while simultaneously providing PSM in Biotechnology students formal laboratory training. Personal discussions with current students reveal similar positive comments with the additional negative that looking for internships is a stressful undertaking due to the difficulty communicating with local biotechnology firms. We are working on improving this from several avenues including working more closely with the UD career services center and the Delaware Biotechnology Institute on streamlining internship identification.

Assessment by faculty in Biological Sciences teaching students in the program

In September of 2014, Departmental faculty were surveyed in regard to their perception of the preparedness of PSM students for graduate level work and the contributions of PSM students to their graduate level courses; particularly in contrast to the Ph.D. and research-based MS students that normally populate these classes. The response was uniformly positive. A few specific comments follow: One instructor, who has taught most of the program students noted "*All together they were a pretty good lot and with the possible exception of one, they were all very motivated."* Another stated that " *Since the inception of the PSM program, generally I have 2-3 PSM students enrolled in my course each semester. These students are on par with the traditional graduate students in my class and in all cases to date have received a grade B or higher. Thus the caliber of the students is high so much so that I had a PSM student who switched to the MS program and ultimately to the PhD program after taking my class.*" A third faculty member noted "*I have been very impressed with all the PSM students that have been in my classes. These students have been among the very best in each class. They stand out in particular for their level of*

engagement in the material and, in particular, they have all been outstanding contributors to class discussion. "

Thus, the faculty in Biological Sciences feel that the program admits students with background/credentials that are competitive with students enrolled in our traditional graduate programs and are pleased with the students, both from the perspective of the grades they earn and their contributions to class discussions etc.

Industrial advisory board assessment:
During fall 2013, the industrial advisory board for the PSM in Biotechnology met in person, and reviewed all aspects of the program including the curriculum, the students who have participated in the program, and their outcomes. The consensus from that meeting was that the program was functioning well and preparing students appropriately for positions in the biotechnology industry. The board did make one very strong recommendation for improvement, and that was to encourage PSM students to take an accounting course as part of their degree since interpreting financial documents is an important skill in the business world. We implemented this suggestion as part of our 2014 curricular revision and ACCT800- *Financial Reporting and Analysis* is now an option in the degree as of Fall 2014.

In summary, the alumni, current students, faculty and industrial advisory board all find great value in this program and are supportive of its continuance.

f. What are the department/unit's strategies for student advisement?

All students are advised by the graduate program director via email and face-to face meetings. Such advisement includes in the first year: appropriate course selection, advisement of UD resources such as career services and the library, discussion of useful professional development activities, preparation of resumes and other personal "marketing" documents such as Linkedin profiles. During the second year, these meetings continue, but the focus shifts to finding an internship, how to do a comprehensive analysis of the company, how to understand ones role in a company, developing the internship proposal/final report and the job search. Finally, while not required by the program, many PSM students also do stints in faculty research labs in order to build their bench skills. The students who undertake these experiences receive additional advising/mentoring from the professor in charge of the laboratory and their students/postdoctoral fellows.

g. If applicable, specify if the program meets all accreditation requirements (e.g.,ABET, AACSB, APA, CADE etc.).

This program meets all of the standards for "affiliation" with the Professional Science Masters Association (see sciencemasters.com) and holds such affiliation until 2017 when this status will be up for renewal.

h. Report any changes in the program admission criteria, degree requirements, or subject areas since the program was initiated.

We revised the degree requirements for the program during the 2013-2014 academic year to reflect both evolution of course offerings in this area at UD since the program's inception and to rework the written component of the internship to better reflect evolution of how students are advised to put these documents together. See appendix two for the side-by-side comparison of the program as originally approved and the current approved version.

We will also be putting forth another curricular revision this year to both delete courses that we were informed would no longer be taught and add courses that departments who offer courses for the program feel would be valuable for PSM in Biotechnology students. These are outlined in the letters of support for the program.

i. General description of recruiting procedures - include any information for under-represented populations.

Recruiting for this program is largely via the Professional Science Masters Association web site (www.sciencemasters.com), our departmental web site for the program (www.bio.udel.edu/psm-biotechnology/), and our participation in various career and graduate school fairs both locally (the Delaware Biotechnology Institute), as well as regionally (Millersville University Career Fair). We also work with the Office of Graduate and Professional Studies to recruit students from underrepresented populations by having a recruiting presence at the ABRCMS and SACNAS meetings, as well as local and regional McNair events which are focused on increasing the numbers of underrepresented students in STEM

2. Student information:
a. Application and enrollment history - provide a tabular summary or graphical representation by year showing numbers of applicants, offers, matriculated, graduated, and dropped out (this data must be confirmed by the Admission's Office, the Registrar's Office, the Office of Graduate Studies or the Office of Institutional Research and Planning, as appropriate).

	Degree	TERM	applied	admitted	enrolled
ASPSM	BIOT-PSM	2108; Fall 2010	13	7	2
		2113; Spring 2011	13	6	1
		2118; Fall 2011	30	17	2
		2123; Spring 2012	12	4	2
		2128; Fall 2012	38	16	3
		2138; Fall 2013	50	25	4
		2143; Spring 2014	8	5	3
		2148; Fall 2014	31	11	2
		Total for BIOT-PSM	**195**	**91**	**19**

The acceptance rate for the PSM in Biotechnology is higher than that for our traditional MS/Ph.D. programs. This arises because we generally accept all qualified applicants to the PSM in Biotechnology, while admission offers to the MS/Ph.D. are driven by both available financial aid and the number of research mentors in the student's area of research interest. Further, the "yield" for the PSM in Biotechnology is much lower than the MS/Ph.D. as it is a professional,

self-funded program and contacts with admitted students who chose not to attend reveal that they are often "price conscious" and some (but certainly not all) similar programs have much lower tuition than UD currently charges. At this point, we are not seeking to greatly increase the enrollment into this program, as the maximum target enrollment would be about double what it currently is based on current available faculty/staff resources. However, we are in the midst of discussions with the Arts and Sciences Dean's office on how to modify the program's price structure to increase the program's appeal from the cost side while still maintaining the program's financial viability.

PSM outcomes (Data obtained from Office of Graduate Studies, September 2014)

Outcomes of matriculated PSM students	**No of students**
PSM 5/2012	1
PSM 2/2012	1
PSM 1/2013	1
PSM 8/2013	1
PSM 2/2014	1
PSM 5/2014	1
No PSM; switched to PHD in BISC	2
NO PSM; switched to MS in BISC	2
Withdrew from program	2
In Progress	7
Total number of matriculated PSM students since inception	19

One of the two students who withdrew was a foreign student who left the program after one semester to enter a program at another university where she received full financial support. The other student came to our program from the ELI-conditional admissions program and had earned solid undergraduate grades in China. Despite this, and his language training at ELI, he was unable to obtain at least a B in program courses. The reasons for this coursework difficulty are unclear.

The four students who switched to BISC research based degree programs did so due to interests that developed more towards "research" and away from "scientific business." The program is structured to allow this switch to occur pretty easily as long as students chose electives that overlap with the required classes for the MS/Ph.D. and gain research experience in faculty labs while enrolled as a PSM student. One of the students who switched to the Ph.D. is now post-candidacy, and the other is making solid progress towards degree, winning an international poster award from the Association for Research in Vision and Ophthalmology in May of 2014.

b. Annotated evidence of placement for students who have graduated - indicate how the department facilitates placement.

Alumnus last name	*Internship placement*	*First position*	*Current position*
Friedberg	Ashland Chemical	Ashland Chemical	Laid off
Ahmer	Dupont Qualicon	DuPont Titanium Tech	DuPont Titanium Tech
Smith	QPS, LLC	QPS, LLC	UD research associate
Marks	Hudson Robotics	Ph.D. student at UD	Ph.D. student at UD

Orr	Gore	ICON plc	ICON plc
Witham	Air Liquide	Air Liquide	Air Liquide

Program students are advised on resume preparation from the time that they matriculate by both their faculty advisor and the UD career services center. They also receive advice/help with internship placements from these sources. Currently, about half of the graduates have stayed on at their internship site after graduation. The other half have either quickly obtained employment at other companies or pursued additional education.

Three additional students are currently working on their internships, one with the Delaware Department of State on a large biotechnology industry sector review for the region. The second is completing his internship with Assay Depot, a consolidator of research services based in California, while the third is tentatively completing his internship with the UD technology transfer office. All three of these students are on target to graduate in May of 2015.

c. Identify sources and levels of financial support for students in the graduate program and indicate the proportion receiving assistantships.*

The Professional Science Masters in Biotechnology is a professional program, and as such, all students in the program pay tuition (none receive assistantships). The program does provide partial tuition waivers for a portion of the enrolled credits, particularly for students who are registered for over 9 credits or who are enrolled in full time (6 credit) internships and need to maintain full-time status. We are planning to revise this financial aid structure over the next year to offer full-time students partial tuition scholarships instead of the current tuition waivers based on the number of credits taken over 9. Discussions on how best to structure this in such a way to maintain the program's financial viability while improving program appeal to applicants are ongoing with the Arts and Sciences Dean's Office

d. Identify demand and competitive factors in the region, nationally or internationally for attracting students - explain how this benefits and/or challenges the program.

The PSM in Biotechnology program at UD competes for students interested in cross training between business and biotechnology with forty other PSM programs in Biotechnology nationally/internationally. Several of these programs are located in our region including those based at Temple University, American University, George Washington University, Rutgers, and the University of Maryland. This number of programs appears to neither hurt nor harm program recruiting since domestic PSM students appear to often chose programs that are geographically close to their community/workplace. The number of programs nationally does impact our ability to recruit some international students as they often have other options, some of which are lower cost. However, the English Language Institute Conditional Admissions program is a big draw for international students to UD as it allows academically qualified students who are not fluent in English a clear path to pursue graduate training in the USA. This articulation is not common nationally so this is a draw to the program.

The PSM in Biotechnology program's largest competitor is not other PSM programs though, it is traditional Masters programs, including our department's research thesis based MS and Ph.D. in Biological Sciences. This occurs because students enrolled in Ph.D. programs in

the Sciences are traditionally given full tuition scholarships and generous stipends, while MS students in thesis-based programs often receive full or partial support as well. Thus, for many students, the advantages of pursuing a degree that includes business training/company internships are weighed against the program cost. Also, many people in our target demographic are much more familiar with scientific research than business, and thus find a research thesis based degree more appealing. Finally, many of our students are more interested in pursuing "bench science" roles in industry than "business" roles, and the research MS is much better preparation for a bench career than the PSM. These phenomena are seen clearly in regard to our outcomes numbers as four of our 19 matriculated PSM students have switched from the PSM to our research based MS and/or Ph.D. degrees in Biological Sciences. That said, most of the program graduates and many of those currently matriculated have a real commitment to working at the interface between science and the business world, and the program structure gives these students the tools that they need to be successful in that realm. We consider the "flow" of students from the PSM to our research degrees to be a positive outcome of the program as these students are very strong academically and have a strong commitment to pursuing research/bench science careers.

3. Identify factors that make this program unique or distinctive compared to similar programs at other institutions.

Professional science masters programs work under two different models. Some have all program courses tailored to the program with a deep integration between the business and scientific content. Others use the model we pursue at UD where the vast majority of the coursework consists of required or elective courses in other graduate programs. This means that PSM in Biotechnology students at UD take business courses alongside MBA students while their science courses are taken alongside Ph.D./MS students enrolled in a wide variety of UD graduate programs. Both models have their advantages and disadvantages. Our model has the disadvantage that business and science concepts are not explicitly integrated, which can make it more difficult for students to see connections within the curriculum. However, it has the strong advantages of allowing us to provide a broad gamut of electives to students enrolled in a relatively small program, ensures the rigor of the content, and it also allows PSM students to transfer easily to the research-based MS/Ph.D. program in Biological Sciences; an option that has been taken by four of the 19 students who have matriculated into the PSM to date.

4.Overview of interdisciplinary relationships (if any) - include trends on what students choose for electives.

The PSM in Biotechnology is inherently an interdisciplinary program as students are required to take course work in business, the life sciences, statistics, and at least one other area taken from the following list (engineering, agriculture, health sciences, chemistry, bioinformatics). Students in the program take a wide variety of courses and can chose among multiple courses to fulfill any particular requirement in most cases. Appendix 4 has the courses that have been taken by all matriculated PSM students prior to fall 2014. There are no particular "trends" in regard to which courses students chose for electives. This is not surprising as the elective list is large and our students have a wide variety of interests and perspectives.

5. Characterize whether the facilities available for this program are adequate to support student, faculty, and staff needs.

Facilities are sufficient to run the program at its current size, and we estimate that we could handle up to twice the current enrollment at the current levels of staffing/space. All program expenses are covered as students in the program pay tuition, and the program brings net income into UD and the Department of Biological Sciences. However, the program would be enhanced if UD had more centralized support for negotiating/facilitating internship placements in industry. We are currently in discussions with the UD career services center to work out the best way to accomplish this.

6. Provide information on other budgetary requirements of the program beyond the typical unit expenses.

None, this program is financially self-sustaining, and all budgetary needs to run the program are covered by tuition. The financial model for the program is based on the following equation: Gross tuition paid by students-program administrative expenses-cross college adjustments= Net tuition income. This tuition is then split between the Department of Biological Sciences and the Dean's office. This program has generated a net profit every year that it has been in operation.

7. Other information of value for the review of the program.

The PSM in Biotechnology program has also proven very valuable for students who enter the program, then realize that their true interests lay much more in the creation of new knowledge than in the interface between business and biotechnology that is the focus of the PSM in Biotechnology program. To date, we have had four students matriculate initially into the PSM in Biotechnology, then transfer to the MS in Biological Sciences, a thesis based Master's degree that focuses on training students to be productive bench scientists. Of these, two subsequently transferred to the Ph.D. in Biological Sciences, one of whom has gone "full circle" and is currently a dual Ph.D. in Biological Sciences/Masters in Business Administrative student. Thus, having the PSM in Biotechnology within the Department of Biological Sciences has strengthened the opportunities for students to customize their education as their interests mature while in graduate school.

Appendix 1
Original graduate program proposal, 2010
Professional Science Master's in Biotechnology

I. *DESCRIPTION*

Professional Science Master's (PSM) degrees have been developed by the Council of Graduate Schools in conjunction with the Sloan Foundation to fill a need for workers trained at an advanced level in the Sciences whose background is broader than that found in the graduate of a traditional MS program. PSMs are designed as terminal degrees serving a similar role to the MBA degree for business graduates, by providing a comprehensive science curriculum that trains graduates to work in interdisciplinary teams that are expected to function in a business setting. The Professional Science Master's in Biotechnology seeks to train students in the advanced biological topics necessary to have a comprehensive understanding of modern life science research, provide exposure to related fields such as bioengineering, statistics, chemistry and bioinformatics and foster an understanding of business/organizational management issues. The course work requirements of the degree are integrated by a "capstone" experience which in most cases is expected to consist of an internship in a business setting. Students completing the program will have a broad exposure to both the scientific underpinnings of biotechnology and how these are applied practically in industrial settings and will be well prepared to take on diverse roles in the biotechnology industry. This will be assessed by both surveys of students and internship mentors and long term tracking of career trajectories (see assessment plan for more detail)

II. *RATIONALE AND DEMAND*

A. Institutional factors.

1. In May of 2008, the University of Delaware unveiled its "Path to Prominence" strategic plan. Objective III of the strategic plan it to achieve "Excellence in Professional Education" to meet the needs of a world where a bachelor's degree is no longer enough. In fall 2009, President Harker has highlighted the Professional Science Master's initiative as important progress towards the Excellence in Professional Education objective during town hall meetings with UD faculty (see Powerpoint presentation at http://www.udel.edu/udaily/2010/sep/townhalls091509.html.
2. The planning process began in late fall of 2008 in consultation between the Graduate Program Director of Biological Sciences, Melinda K. Duncan Ph.D., members of the Delaware Bioscience Industry Association and John Sawyer

Ph.D., current Associate Provost for Professional Education, UD about the need to professional training opportunities in biotechnology at the Masters level in the State of Delaware. Drs. Duncan and Sawyer applied for and were awarded a program development grant from the Delaware Valley Innovation Network in March of 2009. Since then, the curriculum has been designed in consultation with an industrial advisory board comprised of managers based in Delaware biotechnology industries, onsite discussions with mid-level managers at local biotechnology companies, the faculty of the Department of Biological Sciences, the chairs of the Departments of Computer science and Chemistry as well as the Dean's and the chairs of affected Departments from the Colleges of Health Sciences, Agriculture and Natural Resources, Arts and Sciences, Alfred Lerner College of Business and Economics, Engineering, Education and Public Policy, and Earth, Oceans and Environment

3. The impact of this program on University programs will be to increase the enrollment in graduate courses in biotechnology related fields and it will require the offering of business related content. Commitments have been obtained from all affected units to provide this.
4. The proposed curricula would more fully utilize existing resources since it will provide enrollment for some currently undersubscribed courses in the life sciences, particularly those taught outside of the College of Arts and Sciences.

B. Student demand

1. The current goal is to enroll 10 new graduate students per academic year in this program. The enrollment numbers are derived from inquiries of potential applicants to the Department of Biological Sciences seeking such programs and discussions with leaders in Delaware Biotechnology industry. These students are projected to be new to the university since this program will address currently unfulfilled demand for a program that provides training at the interface between science and business.
2. This curriculum is primarily intended to meet the needs of full-time students who desire Master's level training to prepare them for careers in biotechnology industry. However, efforts are ongoing to move a significant proportion of the content to evening or online offerings to meet the needs of working professionals.

C. Transferability

We expect few to no students to transfer into this from other UD degree programs,

although students pursuing graduate certificates, particularly the biotechnology certificate, will be encouraged to enroll. All applicable UD coursework taken as a student in other programs will transfer to this degree as long as it has not counted towards another UD degree. The exception is that all coursework applied to UD graduate certificates (that has not been applied to a degree) will be fully applicable to the PSM in Biotechnology.

D. Access to graduate and professional programs

N/A

E. Demand and employment factors

This degree seeks to prepare students for employment in the Biotechnology industry. The Delaware Valley Innovation Network Talent Gap Analysis for Delaware Valley Biotechnology industry (published Winter 2009, see http://www.delawarevalleyinnovationnetwork.com/reports/gap-analysis) has identified a need to increase the number of qualified biotechnology workers able to fill jobs in the growing biotechnology sector. This report also states that local industry currently has difficulty finding employees that have a strong, diverse scientific background coupled with communication, teamwork, leadership and business skills. The PSM in Biotechnology seeks to fill this gap.

F. Regional, state, and national factors

1. There are currently no comparable courses of study offered by any university in The State of Delaware. Both the Department of Biological Sciences University of Delaware and Department of Biological Sciences/Biotechnology, Delaware State University, offer MS degrees in Biological Sciences. However, neither existing program requires the business/scientific teamwork-leadership coursework of the Professional Science Master's and neither requires an industrial internship. The National Professional Science Master's Association lists 35 programs nationwide in biotechnology related fields. The only programs in our geographic area are George Washington University, Northeastern University, Pennsylvania State University, St. Johns University, State University of New York at Brockport, and University of Connecticut. There are no established programs in the Delaware Valley. The closest similar programs that are recognized Professional Science Master's degrees are located at Temple University and Thomas Jefferson University (Philadelphia, Pennsylvania), The University of Maryland, Baltimore County (Baltimore, Maryland) and The University of Maryland, University College (Adelphi, Maryland). Of these, the only the Maryland schools have Professional Science Master's in Biotechnology programs. The geographic distance between Baltimore and Delaware makes these programs very

inconvenient for part-time students living and working in Delaware. Further, the Maryland programs primarily serve the needs of Baltimore/Washington corridor biotech employers and would not draw new talent into the Delaware talent pool accessible to Delaware biotech employers.

2. There is no existing accrediting body for these types of program beyond the university level accreditation of Middle States. However, The Council of Graduate Schools formally recognizes Professional Science Master's programs. The National Professional Science Master's Association (NPSMA) is a collaboration of Professional Science Master's degree program directors, faculty, administrators, alumni, and students that supports PSM degree initiatives. The NPSMA publishes guidelines and best practices for PSM programs. The program has been designed to meet the recognition requirements (see http://www.sciencemasters.com/PSMAffiliation/HowtoApplyforPSMAffiliation/tabid/116/Default.aspx). Further, the curriculum has been designed both in consultation with our industrial advisory board and other interested biotechnology industry representatives from the State of Delaware. This is a requirement for PSM recognition and ensures that students completing the program will have skills that meet the needs of potential employers. Upon program approval by the University of Delaware, we will seek recognition as a Professional Science Master's program from the Council of Graduate Schools. NPSMA is currently investigating accreditation for such programs and may become the accrediting body for PSM programs. Once accreditation standards are developed, UD will apply for that accreditation. John Sawyer is the University of Delaware representative to the NPSMA. Upon recognition of PSM programs at Delaware, the University will become an institutional member.

G. Describe other strengths

1. The University of Delaware is uniquely positioned to offer the Professional Science Master's degree in Biotechnology. Our focus reflects the academic strengths of our Faculty, our longstanding and ongoing commitment to biological sciences and the biotechnology industry, our existing and developing partnerships, and the unique characteristics of the region.
2. Strong research capabilities in Biotechnology and Bioinformatics at Bio-related research centers at the University of Delaware such as the ***Center for***

Translational Cancer Research, the ***Avian Biosciences Center*** and the ***Center for Biomedical Engineering Research.***

3. ***Delaware Biotechnology Institute***: The institute was established in 1999 to promote research, education, and technology transfer for biotechnology applications to the benefit of the environment, agriculture, and human health.
4. ***Delaware Health Sciences Alliance***: A partnership between the *University of Delaware, Thomas Jefferson University, Christiana Care Health Systems,* and *The Nemours Foundation/Alfred I. DuPont Hospital for Children,* to support joint and collaborative education, research, public outreach, and student internships.
5. The Delaware Valley region is a major center of biosciences industry.
6. 11.5% of new jobs in the Delaware Valley region are in the biosciences.
7. Every new biosciences job in the region supports 3.7 additional jobs.
8. Longstanding relationships with key bio industry companies such as ***AstraZeneca*** and ***DuPont***.
9. Melinda Duncan and John Sawyer obtained a Department of Labor grant through the Delaware Valley Innovation Network to develop this program. In doing so we partnered with the Delaware Biosciences Association (DBA) to build the Industry Advisory Board for the program. DBA and several members of the industry advisory board will partner with the University of Delaware to provide internships and experiential learning opportunities for students in the program. The Office of Graduate and Professional Education is currently working to specify the form of the internships and the formal structure of these relations to assure that we will secure ample meaningful internships for the students.
10. An engaged industrial advisory board representing both small and large biotechnology firms with a presence in Delaware including; Siemens, DuPont, Thermo-Fisher, Fraunhofer, Incyte, Noramco, and WL Gore.

III. *ENROLLMENT, ADMISSIONS AND FINANCIAL AID*

A. The current enrollment goal is to admit 10 students per year into the program with a total of 20 students enrolled at any one time. This limit is based on the availability of seats in the graduate level classes and faculty/staff time available to provide appropriate academic advisement. If the program is successful and proves very popular in the future, it would be possible to admit additional students although additional faculty teaching and faculty/staff administrative resources would need to be identified to do so.

B. Admission Requirements

Applicants will be selected based on undergraduate and any prior graduate transcripts, letters of recommendation, strength of prior experience in the field, the GRE, and the TOEFL if applicable. See graduate program policy for details.

C. Student Expenses and Financial Aid

1. The majority of student financial support for this program is provided from the student's resources supplemented through traditional financial aid mechanisms including loans.

D. Institutional Factors

Students completing this program will receive the Professional Science Master's (PSM) degree. This is the appropriate form of recognition since it is distinctly different from traditional MS programs in that it 1) is intended to be a terminal degree 2) combines both science and business training 3) includes a required industrial internship experience.

E. Describe the curriculum

The PSM in Biotechnology requires 42 credits of graduate level course work consisting of:
1) 12 credits of graduate level course work in the biological sciences comprised of at least one course in each of three of the five following areas: Molecular Biology, Genetics, Cell Biology, Physiology and Microbiology (see list below)
2) 9 credits of graduate level courses in fields related to biotechnology including bioinformatics, engineering, chemistry, agriculture, food safety, health sciences and statistics (see approved list below). One class must be from the category "statistics" unless the student has prior coursework in statistics. This determination is made by the program director.
3) 15 credits of "Plus" courses, one from each of the following five categories: ethics, intellectual property/legal regulatory affairs, survey of business or public administration, leadership and organizations, and project management/decision making (see below).
4) Six credits of BISC 872, internship. The experiential portion of this class will in most cases be completed during a 7 month long, full-time internship at a biotechnology company and be supervised jointly by a representative of the host company and a University of Delaware faculty member. Students pursuing the PSM degree who have significant prior bench experience will be encouraged to focus their capstone on improving a company's business/management plan or moving a newly developed product to market. Such projects could include; an analysis of how to bring a product to market, how to improve team interactions between company groups or how to scale up a research project to commercial scale. Students pursuing the PSM degree without prior experience working at the bench will be encouraged to focus their capstone on a specific scientific research question. Such projects could include: testing methods to increase production of recombinant proteins, testing the specificity of antibodies being developed or direct research product development. The capstone is assessed by the quality of the work performed at the internship and two written reports 1) a plan of work outlining the background of the project, the learning objectives for the internship and goals to be accomplished developed in consultation

with and approved by both the faculty and internship mentors and 2) a scholarly paper outlining the objectives of internship, what was accomplished on each objective and recommendations for future work. Internships may be full-time or part-time depending on the schedule/needs of the student and employer. Internships may be paid or unpaid with the final grade based on the written reports and mentor evaluation. Students who are employed in the field of biotechnology are encouraged to develop their capstone projects at their place of employment as part of a professional development plan, however the expectation is that the "capstone" will be different than the student's normal job responsibilities.

Please see the attached graduate program policy for full details of the curriculum:

V. *RESOURCES AVAILABLE*

A. Learning Resources

See attached library assessment statement

B. Faculty / Administrative Resources

The program administrator is Melinda K. Duncan, Ph.D., Tenured Full Professor and Graduate Program Director, Department of Biological Sciences. She has been involved in the administration of graduate programs in Biological Sciences for the past 11 years and has served as the Biological Sciences Graduate Program Director since 2005. The coordination of the Plus curriculum and internships will occur in collaboration with John Sawyer, Ph.D., Tenured Full Professor, Department of Business Administration, Associate Provost for Professional Education. Drs. Duncan and Sawyer previously developed a joint Ph.D. in Biological Sciences/MBA program which graduated its first student in May 2009.

C. External Funding

Drs. Duncan and Sawyer have received funding from the Delaware Valley Innovation Network to provide the initial resources necessary to develop this proposal. A grant to fund part of the initial startup of the program is in preparation for submission to the National Science Foundation

VI. *RESOURCES REQUIRED*

A. Learning Resources

The learning resources necessary for basic implementation are generally in place in the form of existing graduate classes in the biological science and related fields. However, the Lerner College of Business is developing BUAD500, "Survey of Business" to provide the prerequisite training necessary to complete the "Plus" curriculum. In order to

compete for both the highest caliber of student and to fulfill the needs of the part-time student population in the future, additional sections of the most popular graduate classes will need to be offered after normal working hours, more courses will need to be developed in fields relevant to biotechnology industry such as fermentation, legal issues in biotechnology, and biotechnology business administration, and the University Office of Financial Aid will need to be more responsive to the needs of tuition paying graduate students.

B. Personnel Resources

The Department of Biological Sciences is currently very short of full time faculty to cover existing undergraduate and graduate course offerings. For this program to succeed and expand in the future, additional faculty members qualified to teach graduate courses relevant to biotechnology will need to be hired. In some cases, such faculty could be on supplemental contracts, however, full time faculty members are preferred to ensure the academic rigor of the program.

C. Budgetary Needs

Since the PSM in Biotechnology is a program with interdisciplinary coursework spread over all seven UD colleges, the tuition for students enrolled in the program will need to be apportioned to fairly compensate all participants. The budget policy for PSM programs is currently under negotiation among the College Deans since all seven UD colleges provide course content to this program.

The initial proposal from the Department of Biological Sciences is below:

1) 20% of tuition shall be for program administration including staff time, computer support, program marketing & recruiting, office supplies, teaching buyout and/or salary for the program administrator, etc.

2) The remaining 80% of tuition for classes taken outside of the College of Arts and Sciences will be sent to the College teaching the class.

3) The exception to this policy is the tuition generated due to BISC872, internship. Mentoring of student internships will be time intensive for faculty members and there is currently no incentive for faculty members to take on this responsibility either in the Collective Bargaining Agreement or in contributions to faculty research programs. In order to provide faculty with incentives to perform this critical role, 60% of tuition generated for BISC872 will be returned to the faculty member mentoring the internship in a professional

development account. The remaining 20% of the tuition will be retained in the College in which the faculty member holds primary appointment.

VII. *IMPLEMENTATION AND EVALUATION*

A. Implementation Plan

All classes for the program are either existing or are currently submitted to the challenge list for permanent numbers to be in place by fall 2010. The program will seek to quickly market the program immediately after program approval is obtained in order to matriculate at least a small class for fall 2010. At this time, the program director will identify faculty members willing to serve as faculty advisors/internship mentors. The program director in collaboration with John Sawyer, Associate Provost for Professional Studies and the Office of Graduate and Professional Studies, will develop a pool of prospective industrial internship mentors.

B. Assessment Plan

Assessment plan PSM in biotechnology				
Objectives	**Strategic Activities**	**Measures**	**Short-term Outcomes**	**Long-term Impact**
1. Train students in life science disciplines pertinent to biotechnology	recruit excellent applicants and matriculate students with credentials similar to those in the existing departmental graduate programs	Number and demographic data of student applicants and matriculated students.	Retention and time to degree statistics	Students gain employment in biotechnology related fields
	Course work covering the disciplines of cell biology, molecular biology, genetics, microbiology, physiology	Faculty evaluation of student progress in course work Survey of internship mentors Surveys of graduate students in the program and post-graduation	Course work for the PSM degree helped students secure biotechnology related internships and initial employment	Graduates enjoy long term success in biotechnology careers
	Course work covering biotechnology related disciplines including agriculture, chemistry, engineering, health sciences, statistics, lab science	Surveys of students focusing on their experiences in these classes Surveys of graduates to determine the utility of these classes to their career Faculty evaluation of student progress in course work	Course work for the PSM degree helped students secure biotechnology related internships and initial employment Students and graduates report applying knowledge from courses to work settings	Graduates enjoy long term success in biotechnology careers

		Interviews and surveys of internship mentors		
2. Provide training in science related business, organizational management, legal issues, project management and ethics	course work addressing these issues and industrial internship experience	Surveys of students focusing on their experiences in these classes Surveys of graduates to determine the utility of these classes to their career Faculty evaluation of student progress in course work Interviews and surveys of internship mentors	Course work for the PSM degree helped students secure biotechnology related internships and initial employment Students and graduates report applying knowledge from courses to work settings	Graduates enjoy long term success in biotechnology careers
3. Provide experiential training in biotechnology industry to prepare students for the expectations of the workplace	Internships in biotechnology related industrial settings	Surveys of students focusing on their experiences in their internship Surveys of graduates to determine the utility of their internship experience to their career Faculty and internship mentor evaluation of both the internship work and the written products Interviews and surveys of internship mentors	Internship prepares students for the biotechnology workplace and helps them secure their first post-graduation position	Graduates enjoy long term success in biotechnology careers

Program improvement will be an ongoing process. The results of the assessment measures will be shared with both the Industrial Advisory Board for the PSM in Biotechnology and the Graduate Affairs Committee, Biological Sciences. The curriculum will be modified as necessary to achieve the goal of producing graduates who apply the knowledge, skills and abilities gained from the PSM in biotechnology to their career.

VIII. APPENDICES

A. Graduate Program Policy
B. Accreditation Criteria (if appropriate)
C. Letters of Collaborative Agreement
D. Letters of Approval from Contributing Departments
E. Other Pertinent Documents

Professional Science Master's (PSM) in Biotechnology Program Policy

Part I. Program history

A) Statement of purpose and expectations for graduate study

The Professional Science Master's in Biotechnology seeks to provide advanced, interdisciplinary didactic coursework in the life sciences, training in business applicable to scientific industry and experiential training in an industrial setting. Graduates will be poised to enter positions in diverse biotechnology industries.

B) Date of permanent status-
pending

C) Degrees offered Professional Science Master's (PSM) in Biotechnology

Part II. Admission

A) Admission requirements
Admission to the PSM in Biotechnology requires a prior scholastic index (grade point average on a 4.0 point scale) of at least 2.8 overall and 3.0 in the sciences. Those who meet the stated minimum requirements are not guaranteed admission, nor are those who fail to meet all those requirements necessarily precluded from admission if they offer other appropriate strengths.

There is also the possibility of entering the program after the successful completion of two courses of the Biological Sciences core with a grade of B or better (not B-) as a continuing education student and the achievement of an overall GPA of 3.0 in graduate classes attempted. Students may also be admitted after successful completion of the "Certificate in Biotechnology".

Applicants who are not U.S. citizens or permanent residents must complete the Test of English as a Foreign Language (TOEFL) with a score of 550 or higher on the paper-based test or 79 or higher on the Internet-based test. Previous education, training or residence in the U.S. does not exempt foreign nationals from these requirements. Requests for a waiver of the language test requirements (for example, for students from English-speaking countries outside of the U.S., or for foreign students who have a college degree from a U.S. institution) must be approved by the University of Delaware Office of Graduate Studies. Students who need further training in English prior to attending graduate school may apply for admission through the University of Delaware English Language Institute's Conditional Admission Program
http://www.udel.edu/eli/programs_grad_cap.html.

The Graduate Record Examination is required of all applicants to the PSM in Biotechnology including those who have successfully completed the "Certificate in Biotechnology".

B) Prior degree requirements
BA or BS degree, preferably in a science or engineering discipline

C. Application deadlines.
Fall admission: Full consideration deadline: January 15th with rolling admission to continue until May 1st for foreign nationals and July 1st for US citizens/permanent residents.

Spring Admission: Full consideration deadline: October 1st with rolling admission to continue until November 1st for foreign nationals, December 15th for US citizens/permanent residents.

D. Special competencies needed
Applicants are required to have completed, at the undergraduate level, the following (or the equivalent): two years of biological sciences; one year of mathematics, preferably to include calculus and/or statistics; one year of college physics; one year of general chemistry; and one course in organic chemistry.

E. Admission categories.
Provisional admission may be offered with the stipulation that any deficiency in undergraduate training be made up (without graduate credit).
Students with TOEFL scores below the minimum required for admission may be considered for conditional admission if they enter the University of Delaware English Language Institute's academic English program.

F. Other documents required
Applications must also include three letters of recommendation from persons able to judge the applicant's ability to pursue graduate study, a resume or CV outlining work and/or academic experience in the field of biotechnology as well as an application essay consisting of the answers to the following questions:

1. What scientific research/employment experience have you had? Please be specific about the field of work and job responsibilities
2. What are your long-term professional objectives?
3. What specific attributes of our Department and the PSM in Biotechnology make you feel that this degree is appropriate to help you achieve your professional objectives?

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G. University statement:
Admission to the PSM in Biotechnology program is competitive. Those who meet stated requirements are not guaranteed admission, nor are those who fail to meet all of those requirements necessarily precluded from admission if they offer other appropriate strengths.

Part III. Academic
A. Degree Requirements

1. List course requirements
The PSM in Biotechnology requires 42 credits of graduate level course work consisting of:
1) 12 credits of graduate level course work in the biological sciences comprised of at least one course in each of three of the five following areas: Molecular Biology, Genetics, Cell Biology, Physiology and Microbiology (see list below)
2) 9 credits of graduate level courses in fields related to biotechnology including bioinformatics, engineering, chemistry, agriculture, food safety, health sciences and statistics (see approved list below). One class must be from the category "statistics" unless the student has prior coursework in statistics. This determination is made by the program director.
3) 15 credits of "Plus" courses, one from each of the following five categories: ethics, intellectual property/legal regulatory affairs, Survey of business or public administration, Leadership and organizations and Project management/decision making (see below).
4) 6 credits of BISC 872, internship. The experiential portion of this class will in most cases be

completed during a 7 month long, full time internship at a biotechnology company and be supervised jointly by a representative of the host company and a University of Delaware faculty member. Students pursuing the PSM degree who have significant prior bench experience will be encouraged to focus their capstone on improving a company's business/management plan or moving a newly developed product to market. Such projects could include; an analysis of how to bring a product to market, how to improve team interactions between company groups or how to scale up a research project to commercial scale. Students pursuing the PSM degree without prior experience working at the bench will be encouraged to focus their capstone on a specific scientific research question. Such projects could include: testing methods to increase production of recombinant proteins, testing the specificity of antibodies being developed or direct research product development. The capstone is assessed by the quality of the work performed at the internship and two written reports 1) a plan of work outlining the background of the project, the learning objectives for the internship and goals to be accomplished developed in consultation with and approved by both the faculty and internship mentors and 2) a scholarly paper outlining the objectives of internship, what was accomplished on each objective and recommendations for future work. Internships may be full-time or part-time depending on the schedule/needs of the student and employer. Internships may be paid or unpaid with the final grade based on the written reports and mentor evaluation. Students who are employed in the field of biotechnology are encouraged to develop their capstone projects at their place of employment as part of a professional development plan, however the expectation is that the "capstone" will be different than the student's normal job responsibilities.

The program will make every effort to assist students with identifying internship opportunities and negotiating internship plans. However, students bear significant responsibility in this process as well and failure to either identify an internship and/or formulate an acceptable internship plan by the end of the student's third semester of full time study (or completion of 33 credits of course work) is considered failure to make satisfactory progress towards degree.

Biological Sciences (12 credits, four classes; must include classes from at least three of the five following categories)

Cell Biology	**Credits**
BISC 612- Advanced Cell Biology	3
BISC 625- Cancer Biology	3
BISC 671- Cellular and Molecular Immunology	4
PLSC635- Plant Developmental Biology	3

Genetics	**Credits**
BISC 654- Biochemical Genetics	3
BISC 656- Evolutionary Genetics	3
BISC 693- Human Genetics	3
PLSC 636- Advanced Plant Genetics	3
PLSC 605- Plant breeding	3

Microbiology	**Credits**
ANFS 635- Animal Virology	3

ANFS 639- Food Microbiology	3
BISC 641- Microbial ecology	3
BISC 682- Bacterial Pathogens; molecular mechanisms	3
BISC 645- Bacterial Evolution	3
BISC 679- Virology	3
PLSC 619- Soil Microbiology	4
PLSC 629- Introduction to Fungi	4
MAST 618- Marine microbial ecology	3

Molecular Biology	**Credits**
ANFS 670- Principles of Molecular Genetics	3
BISC 602- Molecular Biology of Animal Cells	3
BISC 665- Advanced Molecular Biology and Genetics	3
CHEM642- Biochemistry II	3

Physiology	**Credits**
BISC 605- Advanced Mammalian Physiology	3
BISC 615- Vertebrate Developmental Biology	3
BISC 675- Cardiovascular Physiology	3
HESC 651-Neurophysiological Basis of Human Movement	3
HESC 654- Survey of Medical Physiology	3

Biotechnology-related science courses (three courses from the following list adding up to at least 9 credits, one must be from the category "statistics" unless the student has documented prior exposure to statistical analysis of data)

Agriculture/food science:	**Credits**
ANFS 628- Food Chemistry	4
ANFS 629- Food Analysis	4
ANFS 633- Poultry pathology	3
ANFS 636- Immunology of domestic animals	3
ANFS 637- Avian immunology	3
ANFS 645- Food engineering technology	3
ANFS 649- Food biotechnology	4
ANFS 654- Advanced ruminant nutrition	3
BREG 603/PLSC 603- Soil physics	3
ENWC 611- Insect pest management	3
ENWC 610- Medical, Veterinary, and forensic entomology	3
ENWC 619- Biological control	3
ENWC 805- Insect-plant chemical ecology	3

Bioinformatics:	**Credits**
ANFS 644- Bioinformatics	3
CISC 636- Introduction to bioinformatics	3
CISC 637- Database Systems	3
CISC 681- Artificial Intelligence	3
CISC 683- Introduction to data mining	3
CISC 841- Bioinformatics	3

MAST 697- Bioinformatics programming for Biologists	3
MAST 698- Environmental and systems bioinformatics	3

Chemistry/Biochemistry	**Credits**
CHEM 641- Biochemistry	3
CHEM 645- Proteins, Structure and Function	3
CHEM 646- DNA-Protein Interactions	3
CHEM 649- Molecular Biophysics	3
CHEM 653- Bioinorganic Chemistry	3
CHEM 681- Green Chemistry	3

Engineering:

CHEG 617- Colloid science and engineering	3
CHEG 620- Biochemical Engineering	3
CHEG 621- Metabolic engineering	3
CHEG 625- Green Engineering	3
CHEG 649- Molecular Biophysics	3
CHEG 650- Biomedical Engineering	3
CHEG 805- Multidisciplinary biotechnology	3
CPEG 630- Neurons and networks	3
ELEG 643- Biomedical Nanotechnology	3
ELEG 670- Biophysics of excitable membranes	3
ELEG 671- Introduction to biomedical engineering	3
ELEG 675- Image processing with biomedical applications	3
ELEG 678- Introduction to nano and biophotonics	3
ELEG 679- Introduction to medical imaging systems	3
MEEG 612- Biomechanics of human movement	3
MEEG 682- Clinical biomechanics	3
MEEG 683- Orthopedic Biomechanics	3
MEEG 684- Biomaterials and tissue engineering	3
MEEG 685- Control of human movement	3
MEEG 686- Cell and tissue transport	3

Health Sciences

BISC 600- Biotechnology and molecular medicine	3
HESC 601- Research Methods	3
HESC687- Nursing Sciences Research	3
NURS 621- Advanced pathophysiology	3
NURS 622- Advanced pharmacology	3
NURS 638- Health sciences evaluation	3
PHYT 809- Psychosocial Aspects of Health and Disease	3
PHYT 606- Research	3
PHYT 623- Clinical Neuroscience	3

Advanced Laboratory Techniques

BISC 601- Immunochemistry	4
BISC 604- Nucleic Acids Laboratory	4
BISC 619- Gene Expression Laboratory	4

Statistics/data analysis:

BISC 643- Biological Data Analysis	3
CHEG 604- Probability and statistics for engineering	3
STAT 608- Statistical Research Methods	3
STAT 609- Regression and Experimental Design	3
STAT 611- Regression Analysis	3
STAT 615- Design and Analysis of Experiments`	3
STAT 616- Advanced Design of Experiments	3
STAT 617- Multivariate Analysis	3
STAT 619- Time Series Analysis	3
STAT 620- Nonparametric Statistics	3
STAT 621- Survival Analysis	3
STAT 656- Biostatistics	3
STAT 674- Applied Data Base Management	3
STAT 675- Logistic Regression	3

PSM Plus component (15 credits):

Whereas students in Professional Science Master's Programs may have professional goals that would lead them into business and industry, or to government or non-profit employment, the University of Delaware offers two tracks for the PSM PLUS component.
PSM students will take at least 15 credits of PLUS coursework in addition to their science core. The University recommends the student follow one of the tracks below, however students may cross over tracks to fit their interest.

Business/industry track	**Government/non-profit track**
Survey of Business (3 credits)	**Survey of Public Administration (3 credits)**
BUAD 500- Survey of Business*	UAPP 803- Seminar in Public Administration
Leadership and Organizations (3 credits)	**Leadership and Organizations (select 1, 3 credits)**
BUAD 870- Leadership and Organizational Behavior	UAPP 835- Organizations and Management
	UAPP 604- Leadership in Organizations
Project Management, Operations or Entrepreneurship (select 1, 3 credits)	**Managerial Decision Making or Financial Management (select 1, 3 credits)**
BUAD 835- Managing New Product Development Projects	UAPP 819- Management Decision Making in Public & Nonprofit
BUAD 831- Operations Management and Management Science	UAPP 833- Financial Management in Public and Nonprofit Sectors
BUAD 871- Managing for Creativity and	UAPP 827- Program and Project Analysis

Innovation	
ENTR 860- High Tech Entrepreneurship	UAPP 829- Taxation and Fiscal Policy
MISY 840 -Project Management and Costing	
Intellectual Property (3 credits)	**Legal and Regulatory Affairs (3 credits)**
CHEG 595- Intellectual Property for Engineers and Scientists	UAPP 646- Administrative Law and Policy
Ethics (3 credits):	
BISC 631- Practice of Science	UAPP 648- Environmental Ethics
BUAD 840- Ethical Issues in Global Business Environments	UAPP 650- Values Ethics and Leadership

*BUAD500 meets prerequisites for BUAD835, BUAD831 and BUAD871

2. Advisement All students will develop a plan of study in consultation with their advisor upon matriculation into the program.

3. Give procedure for petitions for variance in degree requirements (e.g., course substitution policies, completion deadlines, etc.)
All petitions for course substitutions and variances in the completion deadlines must be made to the Graduate Affairs Committee, Department of Biological Sciences.

4. Define any grade minimums in courses that are different from University policy.

Only graduate courses completed with a grade of B or higher fulfill the biological sciences core and the biotechnology-related course requirements including the internship for the PSM in Biotechnology. Students receiving a B- or lower in a required core course are subject to dismissal from the program. However, they may file an appeal to the Department of Biological Sciences Graduate Affairs Committee for approval to retake the course and remain in the program. If the appeal is not approved, the Graduate Affairs Committee will recommend to the Office of Graduate Studies that the student be dismissed from the program.

Students must also earn a minimum index of 3.0 in all "plus" component courses attempted to earn the PSM in Biotechnology, and no course with a grade below a C- may be counted toward the degree.

5. Identify any courses, which may not be used towards the degree.

Only courses listed in the curriculum may count towards the degree unless a variance is granted by the Graduate Affairs Committee, Department of Biological Sciences.

6. Identify expectations of facility of expression in English (oral and written) as part of the degree requirement.

While there are no specific requirements, successful completion of the degree will require fluency in both written and spoken English.

B. Committees for exams, thesis, or dissertations

This degree has no thesis or dissertation requirements. The director of the program will compile a list of University of Delaware faculty members who are willing serve as academic advisors for PSM Biotechnology students. Students will select advisors from this list who have expertise most appropriate for their career interests within the first two weeks after matriculation. The academic advisor in consultation with the program director will provide guidance on course selection and the academic advisor will also be responsible helping the student formulate the expectations for their internship experience and for evaluating the student's capstone internship report.

It is highly encouraged that part-time students working in biotechnology-related fields work with both their UD academic advisor and employer prior to matriculation to develop a comprehensive professional development plan that coordinates PSM Biotechnology degree requirements with work responsibilities.

C. Timetable and definition of satisfactory progress towards the degree

1. Academic load

Full-time students will enroll in at least 9 credits of classes per semester (fall and spring), however, in order to complete the degree in two years, the student will need to enroll in 12 credits of classes at least two semesters. Part-time students are expected to enroll in at least one class per regular academic semester to remain matriculated in the program and are expected to complete their degree within five years.

Time line for degree:

Semester 1- enroll in 9 credits of coursework
Semester 2- enroll in 12 credits of coursework
Semester 3- enroll in 12 credits of coursework
Winter after semester 3- begin internship
Semester 4- enroll in BISC 872 internship and single remaining didactic course (Plus course taken during evening hours, 9 credits)
Summer after semester 3- sustaining status, complete internship and final report, graduate

Normal progress towards degree is reviewed for all students in the program at the end of every academic semester and is assessed based on grades, participation in program activities and performance in the internship.

2. Grade requirements (general and specific).

Only graduate courses completed with a grade of B or higher fulfill the biological sciences core and the biotechnology-related course requirements for the PSM in Biotechnology. Students must also complete BISC872, internship with a grade of at least B. Students receiving a B- or lower in a required core course are subject to dismissal from the program. However, they may file an appeal to the Department of Biological Sciences Graduate Affairs Committee for approval to retake the course and remain in the program. If the appeal is not approved, the Graduate Affairs Committee will recommend to the Chair of the Department of Biological Sciences that the student be dismissed from the program.

Students must also earn a minimum index of 3.0 in all "plus" component courses attempted to earn the PSM in Biotechnology.

All graduate courses successfully completed with a B or higher that were applied towards earned

graduate certificates, but not graduate degrees, at the University of Delaware will be directly applicable to the PSM in Biotechnology.

3. Thesis/dissertation progress timetable guidelines.
N/A

4. Thesis/dissertation defense guidelines.
N/A

5. Forms required.
The application for advanced degree must be filed with the Office of Graduate studies prior to the beginning of the last semester in the program

6. Identify consequence for failure to make satisfactory progress.
Students failing to make satisfactory progress towards degree will be identified by the Graduate Affairs Committee, Department of Biological Sciences, in consultation with the student's academic advisor/program director. Recommendations for dismissal are made by the Department Chair of Biological Sciences to the University of Delaware Office of Graduate studies.
Students who feel that they have been graded inappropriately or receive what they perceive as an unfair evaluation by a faculty member may file grievances in accordance with University of Delaware policies. Students are encouraged to contact the Department's Graduate Program Director prior to filing a formal grievance in an effort to resolve the situation informally.

Part IV. Assessment Plan

Consistent with the Mission Statement presented earlier in this document, five student learning goals are defined. Students will:

1. Have advanced knowledge of the discipline of biotechnology
2. Have experience working with interdisciplinary teams on biotechnology
3. Achieve competence in scientific communication
4. Be knowledgeable in scientific business ethics
5. Understand the application of business/management theory to science

The specific goals stated above are mapped to various science and PLUS courses in the program Assessment Plan which guides program evaluation and is filed with the Center for Educational Effectiveness.

These goals are be assessed through multiple indicators including:

- Faculty evaluation of student progress in course work
- Survey of internship mentors
- Surveys of students and program alumni
- Faculty and internship mentor evaluation of the internship work and written products
- Employer surveys

Both short term and long term impacts are assessed.

Part V. Financial aid-
Students enrolled in this program are responsible for their tuition and living expenses. Both the Department of Biological Sciences and University of Delaware Office of Financial Aid will provide assistance in identifying suitable fellowships, grants and loans to help finance their

education.

Part VI. Departmental Operations

A. General student responsibilities

Access to Student Records

Students wishing to review their Departmental file must submit a written request to the Graduate Program Director at least 24 hours in advance. Students must review the file in the presence of departmental staff or faculty and are not permitted to remove a file from Wolf Hall but may photocopy documents from their folder. All access to student records is in accordance with the Family Educational Rights and Privacy Act.

Standards of Student Conduct

A)Academic honesty

All graduate students are subject to University of Delaware regulations regarding academic honesty.

B) Laboratory Safety and Research Regulations

Graduate students performing laboratory research are subject to all University regulations regarding safety, use of human subjects and animals, and hazardous/radioactive material use and disposal. These guidelines may be found in the University of Delaware Policies and Procedures Manual. Students participating in off campus internship experiences are expected to fully comply will all safety regulations of the workplace.

C) Contact information

It is the responsibility of all students to ensure that their contact information on file with the university is current (mailing address, phone number, email address). It is also the student's responsibility to regularly monitor their email, phone and mail for important notices regarding their enrollment.

D). Departmental facilities

Occasionally student's graduate assistantship or other assignments may require the use of departmental laboratories or other facilities. Keys to laboratories, etc., are maintained in the Department office and will be issued based on faculty and Department Chair approval.
Any assignments that require the expenditure of departmental funds (e.g. data collection activities) require departmental approval in advance and are processed through the department in which the work is to be done.

B) **Guidelines for Formal CGS Recognition as a Professional Science Master's (PSM) Program**

The Professional Science Master's (PSM) degree is a unique professional degree grounded in science and/or mathematics and designed to prepare students for a variety of career options in business, government, or non-profit organizations. The degree combines advanced coursework in science and/or math with an appropriate array of professional skill-development activities to produce graduates highly valued by employers and fully prepared to progress toward leadership roles. The PSM is designed to be self-contained and is not a traditional master's degree earned en route to or from a PhD degree.

The following criteria are intended to provide guidance to faculty and institutions planning new PSM programs, or to assist leaders of existing programs who feel their programs meet the criteria to be recognized as a PSM or who wish to modify their programs in order to be recognized as a PSM. The following criteria are deemed important for a master's program to qualify for PSM status.

- A majority of program course work in graduate-level science and/or mathematics courses in one or more disciplines. An interdisciplinary curriculum is highly desirable.
- A professional skills component (often called the "plus" component of a "science-plus degree") that may consist of a variety of relevant courses and activities developed in consultation with prospective employers. Examples include business basics, legal and regulatory issues, finance and marketing, communication and teamwork, and are often developed in collaboration with appropriate academic units outside the sciences or taught by adjunct faculty from the targeted employment sector. In addition to courses and workshops, professional skills are usually enhanced by internships and problem-based projects sponsored by employers. The professional component should result in a portfolio of experiences recognized by and involving the client employers.
- Program quality assurance should be provided using the faculty-based mechanisms normally used by the institution for graduate programs in order to ensure institutional integration and sustainability. It is understood that the professional nature of the program may lead to substantial participation by non-academic practicing professionals, for example as adjunct faculty course instructors or student internship mentors.
- An active and engaged employer advisory board. Examples of board and/or individual-member functions include providing advice on the program curriculum, assisting with internships and placement, assisting with project-identification, and/or interacting individually with students.
- A commitment to report enrollment and degrees annually and an attempt to track the employment history of every graduate in order to help assess program outcomes and success.
- Agreement to use the name "Professional Science Master's" and the PSM logo on Websites and advertising brochures. In turn the program will be listed on CGS national PSM websites and data bases, and will be included in CGS PSM promotional activities.

In order to use the trade-marked title and logo "PSM" institutions must apply to the Council of Graduate Schools for recognition as a PSM by addressing each of the above stated criteria and by submitting an application to profmasters@cgs.nche.edu.

From Fall 2010	Current as of Fall 2014
Professional Science Master's (PSM) in Biotechnology Program Policy	**Professional Science Master's (PSM) in Biotechnology Program Policy**
Part I. Program history	**Part I. Program history**
A) Statement of purpose and expectations for graduate study The Professional Science Master's in Biotechnology seeks to provide advanced, interdisciplinary didactic coursework in the life sciences, training in business applicable to scientific industry and experiential training in an industrial setting. Graduates will be poised to enter positions in diverse biotechnology industries.	**A) Statement of purpose and expectations for graduate study** The Professional Science Master's in Biotechnology seeks to provide advanced, interdisciplinary didactic coursework in the life sciences, training in business applicable to scientific industry and experiential training in an industrial setting. Graduates will be poised to enter positions in diverse biotechnology industries.
B) Date of permanent status- Provisional status, May 2010; Pending review for Permanent Status in 2015	**B) Date of permanent status-** Provisional status, May 2010; Pending review for Permanent Status in 2015
C) Degrees offered Professional Science Master's (PSM) in Biotechnology	**C) Degrees offered** Professional Science Master's (PSM) in Biotechnology
Part II. Admission	**Part II. Admission**
A) Admission requirements Admission to the PSM in Biotechnology requires a prior scholastic index (grade point average on a 4.0 point scale) of at least 2.8 overall and 3.0 in the sciences. Those who meet the stated minimum requirements are not guaranteed admission, nor are those who fail to meet all those requirements necessarily precluded from admission if they offer other appropriate strengths. There is also the possibility of entering the program after the successful completion of two courses of the Biological Sciences core with a grade of B or better (not B-) as a continuing education student and the achievement of an overall GPA of 3.0 in graduate classes attempted. Students may also be admitted after successful completion of the "Certificate in Biotechnology". Applicants who are not U.S. citizens or permanent residents must complete the Test of English as a Foreign Language (TOEFL) with a score of 550 or higher on the paper-based test or 79 or higher on the Internet-based test. Previous education, training or residence in the U.S. does not exempt foreign nationals from these requirements. Requests for a waiver of the language test requirements (for example, for students from English-speaking countries outside of the U.S., or for foreign students who have a college degree from a U.S.	**A) Admission requirements** Admission to the PSM in Biotechnology requires a prior scholastic index (grade point average on a 4.0 point scale) of at least 2.8 overall and 3.0 in the sciences. Those who meet the stated minimum requirements are not guaranteed admission, nor are those who fail to meet all those requirements necessarily precluded from admission if they offer other appropriate strengths. There is also the possibility of entering the program after the successful completion of two courses of the Biological Sciences core with a grade of B or better (not B-) as a continuing education student and the achievement of an overall GPA of 3.0 in graduate classes attempted. Students may also be admitted after successful completion of the "Certificate in Biotechnology". Applicants who are not U.S. citizens or permanent residents must complete the Test of English as a Foreign Language (TOEFL) with a score of 550 or higher on the paper-based test or 79 or higher on the Internet-based test. Previous education, training or residence in the U.S. does not exempt foreign nationals from these requirements. Requests for a waiver of the language test requirements (for example, for students from English-speaking countries outside of the U.S., or for foreign students who have a college degree from a U.S.

institution) must be approved by the University of Delaware Office of Graduate Studies. Students who need further training in English prior to attending graduate school may apply for admission through the University of Delaware English Language Institute's Conditional Admission Program http://www.udel.edu/eli/programs_grad_cap.html.	institution) must be approved by the University of Delaware Office of Graduate Studies. Students who need further training in English prior to attending graduate school may apply for admission through the University of Delaware English Language Institute's Conditional Admission Program http://www.udel.edu/eli/programs_grad_cap.html.
The Graduate Record Examination is required of all applicants to the PSM in Biotechnology including those who have successfully completed the "Certificate in Biotechnology".	The Graduate Record Examination is required of all applicants to the PSM in Biotechnology including those who have successfully completed the "Certificate in Biotechnology".
B) Prior degree requirements BA or BS degree, preferably in a science or engineering discipline	**B) Prior degree requirements** BA or BS degree, preferably in a science or engineering discipline
C. Application deadlines. **Fall admission:** Full consideration deadline: January 15th with rolling admission to continue until May 1st for foreign nationals and July 1st for US citizens/permanent residents. **Spring Admission:** Full consideration deadline: October 1st with rolling admission to continue until November 1st for foreign nationals, December 15th for US citizens/permanent residents.	**C. Application deadlines.** **Fall admission:** Full consideration deadline: January 15th with rolling admission to continue until May 1st for foreign nationals and July 1st for US citizens/permanent residents. **Spring Admission:** Full consideration deadline: October 1st with rolling admission to continue until November 1st for foreign nationals, December 15th for US citizens/permanent residents.
D. Special competencies needed Applicants are required to have completed, at the undergraduate level, the following (or the equivalent): two years of biological sciences; one year of mathematics, preferably to include calculus and/or statistics; one year of college physics; one year of general chemistry; and one course in organic chemistry.	**D. Special competencies needed** Applicants are required to have completed, at the undergraduate level, the following (or the equivalent): two years of biological sciences; one year of mathematics, preferably to include calculus and/or statistics; one year of college physics; one year of general chemistry; and one course in organic chemistry.
E. Admission categories. Provisional admission may be offered with the stipulation that any deficiency in undergraduate training be made up (without graduate credit). Students with TOEFL scores below the minimum required for admission may be considered for conditional admission if they enter the University of Delaware English Language Institute's academic English program.	**E. Admission categories.** Provisional admission may be offered with the stipulation that any deficiency in undergraduate training be made up (without graduate credit). Students with TOEFL scores below the minimum required for admission may be considered for conditional admission if they enter the University of Delaware English Language Institute's academic English program.
F. Other documents required Applications must also include three letters of recommendation from persons able to judge the applicant's ability to pursue graduate study, a resume or CV outlining work and/or academic experience in the field of biotechnology as well as an application essay consisting of the answers to the following questions: 1. What scientific research/employment experience have you had? Please be specific	**F. Other documents required** Applications must also include three letters of recommendation from persons able to judge the applicant's ability to pursue graduate study, a resume or CV outlining work and/or academic experience in the field of biotechnology as well as an application essay consisting of the answers to the following questions: 4. What scientific research/employment experience have you had? Please be specific

about the field of work and job responsibilities 2. What are your long-term professional objectives? 3. What specific attributes of our Department and the PSM in Biotechnology make you feel that this degree is appropriate to help you achieve your professional objectives? .	about the field of work and job responsibilities 5. What are your long-term professional objectives? 6. What specific attributes of our Department and the PSM in Biotechnology make you feel that this degree is appropriate to help you achieve your professional objectives? .
G. University statement: Admission to the PSM in Biotechnology program is competitive. Those who meet stated requirements are not guaranteed admission, nor are those who fail to meet all of those requirements necessarily precluded from admission if they offer other appropriate strengths.	**G. University statement:** Admission to the PSM in Biotechnology program is competitive. Those who meet stated requirements are not guaranteed admission, nor are those who fail to meet all of those requirements necessarily precluded from admission if they offer other appropriate strengths.
Part III. Academic **A. Degree Requirements**	**Part III. Academic** **A. Degree Requirements**
1. List course requirements The PSM in Biotechnology requires 42 credits of graduate level course work consisting of: 1) 12 credits of graduate level course work in the biological sciences comprised of at least one course in each of three of the five following areas: Molecular Biology, Genetics, Cell Biology, Physiology and Microbiology (see list below) 2) 9 credits of graduate level courses in fields related to biotechnology including bioinformatics, engineering, chemistry, agriculture, food safety, health sciences and statistics (see approved list below). One class must be from the category "statistics" unless the student has prior coursework in statistics. This determination is made by the program director. 3) 15 credits of "Plus" courses, one from each of the following five categories: ethics, intellectual property/legal regulatory affairs, Survey of business or public administration, Leadership and organizations and Project management/decision making (see below). 4) 6 credits of BISC 872, internship. The experiential portion of this class will in most cases be completed during a 7 month long, full time internship at a biotechnology company and be supervised jointly by a representative of the host company and a University of Delaware faculty member. Students pursuing the PSM degree who have significant prior bench experience will be encouraged to focus their capstone on improving a company's business/management plan or moving a newly developed product to market. Such projects could include; an analysis of how to bring a product to market, how to improve team interactions between company groups or how to scale up a research project to commercial scale. Students pursuing the PSM degree without prior experience working at the bench will be encouraged to focus their capstone on a specific	**1. List course requirements** The PSM in Biotechnology requires 42 credits of graduate level course work consisting of: 1) 12 credits of graduate level course work in the biological sciences comprised of at least one course in each of three of the five following areas: Molecular Biology, Genetics, Cell Biology, Physiology and Microbiology (see list below) 2) 9 credits of graduate level courses in fields related to biotechnology including bioinformatics, engineering, chemistry, agriculture, food safety, health sciences and statistics (see approved list below). One class must be from the category "statistics" unless the student has prior coursework in statistics. This determination is made by the program director. 3) 15 credits of business/management courses, one from each of the following five categories: ethics; intellectual property/legal regulatory affairs; survey of business or introductory accounting; leadership and organizations; project management/decision making (see below). 4) 6 credits of BISC 872, internship. The experiential portion of this class will in most cases be completed during a 7 month long, full time internship at a biotechnology company and be supervised jointly by a representative of the host company and a University of Delaware faculty member. Students pursuing the PSM degree who have significant prior bench experience will be encouraged to focus their capstone on improving a company's business/management plan or moving a newly developed product to market. Such projects could include; an analysis of how to bring a product to market, how to improve team interactions between company groups or how to scale up a research project to commercial scale. Students pursuing the PSM degree without prior experience working at the bench will be encouraged to focus their capstone on a specific

scientific research question. Such projects could include: testing methods to increase production of recombinant proteins, testing the specificity of antibodies being developed or direct research product development. The capstone is assessed by the quality of the work performed at the internship and two written reports 1) a plan of work outlining the background of the project, the learning objectives for the internship and goals to be accomplished developed in consultation with and approved by both the faculty and internship mentors and 2) a scholarly paper outlining the objectives of internship, what was accomplished on each objective and recommendations for future work. Internships may be full-time or part-time depending on the schedule/needs of the student and employer. Internships may be paid or unpaid with the final grade based on the written reports and mentor evaluation. Students who are employed in the field of biotechnology are encouraged to develop their capstone projects at their place of employment as part of a professional development plan, however the expectation is that the "capstone" will be different than the student's normal job responsibilities. The program will make every effort to assist students with identifying internship opportunities and negotiating internship plans. However, students bear significant responsibility in this process as well and failure to either identify an internship and/or formulate an acceptable internship plan by the end of the student's third semester of full time study (or completion of 33 credits of course work) is considered failure to make satisfactory progress towards degree.	scientific research question. Such projects could include: testing methods to increase production of recombinant proteins, testing the specificity of antibodies being developed or direct research product development. The capstone is assessed by the quality of the work performed at the internship and two written reports. The first is due within one month of the start of the internship and includes a comprehensive description of the work environment including corporate history, corporate organizational structure including a description of the corporate focus, and a detailed description of the organization of the internship environment emphasizing its value to the company as a whole. This document should also include a plan of work outlining the background of the project, the learning objectives for the internship and goals to be accomplished developed in consultation with and approved by both the faculty and internship mentors. The second, a paper is due at the completion of the internship and should outline the objectives of internship, the value of these objectives to the company, what was accomplished on each objective, and recommendations for future work. This document should also discuss what skills the student learned/refined during the internship, what aspects of the PSM curricula were helpful for success in the internship and what additional knowledge would have been useful. Internships may be full-time or part-time depending on the schedule/needs of the student and employer. Internships may be paid or unpaid with the final grade based on the written reports and mentor evaluation. Students who are employed in the field of biotechnology are encouraged to develop their capstone projects at their place of employment as part of a professional development plan, however the expectation is that the "capstone" will be different than the student's normal job responsibilities. The program will make every effort to assist students with identifying internship opportunities and negotiating internship plans. However, students bear significant responsibility in this process as well and failure to either identify an internship and/or formulate an acceptable internship plan by the end of the student's third semester of full time study (or completion of 33 credits of course work) is considered failure to make satisfactory progress towards degree.
Biological Sciences Core (12 credits, four classes; must include classes from at least three of the five following categories)	**Biological Sciences Core (at least 12 credits, four classes; must include classes from at least three of the five following categories)**

Cell Biology	Credits
BISC 612- Advanced Cell Biology	3
BISC 625- Cancer Biology	3
BISC 671- Cellular and Molecular Immunology	4
PLSC635- Plant Developmental Biology	3

Genetics	Credits
BISC 654- Biochemical Genetics	3
BISC 656- Evolutionary Genetics	3
BISC 693- Human Genetics	3
PLSC 636- Advanced Plant Genetics	3
PLSC 605- Plant breeding	3

Microbiology	Credits
ANFS 635- Animal Virology	3
ANFS 639- Food Microbiology	3
BISC 641- Microbial ecology	3
BISC 682- Bacterial Pathogens; molecular mechanisms	3
BISC 645- Bacterial Evolution	3
BISC 679- Virology	3
PLSC 619- Soil Microbiology	4
PLSC 629- Introduction to Fungi	4
MAST 618- Marine microbial ecology	3

Molecular Biology	Credits
ANFS 670- Principles of Molecular Genetics	3
BISC 602- Molecular Biology of Animal Cells	3
BISC 665- Advanced Molecular Biology and Genetics	3
CHEM642- Biochemistry II	3

Physiology	Credits
BISC 605- Advanced Mammalian Physiology	3
BISC 615- Vertebrate Developmental Biology	3
BISC 675- Cardiovascular Physiology	3
HESC 651-Neurophysiological Basis of Human Movement	3
HESC 654- Survey of Medical Physiology	3

Biotechnology-related science courses (three courses from the following list adding up to at least 9

Cell Biology	Credits
BISC 612- Advanced Cell Biology	3
BISC 625- Cancer Biology	3
BISC 671- Cellular and Molecular Immunology	4
PLSC635- Plant Developmental Biology	3
ANFS 671 Paradigms in Cell Signaling	3
BISC639 Developmental Neurobiology	4
BISC690 Fundamentals of Pharmacology	3
BMEG605 Princ of BME I: Molec and cell systems	3

Genetics	Credits
BISC 654- Biochemical Genetics	3
BISC 656- Evolutionary Genetics	3
BISC 693- Human Genetics	3
PLSC 636- Plant Genes and Genomes	3

Microbiology	Credits
ANFS 635- Animal Virology	3
ANFS 639- Food Microbiology	3
BISC 682- Bacterial Pathogens; molecular mechanisms	3
BISC 679- Virology	3
PLSC 619- Soil Microbiology	4
PLSC 629- Introduction to Fungi	4
MAST 618- Marine microbial ecology	3
MAST625 Microbial Physiology and Diversity	3

Molecular Biology	Credits
ANFS 670- Principles of Molecular Genetics	3
BISC 602- Molecular Biology of Animal Cells	3
CHEM642- Biochemistry II	3

Physiology	Credits
BISC 605- Advanced Mammalian Physiology	4
BISC 615- Vertebrate Developmental Biology	3
BISC 675- Cardiovascular Physiology	3
KAAP 651-Neurophysiological Basis of Human Movement	3
BISC 606 Advanced Mammalian Physiology II	4
BISC627 Advanced Neurophysiology	3
BMEG606 Princ of BME II: Tissue and organ systems	3

Biotechnology-related science courses (three courses from the

credits, one must be from the category "statistics" unless the student has documented prior exposure to statistical analysis of data)

Agriculture/food science:

	Credits
ANFS 628- Food Chemistry	4
ANFS 629- Food Analysis	4
ANFS 633- Poultry pathology	3
ANFS 636- Immunology of domestic animals	3
ANFS 637- Avian immunology	3
ANFS 645- Food engineering technology	3
ANFS 649- Food biotechnology	4
ANFS 654- Advanced ruminant nutrition	3
BREG 603/PLSC 603- Soil physics	3
ENWC 611- Insect pest management	3
ENWC 610- Medical, Veterinary, and forensic entomology	3
ENWC 619- Biological control	3
ENWC 805- Insect-plant chemical ecology	3

Bioinformatics:

	Credits
ANFS 644- Bioinformatics	3
CISC 636- Introduction to bioinformatics	3
CISC 637- Database Systems	3
CISC 681- Artificial Intelligence	3
CISC 683- Introduction to data mining	3
CISC 841- Bioinformatics	3
MAST 697- Bioinformatics programming for Biologists	3
MAST 698- Environmental and systems bioinformatics	3

Chemistry/Biochemistry

	Credits
CHEM 641- Biochemistry	3
CHEM 645- Proteins, Structure and Function	3
CHEM 646- DNA-Protein Interactions	3
CHEM 649- Molecular Biophysics	3
CHEM 653- Bioinorganic Chemistry	3
CHEM 681- Green Chemistry	3

Engineering:

CHEG 617- Colloid science and engineering	3
CHEG 620- Biochemical Engineering	3
CHEG 621- Metabolic engineering	3
CHEG 625- Green Engineering	3

following list adding up to at least 9 credits, one must be from the category "statistics" unless the student has documented prior exposure to statistical analysis of data)

Agriculture/food science:

	Credits
ANFS 628- Food Chemistry	4
ANFS 629- Food Analysis	4
ANFS 636- Immunology of domestic animals	3
ANFS 637- Avian immunology	3
ANFS 643- Food engineering technology	3
ANFS 649- Food biotechnology	4
PLSC 603- Soil physics	3
ENWC 611- Insect pest management	3
ENWC 610- Medical, Veterinary, and forensic entomology	3
ENWC 619- Biological control	3
ENWC 805- Insect-plant chemical ecology	3

Bioinformatics:

	Credits
BINF 644- Bioinformatics	3
CISC 636- Introduction to bioinformatics	3
CISC 841- Bioinformatics	3
MAST 697- Bioinformatics programming for Biologists	3
MAST 698- Environmental and systems bioinformatics	3
BINF650 Protein Modifications	3
BINF694 Systems Biology I	3
BINF695 Computational System Biology	3
BINF816 Systems Biology of Cells in Engineered Environments	3

Chemistry/Biochemistry

	Credits
CHEM 641- Biochemistry	3
CHEM 645- Proteins, Structure and Function	3
CHEM 646- DNA-Protein Interactions	3
CHEM 686- Biophysical Chemistry	3
CHEM 653- Bioinorganic Chemistry	3
CHEM 681- Green Chemistry	3
CHEM643 Intermediary Metabolism	3
CHEM684 Biochemistry of Nucleic Acids	3
PLSC608/CHEM608 Environmental Soil Chemistry	3

Engineering:

CHEG 621- Metabolic engineering	3
CHEG 625- Green Engineering	3

CHEG 649- Molecular Biophysics 3 CHEG 650- Biomedical Engineering 3 CHEG 805- Multidisciplinary biotechnology 3 CPEG 630- Neurons and networks 3 ELEG 643- Biomedical Nanotechnology 3 ELEG 670- Biophysics of excitable membranes 3 ELEG 671- Introduction to biomedical engineering 3 ELEG 675- Image processing with biomedical applications 3 ELEG 678- Introduction to nano and biophotonics 3 ELEG 679- Introduction to medical imaging systems 3 MEEG 612- Biomechanics of human movement 3 MEEG 682- Clinical biomechanics 3 MEEG 683- Orthopedic Biomechanics 3 MEEG 684- Biomaterials and tissue engineering 3 MEEG 685- Control of human movement 3 MEEG 686- Cell and tissue transport 3 **Health Sciences** BISC 600- Biotechnology and molecular medicine 3 HESC 601- Research Methods 3 HESC687- Nursing Sciences Research 3 NURS 621- Advanced pathophysiology 3 NURS 622- Advanced pharmacology 3 NURS 638- Health sciences evaluation 3 PHYT 809- Psychosocial Aspects of Health and Disease 3 PHYT 606- Research 3 PHYT 623- Clinical Neuroscience 3 **Advanced Laboratory Techniques** BISC 601- Immunochemistry 4 BISC 604- Nucleic Acids Laboratory 4 BISC 619- Gene Expression Laboratory 4 **Statistics/data analysis:** BISC 643- Biological Data Analysis 3 CHEG 604- Probability and statistics for engineering 3 STAT 608- Statistical Research Methods 3 STAT 609- Regression and Experimental Design 3 STAT 611- Regression Analysis 3 STAT 615- Design and Analysis of Experiments`3 STAT 616- Advanced Design of Experiments 3 STAT 617- Multivariate Analysis 3 STAT 619- Time Series Analysis 3 STAT 620- Nonparametric Statistics 3 STAT 621- Survival Analysis 3 STAT 656- Biostatistics 3 STAT 674- Applied Data Base Management 3 STAT 675- Logistic Regression 3 **PSM Plus component (15 credits):**	CHEG 650- Biomedical Engineering 3 ELEG 670- Biophysics of excitable membranes 3 ELEG 671- Introduction to biomedical engineering 3 ELEG 675- Image processing with biomedical applications 3 ELEG 678- Introduction to nano and biophotonics 3 ELEG 679- Introduction to medical imaging systems 3 MEEG 612- Biomechanics of human movement 3 MEEG 682- Clinical biomechanics 3 MEEG 683- Orthopedic Biomechanics 3 MEEG 684- Biomaterials and tissue engineering 3 MEEG 685- Control of human movement 3 MEEG 686- Cell and tissue transport 3 BMEG679 Introduction to Medical Imaging Systems 3 CHEG624 Bio-Based Materials 3 ELEG801 Advanced Topics in Biomedical Engineering 3 **Health Sciences** BISC 600- Biotechnology and molecular medicine 3 NURS687- Nursing Sciences Research 3 NURS 621- Advanced pathophysiology 3 NURS 622- Advanced pharmacology 3 PHYT 623- Clinical Neuroscience 3 **Advanced Laboratory Techniques** BISC 601- Immunochemistry 4 BISC 604- Nucleic Acids Laboratory 4 CHEM679 Biomolecular NMR Spectroscopy 3 **Statistics/data analysis:** BISC 643- Biological Data Analysis 3 STAT 608- Statistical Research Methods 3 STAT 609- Regression and Experimental Design 3 STAT 611- Regression Analysis 3 STAT 615- Design and Analysis of Experiments` 3 STAT 616- Advanced Design of Experiments 3 STAT 621- Survival Analysis 3 STAT 656- Biostatistics 3 STAT 674- Applied Data Base Management 3 STAT 675- Logistic Regression 3 **PSM**

Whereas students in Professional Science Master's Programs may have professional goals that would lead them into business and industry, or to government or non-profit employment, the University of Delaware offers two tracks for the PSM PLUS component. PSM students will take at least 15 credits of PLUS coursework in addition to their science core. The University recommends the student follow one of the tracks below, however students may cross over tracks to fit their interest.

**See Table Below

Business/Management component (15 credits):

PSM students will take at least 15 credits of business/management coursework in addition to their science core distributed among the categories listed below.

Survey of Business (3 credits)

BUAD 700- Survey of Business* (preferred)

ACCT800 Financial Reporting and Analysis

Leadership and Organizations (3 credits)

BUAD 870- Leadership and Organizational Behavior
BUAD872 Organizational Development and Change
UAPP761 Conflict Resolution Collab Prob Solving

Project Management, Operations or Entrepreneurship (select 1, 3 credits)

BUAD811 Globalization and Business
BUAD 831- Operations Management and Management Science
BUAD 871- Managing for Creativity and Innovation
ENTR 860- High Tech Entrepreneurship
MISY 840 -Project Management and Costing
UAPP 827- Program and Project Analysis
UAPP698 Management Decision Making in Public & NP Sectors
UAPP697 Leading Organizations in Public & NP Sectors

Intellectual Property (3 credits)

CHEG 595- Intellectual Property for Engineers and Scientists

Ethics (3 Credits)

BUAD 840- Ethical Issues in Global Business Environments
BINF815 – Ethics, Business &Communication

*BUAD700 meets prerequisites for BUAD831 and BUAD871

2. Advisement All students will develop a plan of study in consultation with their advisor upon matriculation into the program. **3. Give procedure for petitions for variance in degree requirements** (e.g., course substitution policies, completion deadlines, etc.) All petitions for course substitutions and variances in the completion deadlines must be made to the Graduate Affairs Committee, Department of Biological Sciences. **4. Define any grade minimums in courses that are different from University policy.** Only graduate courses completed with a grade of B or higher fulfill the biological sciences core and the biotechnology-related course requirements including the internship for the PSM in Biotechnology. Students receiving a B- or lower in a required core course are subject to dismissal from the program. However, they may file an appeal to the Department of Biological Sciences Graduate Affairs Committee for approval to retake the course and remain in the program. If the appeal is not approved, the Graduate Affairs Committee will recommend to the Office of Graduate Studies that the student be dismissed from the program. Students must also earn a minimum index of 3.0 in all "plus" component courses attempted to earn the PSM in Biotechnology, and no course with a grade below a C- may be counted toward the degree. **5. Identify any courses, which may not be used towards the degree.** Only courses listed in the curriculum may count towards the degree unless a variance is granted by the Graduate Affairs Committee, Department of Biological Sciences. **6. Identify expectations of facility of expression in English (oral and written) as part of the degree requirement.** Aside from the TOFEL admission requirement for foreign applicants, there are no specific requirements. However, successful completion of the degree will require fluency in both written and spoken English. **B. Committees for exams, thesis, or dissertations** This degree has no thesis or dissertation requirements. The director of the program will compile a list of University of Delaware faculty members who are willing serve as academic advisors for PSM Biotechnology students. Students will select advisors from this list who have expertise most appropriate for	**2. Advisement** All students will develop a plan of study in consultation with their advisor upon matriculation into the program. **3. Give procedure for petitions for variance in degree requirements** (e.g., course substitution policies, completion deadlines, etc.) All petitions for course substitutions and variances in the completion deadlines must be made to the Graduate Affairs Committee, Department of Biological Sciences. **4. Define any grade minimums in courses that are different from University policy.** Only graduate courses completed with a grade of B or higher fulfill the biological sciences core and the biotechnology-related course requirements including the internship for the PSM in Biotechnology. Students receiving a B- or lower in a required core course are subject to dismissal from the program. However, they may file an appeal to the Department of Biological Sciences Graduate Affairs Committee for approval to retake the course and remain in the program. If the appeal is not approved, the Graduate Affairs Committee will recommend to the Office of Graduate Studies that the student be dismissed from the program. Students must also earn a minimum index of 3.0 in all "plus" component courses attempted to earn the PSM in Biotechnology, and no course with a grade below a C- may be counted toward the degree. **5. Identify any courses, which may not be used towards the degree.** Only courses listed in the curriculum may count towards the degree unless a variance is granted by the Graduate Affairs Committee, Department of Biological Sciences. **6. Identify expectations of facility of expression in English (oral and written) as part of the degree requirement.** Aside from the TOFEL admission requirement for foreign applicants, there are no specific requirements. However, successful completion of the degree will require fluency in both written and spoken English. **B. Committees for exams, thesis, or dissertations** This degree has no thesis or dissertation requirements. The director of the program will compile a list of University of Delaware faculty members who are willing serve as academic advisors for PSM Biotechnology students. Students will select advisors from this list who have expertise most appropriate for their career interests within the first two weeks after

their career interests within the first two weeks after matriculation. The academic advisor in consultation with the program director will provide guidance on course selection and the academic advisor will also be responsible helping the student formulate the expectations for their internship experience and for evaluating the student's capstone internship report. It is highly encouraged that part-time students working in biotechnology-related fields work with both their UD academic advisor and employer prior to matriculation to develop a comprehensive professional development plan that coordinates PSM Biotechnology degree requirements with work responsibilities. **C. Timetable and definition of satisfactory progress towards the degree** **1. Academic load** Full-time students will enroll in at least 9 credits of classes per semester (fall and spring), however, in order to complete the degree in two years, the student will need to enroll in 12 credits of classes at least two semesters. Part-time students are expected to enroll in at least one class per regular academic semester to remain matriculated in the program and are expected to complete their degree within five years. **Time line for degree:** Semester 1- enroll in 9 credits of coursework Semester 2- enroll in 12 credits of coursework Semester 3- enroll in 12 credits of coursework Winter after semester 3- begin internship Semester 4- enroll in BISC 872 internship and single remaining didactic course (Plus course taken during evening hours, 9 credits) Summer after semester 3- sustaining status, complete internship and final report, graduate Normal progress towards degree is reviewed for all students in the program at the end of every academic semester and is assessed based on grades, participation in program activities and performance in the internship. **2. Grade requirements (general and specific).** Only graduate courses completed with a grade of B or higher fulfill the biological sciences core and the biotechnology-related course requirements for the PSM in Biotechnology. Students must also complete BISC872, internship with a grade of at least B. Students receiving a B- or lower in a required core course are subject to dismissal from the program. However, they may file an appeal to the Department of Biological Sciences Graduate Affairs Committee for approval to retake the course and remain in the program. If the appeal is not approved, the Graduate Affairs Committee will recommend to the Chair of the Department of	matriculation. The academic advisor in consultation with the program director will provide guidance on course selection and the academic advisor will also be responsible helping the student formulate the expectations for their internship experience and for evaluating the student's capstone internship report. It is highly encouraged that part-time students working in biotechnology-related fields work with both their UD academic advisor and employer prior to matriculation to develop a comprehensive professional development plan that coordinates PSM Biotechnology degree requirements with work responsibilities. **C. Timetable and definition of satisfactory progress towards the degree** **1. Academic load** Full-time students will enroll in at least 9 credits of classes per semester (fall and spring), however, in order to complete the degree in two years, the student will need to enroll in 12 credits of classes at least two semesters. Part-time students are expected to enroll in at least one class per regular academic semester to remain matriculated in the program and are expected to complete their degree within five years. **Time line for degree:** Semester 1- enroll in 9 credits of coursework Semester 2- enroll in 12 credits of coursework Semester 3- enroll in 12 credits of coursework Winter after semester 3- begin internship Semester 4- enroll in BISC 872 internship and single remaining didactic course (Plus course taken during evening hours, 9 credits) Summer after semester 3- sustaining status, complete internship and final report, graduate Normal progress towards degree is reviewed for all students in the program at the end of every academic semester and is assessed based on grades, participation in program activities and performance in the internship. **2. Grade requirements (general and specific).** Only graduate courses completed with a grade of B or higher fulfill the biological sciences core and the biotechnology-related course requirements for the PSM in Biotechnology. Students must also complete BISC872, internship with a grade of at least B. Students receiving a B- or lower in a required core course are subject to dismissal from the program. However, they may file an appeal to the Department of Biological Sciences Graduate Affairs Committee for approval to retake the course and remain in the program. If the appeal is not approved, the Graduate Affairs Committee will recommend to the Chair of the Department of Biological Sciences that the student be dismissed from

Biological Sciences that the student be dismissed from the program. Students must also earn a minimum index of 3.0 in all "plus" component courses attempted to earn the PSM in Biotechnology. All graduate courses successfully completed with a B or higher that were applied towards earned graduate certificates, but not graduate degrees, at the University of Delaware will be directly applicable to the PSM in Biotechnology. **3. Thesis/dissertation progress timetable guidelines.** N/A **4. Thesis/dissertation defense guidelines.** N/A **5. Forms required.** The application for advanced degree must be filed with the Office of Graduate studies prior to the beginning of the last semester in the program **6. Identify consequence for failure to make satisfactory progress.** Students failing to make satisfactory progress towards degree will be identified by the Graduate Affairs Committee, Department of Biological Sciences, in consultation with the student's academic advisor/program director. Recommendations for dismissal are made by the Department Chair of Biological Sciences to the University of Delaware Office of Graduate studies. Students who feel that they have been graded inappropriately or receive what they perceive as an unfair evaluation by a faculty member may file grievances in accordance with University of Delaware policies. Students are encouraged to contact the Department's Graduate Program Director prior to filing a formal grievance in an effort to resolve the situation informally. **Part IV. Assessment Plan** Consistent with the Mission Statement presented earlier in this document, five student learning goals are defined. Students will: 1. Have advanced knowledge of the discipline of biotechnology 2. Have experience working with interdisciplinary teams on biotechnology 3. Achieve competence in scientific communication 4. Be knowledgeable in scientific business ethics	the program. Students must also earn a minimum index of 3.0 in all "plus" component courses attempted to earn the PSM in Biotechnology. All graduate courses successfully completed with a B or higher that were applied towards earned graduate certificates, but not graduate degrees, at the University of Delaware will be directly applicable to the PSM in Biotechnology. **3. Thesis/dissertation progress timetable guidelines.** N/A **4. Thesis/dissertation defense guidelines.** N/A **5. Forms required.** The application for advanced degree must be filed with the Office of Graduate studies prior to the beginning of the last semester in the program **6. Identify consequence for failure to make satisfactory progress.** Students failing to make satisfactory progress towards degree will be identified by the Graduate Affairs Committee, Department of Biological Sciences, in consultation with the student's academic advisor/program director. Recommendations for dismissal are made by the Department Chair of Biological Sciences to the University of Delaware Office of Graduate studies. Students who feel that they have been graded inappropriately or receive what they perceive as an unfair evaluation by a faculty member may file grievances in accordance with University of Delaware policies. Students are encouraged to contact the Department's Graduate Program Director prior to filing a formal grievance in an effort to resolve the situation informally. **Part IV. Assessment Plan** Consistent with the Mission Statement presented earlier in this document, five student learning goals are defined. Students will: 6. Have advanced knowledge of the discipline of biotechnology 7. Have experience working with interdisciplinary teams on biotechnology 8. Achieve competence in scientific communication 9. Be knowledgeable in scientific business ethics 10. Understand the application of

5. Understand the application of business/management theory to science

The specific goals stated above are mapped to various science and PLUS courses in the program Assessment Plan which guides program evaluation and is filed with the Center for Educational Effectiveness.

These goals are be assessed through multiple indicators including:

- Faculty evaluation of student progress in course work
- Survey of internship mentors
- Surveys of students and program alumni
- Faculty and internship mentor evaluation of the internship work and written products
- Employer surveys

Both short term and long term impacts are assessed.

Part V. Financial aid-

Students enrolled in this program are responsible for their tuition and living expenses. Both the Department of Biological Sciences and University of Delaware Office of Financial Aid will provide assistance in identifying suitable fellowships, grants and loans to help finance their education.

Part VI. Departmental Operations

A. General student responsibilities

Access to Student Records

Students wishing to review their Departmental file must submit a written request to the Graduate Program Director at least 24 hours in advance. Students must review the file in the presence of departmental staff or faculty and are not permitted to remove a file from Wolf Hall but may photocopy documents from their folder. All access to student records is in accordance with the Family Educational Rights and Privacy Act.

Standards of Student Conduct

A)Academic honesty

All graduate students are subject to University of Delaware regulations regarding academic honesty.

B) Laboratory Safety and Research Regulations

Graduate students performing laboratory research are subject to all University regulations regarding safety, use of human subjects and animals, and hazardous/radioactive material use and disposal. These guidelines may be found in the University of Delaware Policies and Procedures Manual. Students participating in off campus internship experiences are expected to fully comply will all safety regulations of the workplace.

5. Understand the application of business/management theory to science

The specific goals stated above are mapped to various science and PLUS courses in the program Assessment Plan which guides program evaluation and is filed with the Center for Educational Effectiveness.

These goals are be assessed through multiple indicators including:

- Faculty evaluation of student progress in course work
- Survey of internship mentors
- Surveys of students and program alumni
- Faculty and internship mentor evaluation of the internship work and written products
- Employer surveys

Both short term and long term impacts are assessed.

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Students enrolled in this program are responsible for their tuition and living expenses. Both the Department of Biological Sciences and University of Delaware Office of Financial Aid will provide assistance in identifying suitable fellowships, grants and loans to help finance their education.

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Standards of Student Conduct

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C) Contact information

C) Contact information It is the responsibility of all students to ensure that their contact information on file with the university is current (mailing address, phone number, email address). It is also the student's responsibility to regularly monitor their email, phone and mail for important notices regarding their enrollment. **D). Departmental facilities** Occasionally student's graduate assistantship or other assignments may require the use of departmental laboratories or other facilities. Keys to laboratories, etc., are maintained in the Department office and will be issued based on faculty and Department Chair approval. Any assignments that require the expenditure of departmental funds (e.g. data collection activities) require departmental approval in advance and are processed through the department in which the work is to be done.	It is the responsibility of all students to ensure that their contact information on file with the university is current (mailing address, phone number, email address). It is also the student's responsibility to regularly monitor their email, phone and mail for important notices regarding their enrollment. **D). Departmental facilities** Occasionally student's graduate assistantship or other assignments may require the use of departmental laboratories or other facilities. Keys to laboratories, etc., are maintained in the Department office and will be issued based on faculty and Department Chair approval. Any assignments that require the expenditure of departmental funds (e.g. data collection activities) require departmental approval in advance and are processed through the department in which the work is to be done.

**Table for current

Business/industry track	Government/non-profit track
Survey of Business (3 credits)	Survey of Public Administration (3 credits)
BUAD 500- Survey of Business*	UAPP 803- Seminar in Public Administration
Leadership and Organizations (3 credits)	Leadership and Organizations (select 1, 3 credits)
BUAD 870- Leadership and Organizational Behavior	UAPP 835- Organizations and Management

	UAPP 604- Leadership in Organizations
Project Management, Operations or Entrepreneurship (select 1, 3 credits)	**Managerial Decision Making or Financial Management (select 1, 3 credits)**
BUAD 835- Managing New Product Development Projects	UAPP 819- Management Decision Making in Public & Nonprofit
BUAD 831- Operations Management and Management Science	UAPP 833- Financial Management in Public and Nonprofit Sectors
BUAD 871- Managing for Creativity and Innovation	UAPP 827- Program and Project Analysis
ENTR 860- High Tech Entrepreneurship	UAPP 829- Taxation and Fiscal Policy
MISY 840 -Project Management and Costing	
Intellectual Property (3 credits)	**Legal and Regulatory Affairs (3 credits)**
CHEG 595- Intellectual Property for Engineers and Scientists	UAPP 646- Administrative Law and Policy
Ethics (3 credits):	
BISC 631- Practice of Science	UAPP 648- Environmental Ethics
BUAD 840- Ethical Issues in Global Business Environments	UAPP 650- Values Ethics and Leadership

Appendix 3: Current curriculum for PSM in Biotechnology approved by Faculty Senate Spring of 2014

The PSM in Biotechnology requires 42 credits of graduate level course work consisting of:
1) 12 credits of graduate level course work in the biological sciences comprised of at least one course in each of three of the five following areas: Molecular Biology, Genetics, Cell Biology, Physiology and Microbiology (see list below)
2) 9 credits of graduate level courses in fields related to biotechnology including bioinformatics, engineering, chemistry, agriculture, food safety, health sciences and statistics (see approved list below). One class must be from the category "statistics" unless the student has prior coursework in statistics. This determination is made by the program director.
3) 15 credits of business/management courses, one from each of the following five categories: ethics; intellectual property/legal regulatory affairs; survey of business or introductory accounting; leadership and organizations; and project management/decision making (see below).
4) 6 credits of BISC 872, internship. The experiential portion of this class will in most cases be 3 completed during a 7 month long, full time internship at a biotechnology company and be supervised jointly by a representative of the host company and a University of Delaware faculty member. Students pursuing the PSM degree who have significant prior bench experience will be encouraged to focus their capstone on improving a company's business/management plan or moving a newly developed product to market. Such projects could include; an analysis of how to bring a product to market, how to improve team interactions between company groups or how to scale up a research project to commercial scale. Students pursuing the PSM degree without prior experience working at the bench will be encouraged to focus their capstone on a specific scientific research question. Such projects could include: testing methods to increase production of recombinant proteins, testing the specificity of antibodies being developed or direct research product development. The capstone is assessed by the quality of the work performed at the internship and two written reports. The first is due within one month of the start of the internship and includes a comprehensive description of the work environment including corporate history, corporate organizational structure including a description of the corporate focus, and a detailed description of the organization of the internship environment emphasizing its value to the company as a whole. This document should also include a plan of work outlining the background of the project, the learning objectives for the internship and goals to be accomplished developed in consultation with and approved by both the faculty and internship mentors. The second, a paper is due at the completion of the internship and should outline the objectives of internship, the value of these objectives to the company, what was accomplished on each objective, and recommendations for future work. This document should also discuss what skills the student learned/refined during the internship, what aspects of the PSM curricula were helpful for success in the internship and what additional knowledge would have been useful. Internships may be full-time or part-time depending on the schedule/needs of the student and employer. Internships may be paid or unpaid with the final grade based on the written reports and mentor evaluation. Students who are employed in the field of biotechnology are encouraged to develop their capstone projects at their place of employment as part of a professional development plan, however the expectation is that the "capstone" will be different than the student's normal job responsibilities.
The program will make every effort to assist students with identifying internship opportunities and negotiating internship plans. However, students bear significant responsibility in this process as well and failure to either identify an internship and/or formulate an acceptable internship plan by the end of the student's third semester of full time study (or completion of 33 credits of course work) is considered failure to make satisfactory progress towards degree.

Biological Sciences Core (at least 12 credits, four classes; must include classes from at least three of the five following categories)

Cell Biology
BISC 612- Advanced Cell Biology 3
BISC 625- Cancer Biology 3
BISC 671- Cellular and Molecular Immunology 4
PLSC635- Plant Developmental Biology 3
ANFS 671 Paradigms in Cell Signaling 3
BISC639 Developmental Neurobiology 4
BISC690 Fundamentals of Pharmacology 3
BMEG605 Princ of BME I: Molec and cell systems 3

Genetics
BISC 654- Biochemical Genetics 3
BISC 656- Evolutionary Genetics 3
BISC 693- Human Genetics 3
PLSC 636- Plant Genes and Genomes 3

Microbiology
ANFS 635- Animal Virology 3
ANFS 639- Food Microbiology 3
BISC 682- Bacterial Pathogens; molecular mechanisms 3
BISC 679- Virology 3
PLSC 619- Soil Microbiology 4
PLSC 629- Introduction to Fungi 4
MAST 618- Marine microbial ecology 3
MAST625 Microbial Physiology and Diversity 3

Molecular Biology
ANFS 670- Principles of Molecular Genetics 3
BISC 602- Molecular Biology of Animal Cells 3
CHEM642- Biochemistry II 3

Physiology
BISC 605- Advanced Mammalian Physiology 4
BISC 615- Vertebrate Developmental Biology 3
BISC 675- Cardiovascular Physiology 3
KAAP 651-Neurophysiological Basis of Human Movement 3
BISC 606 Advanced Mammalian Physiology II 4
BISC627 Advanced Neurophysiology 3
BMEG606 Princ of BME II: Tissue and organ systems 3

Biotechnology-related science courses (three courses from the following list adding up to at least 9 credits, one must be from the category “statistics”

unless the student has documented prior exposure to statistical analysis of data)

Agriculture/food science:
ANFS 628- Food Chemistry 4
ANFS 629- Food Analysis 4
ANFS 636- Immunology of domestic animals 3
ANFS 637- Avian immunology 3
ANFS 643- Food engineering technology 3
ANFS 649- Food biotechnology 4
PLSC 603- Soil physics 3
ENWC 611- Insect pest management 3
ENWC 610- Medical, Veterinary, and forensic entomology 3
ENWC 619- Biological control 3
ENWC 805- Insect-plant chemical ecology 3

Bioinformatics:
BINF 644- Bioinformatics 3
CISC 636- Introduction to bioinformatics 3
CISC 841- Bioinformatics 3
MAST 697- Bioinformatics programming for Biologists 3
MAST 698- Environmental and systems bioinformatics 3
BINF650 Protein Modifications 3
BINF694 Systems Biology I 3
BINF695 Computational System Biology 3
BINF816 Systems Biology of Cells in Engineered Environments 3

Chemistry/Biochemistry
CHEM 641- Biochemistry 3
CHEM 645- Proteins, Structure and Function 3
CHEM 646- DNA-Protein Interactions 3
CHEM 686- Biophysical Chemistry 3
CHEM 653- Bioinorganic Chemistry 3
CHEM 681- Green Chemistry 3
CHEM643 Intermediary Metabolism 3
CHEM684 Biochemistry of Nucleic Acids 3
PLSC608/CHEM608 Environmental Soil Chemistry 3

Engineering:
CHEG 621- Metabolic engineering 3
CHEG 625- Green Engineering 3
CHEG 650- Biomedical Engineering 3
ELEG 670- Biophysics of excitable membranes 3
ELEG 671- Introduction to biomedical engineering 3
ELEG 675- Image processing with biomedical applications 3
ELEG 678- Introduction to nano and biophotonics 3
ELEG 679- Introduction to medical imaging systems 3
MEEG 612- Biomechanics of human movement 3

MEEG 682- Clinical biomechanics 3
MEEG 683- Orthopedic Biomechanics 3
MEEG 684- Biomaterials and tissue engineering 3
MEEG 685- Control of human movement 3
MEEG 686- Cell and tissue transport 3
BMEG679 Introduction to Medical Imaging Systems 3
CHEG624 Bio-Based Materials 3
ELEG801 Advanced Topics in Biomedical Engineering 3

Health Sciences
BISC 600- Biotechnology and molecular medicine 3
NURS687- Nursing Sciences Research 3
NURS 621- Advanced pathophysiology 3
NURS 622- Advanced pharmacology 3
PHYT 623- Clinical Neuroscience 3

Advanced Laboratory Techniques
BISC 601- Immunochemistry 4
BISC 604- Nucleic Acids Laboratory 4
CHEM679 Biomolecular NMR Spectroscopy 3

Statistics/data analysis:
BISC 643- Biological Data Analysis 3
STAT 608- Statistical Research Methods 3
STAT 609- Regression and Experimental Design 3
STAT 611- Regression Analysis 3
STAT 615- Design and Analysis of Experiments` 3
STAT 616- Advanced Design of Experiments 3
STAT 621- Survival Analysis 3
STAT 656- Biostatistics 3
STAT 674- Applied Data Base Management 3
STAT 675- Logistic Regression 3

PSM Business/Management component (15 credits):

PSM students will take at least 15 credits of business/management coursework in addition to their science core distributed among the categories listed below

Survey of Business **(3 credits)**
BUAD 700- Survey of Business* (preferred)
ACCT800 Financial Reporting and Analysis

Leadership and Organizations (3 credits)
BUAD 870- Leadership and Organizational Behavior
BUAD872 Organizational Development and Change
UAPP761 Conflict Resolution Collab Prob Solving

Project Management, Operations or Entrepreneurship (select 1, 3 credits)
BUAD811 Globalization and Business

BUAD 831- Operations Management and Management Science
BUAD 871- Managing for Creativity and Innovation
ENTR 860- High Tech Entrepreneurship
MISY 840 -Project Management and Costing
UAPP 827- Program and Project Analysis
UAPP698 Management Decision Making in Public & NP Sectors
UAPP697 Leading Organizations in Public & NP Sectors

Intellectual Property (3 credits)
CHEG 595- Intellectual Property for Engineers and Scientists

Ethics (3 Credits)

BUAD 840- Ethical Issues in Global Business Environments
BINF815 – Ethics, Business &Communication

Appendix 4

PSM outcomes table

and

Distribution of courses taken by PSM students from Fall 2010 (program inception) through Spring 2014

Information provided by
The Office of Professional and Graduate Studies

(Data from Certificate in Biotechnology students removed)

Degree Completion	No of students
PSM 5/2012	1
PSM 2/2012	1
PSM 1/2013	1
PSM 8/2013	1
PSM 2/2014	1
PSM 5/2014	1
No PSM; switched to PHD	2
NO PSM; switched to MS	2
Withdrew from program	2
In Progress	7
	19

Courses	Ahmer	Friedberg	Kalburge	Smith	Dash	Marks	Gu	Jarrett	Witham	Algh	Gill
	700092922	700332779	701520523	700323756	701808404	700790443	701558808	701832045	701545604	702044600	702041362
ACCT-800						1					
ANFS-643											
ANFS-644		1		1							
ANFS-649	1										
BISC-600	1	1									
BISC-601					1	1			1		
BISC-602											
BISC-604						1			1	1	1
BISC-605					1						
BISC-606											
BISC-612		1									
BISC-615				1							
BISC-625			1			1			1		
BISC-643	1	1		1	1	1	1		1	1	1
BISC-654	1				1	1			1		
BISC-656											1
BISC-667	2	1		1	1				2		
BISC-671							1				
BISC-675				1		1					
BISC-679						1					
BISC-682	1	1	1	1		1					1
BISC-693					1						
BISC-815											
BISC-827											
BISC-827											
BISC-850											
BISC-868											
BISC-869											
BISC-872	1	2		2		2			2		
BUAD-500	1	1		1							
BUAD-700								1	1	1	1

BUAD-831									1		1
BUAD-840	1	1		1	1	1		1	1		
BUAD-864		1									
BUAD-870	1	1	1	1		1		1	1		
CHEG-595	1	1		1		1	1	1	1	1	1
CHEG-620			1								
CHEM-641							1				
CHEM-642											
EGGG-667											1
ENTR-860	1			1				1			
ENWC-619											
HESC-651		1									
MEEG-684											
MISY-840		1				1					
PLSC-636				1							
STAT-608						1					
STAT-674											1
UNIV-500											
Degree Com	PSM-5/2012	PSM-2/2012	No Degree,	PSM-1/2013	No Degree,	PSM-8/2013	Withdrew	Withdrew	PSM-2/2014	In Progress	In Progress
reason			Ph.D. bisc		Ph.D. Bisc		grades poor	no science classes available at night			

Kanwar	Orr	Vrathasha	Bathala	Krishnakumar	Moalwi	Mercier	Parthasarathy
702227317	700335923	702039049	702231098	702217246	702003302	702264932	702264760
1							
	1						
	1						
1	1						
	1	1					
	1	1		1	1		
		1					
	1						
1		1					
1			1	1	1		
		1					
			1				
1			1	1			
inc	2						
1	1	1					

	1						
1	1						
1	1	1					
1							
				1			
	1						
	1						
In Progress	PSM-5/2014	No degree; sv	In Progress	In Progress	No degree, s	In progress	In Progress
		MS BISC			MS BISC		

Appendix 5 Resolution for the Faculty Senate Agenda

WHEREAS, the proposed Professional Science Master's (PSM) in Biotechnology is an interdisciplinary graduate course of study covering the scientific underpinnings of the biotechnology revolution, the management of the interdisciplinary teams necessary to bring biotechnology advances to the marketplace and the ethical/regulatory issues pertinent to these technological advancements and

WHEREAS, there has been much interest over several years from individuals with diverse backgrounds and interest in pursuing advanced graduate studies in biotechnology relevant to the business environment, and

WHEREAS, the experience of the Department of Biological Sciences with graduate level training in the life sciences in collaboration with Departments ranging over all seven Colleges of the University of Delaware provide existing courses and a foundation for the program, and

WHEREAS, the PSM in Biotechnology has been operating since June 2010 under provisional status and has been valuable to its enrolled students

WHEREAS, the proposed program contributes to three milestones on the University's "path to prominence": to become a premier research and graduate university; to achieve excellence in professional education; and the engaged university, be it therefore

RESOLVED, that the Faculty Senate recommends that the Professional Science Master's in Biotechnology receives approval as a permanent academic program of the university, effective June 1, 2015.

UNIVERSITY OF DELAWARE

DEPARTMENT OF BIOLOGY
OFFICE OF THE CHAIR

University of Delaware
Newark, Delaware 19716-2590
Ph: 302/831-6977
Fax: 302/831-2281

Robin W. Morgan, Ph.D.
Professor and Chairman
Department of Biological Sciences
118C Wolf Hall
Telephone (302) 831-6977
Fax No. (302) 831-1033
E-mail: morgan@udel.edu

October 21, 2014

MEMORANDUM

To: Domenico Grasso, Ph.D.
Provost, University of Delaware

Charles Swanik, Ph.D.
Chair, University of Delaware Faculty Senate Graduate Studies Committee

From: Robin W. Morgan, Ph.D.
Interim Chair, Department of Biological Sciences

Robin W. Morgan

I am writing in support of permanent status approval for the Professional Science Masters (PSM) Degree in Biotechnology. This program was proposed five years ago for provisional status to fill the needs of the local biotechnology industry for graduates cross-trained in science and business. In addition, the program has met the need for a non-thesis based Master's degree option for individuals working currently in the biotechnology sector, and it has meshed well with the University's Path to Prominence initiative in that it expanded professional graduate programs at the University to support workforce development in Delaware and the region.

This program has been in operation for four years and has proven valuable even beyond these initial goals. To date, the PSM has matriculated 19 students, and the six program graduates report that the training has accelerated their career progression. Our faculty report that PSM students are very well prepared for graduate level coursework compared to their classmates who are enrolled in the MS or Ph.D. program in Biological Sciences. Furthermore, the presence of PSM students in classrooms has broadened the perspectives explored in class discussions and directed conversations toward practical applications. Unexpectedly, the PSM program has also been valuable to some students as their first exposure to scientific research, and this has resulted in four students who initially matriculated into the PSM switching to either the MS or Ph.D. in Biological Sciences. These very motivated and well prepared students have already shown their worth, with one of the Ph.D. students winning an international poster competition at a scientific meeting this spring and the other having already produced two, first-authored scientific papers from his doctoral work.

UNIVERSITY OF DELAWARE
College of Arts & Sciences
OFFICE OF THE DEAN

4 Kent Way
Newark, DE 19716
Phone: 302-831-2793
Fax: 302-831-6398

27 October 2014

Melinda Duncan
Department of Biological Sciences

Dear Professor Duncan,

I am writing to confirm that the College of Arts and Sciences supports the permanent approval of the Professional Science Masters (PSM) Degree in Biotechnology as a graduate program at the University of Delaware. This degree program was originally proposed five years ago after an analysis of the Delaware Valley workforce identified a growing need for masters-level life scientists, trained in both science and business, to support the region's growing Biotechnology industry. This report corresponded well to the "Pathway to Prominence" goal of expanding professional education at the University of Delaware, and the College was pleased to support the PSM in Biotechnology's provisional status five years ago.

This program has been valuable to the enrolled students and the university in many ways. The PSM in Biotechnology program, while relatively small in itself, leverages existing course offerings in other MS/Ph.D. programs on campus. PSM students take courses from six of the seven UD colleges to create a broad, interdisciplinary program. Students are trained in areas identified by the program's industrial advisory board as critical for career success. All of the graduates from the PSM program to date have either quickly gotten jobs in the field upon graduation (often with their internship employer), or have entered a Ph.D. program for further scientific training.

As an early "professional" science graduate program that enrolls tuition-paying graduate students, the PSM in Biotechnology has also been a laboratory for exploring financial/business models for such programs in the College of Arts and Sciences. The experience gained will be valuable as we seek to create other programs that fill industry needs for scientists cross trained in science and business. Notably, every year since the program's founding, it has been self-sustaining, and both the College and the Department of Biological Sciences have benefitted by sharing the net income.

The PSM in Biotechnology provides valuable training opportunities for students, supports the needs of local industry through collaborative interactions, and is well aligned with our institutional mission and values. As it is also a source of revenue to the College, we have every reason to support permanent status this important program. I thank you and your colleagues for developing the program, and making it a success.

Sincerely,

George H. Watson
Dean

Finally, the program is financially viable and self-supporting and likely to remain so into the future. All courses for the PSM in Biotechnology are routinely taken by students in a host of other UD graduate programs, which means that these students do not need any additional staff-intensive, specialty course offerings. Further, PSM graduate students pay tuition, and the business model of the program allows this tuition to directly cover program expenses with any net income shared equally between the Department of Biological Sciences and College of Arts and Sciences.

In summary, the PSM in Biotechnology program has exceeded our expectations, and I enthusiastically support permanent status for the program at this time.

UNIVERSITY OF DELAWARE
College of Agriculture & Natural Resources
DEPARTMENT OF ANIMAL & FOOD SCIENCES

531 South College Avenue
44 Townsend Hall
Newark, DE 19716-2150
Phone: 302-831-2524

October 17. 2014

To: Melinda Duncan, Biology

From: Limin Kung, Jr., Interim Chair, ANFS

Re: PSM in Biotechnology Degree

The classes listed below are still being offered and are available to students in your PSM in Biotechnology Degree.

ANFS628	Food Chemistry
ANFS629	Food Analysis
ANFS635	Animal Virology
ANFS636	Immunology of domestic animals
ANFS637	Avian immunology
ANFS639	Food Microbiology
ANFS643	Food engineering technology
ANFS649	Food biotechnology
ANFS670	Principles of Molecular Genetics
ANFS671	Paradigms in Cell Signaling

UNIVERSITY OF DELAWARE

CENTER FOR BIOINFORMATICS & COMPUTATIONAL BIOLOGY

Delaware Biotechnology Institute
15 Innovation Way, Suite 205
Newark, DE 19711
Ph: 302/831-0161
bioinformatics.udel.edu

October 1, 2014

Robin Morgan, PhD
Chair, Department of Biological Sciences
University of Delaware

Dear Dr. Morgan,

It is with pleasure that I offer my strong support for the permanent status of the PSM program in Biotechnology. Your Biotechnology PSM program is an important complement to our bioinformatics degree programs. We commit to support your students to enroll in our bioinformatics classes, including:

BINF644	Bioinformatics
BINF650	Protein Modifications
BINF694	Systems Biology I
BINF695	Computational System Biology
BINF815	Ethics, Business and Communication
BINF816	Systems Biology of Cells in Engineered Environments

As with our PSM program in Bioinformatics, these programs offer unique educational opportunities for students, preparing them for professional careers in industry, business, government agencies, or non-profit organizations. Graduates of the PSM program in Biotechnology will certainly benefit our business and industrial partners in the region and beyond, and will serve to strengthen the reputation of our University.

I look forward to closely collaborating with you in meeting the goals of this exciting degree program.

Sincerely,

Cathy H. Wu, Ph.D.
Edward G. Jefferson Chair and Director, Center for Bioinformatics & Computational Biology
Professor, Computer & Information Sciences and Biological Sciences
Director, Master's Programs in Bioinformatics & Computational Biology
Director, PhD Program in Bioinformatics & Systems Biology

UNIVERSITY OF DELAWARE | College of Engineering
BIOMEDICAL ENGINEERING

125 East Delaware Avenue
Newark, DE 19716
Phone: 302-831-6234
Email: bmeg-info@udel.edu

October 7, 2014

Dear Robin:

On behalf of the Biomedical Engineering program, I support the permanent status of the Professional Science Masters in Biotechnology offered in Biological Sciences. Specifically, we would welcome Biotechnology students in our courses:

- BMEG 605: Principles of Biomedical Engineering I: Molecular and Cell Systems
- BMEG 606: Principles of Biomedical Engineering II: Tissue and Organ Systems
- BMEG679: Introduction to Medical Imaging Systems.

Best regards,

Dawn Elliott, PhD
Professor and Director
Biomedical Engineering

UNIVERSITY OF DELAWARE
Alfred Lerner College of Business & Economics
DEPARTMENT OF BUSINESS ADMINISTRATION

Newark, DE 19716-2710
Phone: 302-831-2555
Fax: 302-831-4196

Dr. Stewart Shapiro
Chair, Department of Business Administration
Professor of Marketing
Lerner College of Business & Economics
University of Delaware
Newark, DE 19716

Phone: (302) 831-2516
Fax: (302) 831-4196
Email: sshapiro@udel.edu

Date: October 20, 2014

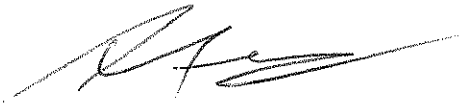
TO: Dr. Robin Morgan
Professor and Chair
Department of Biological Sciences

RE: Letter of support for the PSM in Biotechnology program

Dear Dr. Morgan,

I have reviewed the BUAD course offerings included in your department's Professional Science Masters in Biotechnology program. These courses include BUAD700, BUAD811, BUAD831, BUAD840, BUAD870, BUAD871, and BUAD872. The Department of Business Administration is happy to continue offering these courses and having your students enroll in them with two exceptions. BUAD872 was designed for our Masters in Science program in Organizational Effectiveness, Development and Change (OEDC) and this program has since been disestablished. For this reason BUAD872 will no longer be offered. Further, in the past BUAD700 has had very small enrollment numbers, with about half of those enrolled coming from our now disestablished OEDC program (for example, last time it was taught only 5 students were enrolled who were not in the OEDC program). Hence, it is unlikely that this course will continue to be offered with any regularity. With this said, we are happy to continue to support your PSM in Biotechnology with our other BUAD courses.

Regards,



Stewart Shapiro

UNIVERSITY OF DELAWARE
Department of Chemical & Biomolecular Engineering
OFFICE OF THE CHAIR

Newark, DE 19716-3110
Phone: 302-831-8079/8155
Fax: 302-831-8201

October 14, 2014

Professor Robin W. Morgan, Ph.D.
Chairperson, Department of Biological Sciences
118C Wolf Hall
CAMPUS

Re: Program Review for Professional Science Masters (PSM) in Biotechnology

Dear Professor Morgan:

I understand that the Professional Science Masters (PSM) in Biotechnology is ending its probationary period and is now being considered for permanent status. There are several courses offered by our department that appear in the listed curriculum, and I am pleased to confirm that these courses, when offered, will remain available to students in the Biotechnology PSM. The courses currently listed are:

CHEG595	Intellectual Property for Engineers and Scientists
CHEG621	Metabolic Engineering
CHEG624	Bio-Based Materials
CHEG625	Green Engineering
CHEG650	Biomedical Engineering

Best of luck with your application for permanent status.

Best regards,

Abraham M. Lenhoff
Allan P. Colburn Professor and Chairperson,
Department of Chemical and Biomolecular Engineering

UNIVERSITY OF DELAWARE

DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY
OFFICE OF THE CHAIRMAN

102 Brown Laboratory
University of Delaware
Newark, Delaware 19716-2522
Ph: 302/831-1247
Fax: 302/831-6335

September 25, 2014

Robin W. Morgan, Ph.D.
Professor and Chairperson
Department of Biological Sciences

Dear Dr. Morgan,

I am writing this letter in support of your application for permanent status of the Professional Science Masters program in Biotechnology. I would like to confirm that the Chemistry and Biochemistry Department will continue to allow PSM Biotechnology students to enroll in the classes listed below.

CHEM642	Biochemistry II
CHEM679	Biomolecular NMR Spectroscopy
CHEM 641	Biochemistry I
CHEM 645	DNA-Protein interactions
CHEM 686	Biophysical Chemistry
CHEM 653	Bioinorganic Chemistry
CHEM681	Green Chemistry
CHEM643	Intermediary Metabolism
CHEM684	Biochemistry of Nucleic Acids
CHEM608	Environmental Soil Chemistry

Please accept my best wishes for continued success of this program.

Sincerely,

Murray V. Johnston
Professor and Chair
Department of Chemistry and Biochemistry

UNIVERSITY OF DELAWARE
College of Engineering
DEPARTMENT OF COMPUTER AND INFORMATION SCIENCES

September 17, 2014

Professor Robin Morgan
Department of Biology

Dear Professor Morgan,

It is with pleasure that I write in strong support of the continuation of the PSM in Biotechnology. We in CIS view biotechnology and your PSM as an important complement to our work in computer science and in bioinformatics.

The CIS Department specifically welcomes having students from that program in certain of our classes:

CISC636	Introduction to Bioinformatics
CISC841	Bioinformatics

Our expectation that typically there will be 2 or 3 Biotechnology PSM students in each offering of these courses. Our current class sizes and available resources are sufficient to handle those students in our courses.

We in CIS strongly support the granting of permanent status to your program.

Sincerely,

Errol L. Lloyd
Professor and Chair

101 Smith Hall | Newark, DE 19716-2586 | Ph: 302/831-2712 | Fax: 302/831-8458 | www.cis.udel.edu

UNIVERSITY OF DELAWARE
Department of Electrical & Computer Engineering
OFFICE OF THE CHAIR

Newark, DE 19716-3130
Phone: 302-831-2405
Fax: 302-831-4375

October 3, 2014

Robin W. Morgan, Ph.D
Professor and Chairperson
Department of Biological Sciences
118C Wolf Hall

Dear Professor Morgan,

The Electrical and Computer Engineering Department will support the Professional Science Masters (PSM) in Biotechnology by allowing enrolled students to register for the following ECE courses:

ELEG671	Introduction to biomedical engineering
ELEG675	Image processing with biomedical applications
ELEG678	Introduction to nano and biophotonics
ELEG679	Introduction to medical imaging systems
ELEG801	Advanced Topics in Biomedical Engineering

Please let me know if I can provide any additional information.

Sincerely,

Kenneth E. Barner
Professor and Chair

UNIVERSITY OF DELAWARE
COLLEGE OF AGRICULTURE AND NATURAL RESOURCES
DEPARTMENT OF ENTOMOLOGY AND WILDLIFE ECOLOGY
250 Townsend Hall
University of Delaware
Newark, Delaware 19716-2160
Ph: 302/831-2526
Fax: 302/831-8889

October 13, 2014

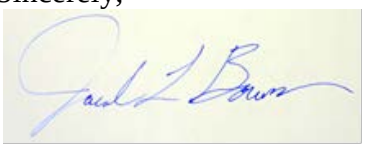
TO: Robin Morgan, Chair
Department of Biological Sciences

FROM: Jacob Bowman, Chair
Department of Entomology and Wildlife Ecology

SUBJECT: Permanent Status approval for the PSM in Biotechnology degree

I approve of ENWC610 (Medical, Veterinary, and forensic entomology), ENWC611 (Insect pest management), ENWC619 (Biological control), and ENWC805 (Insect-plant chemical ecology) being listed. Please note that I'm not sure what is happening with ENWC 610 so it may not be taught in the near future.

Sincerely,



Jacob L. Bowman, Ph.D.
Department Chair
Professor Wildlife Ecology
245 Townsend Hall
Department of Entomology and Wildlife Ecology
University of Delaware
Newark, DE 19716-2160
Office: (302) 831-4621
Email: jlbowman@udel.edu

UNIVERSITY OF DELAWARE | Horn Program in Entrepreneurship

hornprogram@udel.edu
www.udel.edu/horn
302-831-4393

September 29, 2014

Melinda K. Duncan, Ph.D.
Professor
Graduate Program Director
Department of Biological Sciences

Dear Melinda:

The Horn Program in Entrepreneurship will be pleased to continue to allow students enrolled in the Professional Science Masters (PSM) in Biotechnology to enroll in ENTR660: High Technology Entrepreneurship (this course was previously numbered ENTR860). In addition, we would invite your students to enroll in the following ENTR courses, all of which have been recently added, as electives in your program:

ENTR654: Introduction to Entrepreneurship
ENTR658: Application Development for New Technology
ENTR620: Social Entrepreneurship
ENTR655: Startup eXperience I*
*This course requires instructor permission

Thank you for including options for entrepreneurial education for your students.

Sincerely,

Dan Freeman, Ph.D.
Director

UNIVERSITY OF DELAWARE

DEPARTMENT OF KINESIOLOGY
AND APPLIED PHYSIOLOGY
COLLEGE OF HEALTH SCIENCES

540 South College Avenue
201T Health Sciences Complex
Newark, Delaware 19713
Office: (302) 831-2937

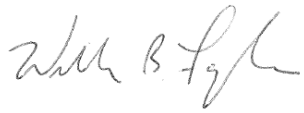
September 17, 2014

Dr. Robin W. Morgan
Professor and Chair
Department of Biological Sciences

Dear Dr. Morgan:

I am in support of the permanent status of the Masters in Biotechnology graduate degree program, and agree to continue to allow PSM in Biotechnology students to enroll in KAAP 651, Neurophysiological Basis of Human Movement.

Sincerely,



William B. Farquhar
Professor and Chair
Department of Kinesiology & Physiology

UNIVERSITY OF DELAWARE | College of Earth, Ocean, & Environment
SCHOOL OF MARINE SCIENCE & POLICY

Thomas E. Hanson
Professor, Marine Biosciences
Associate Director, Marine Biosciences Program
282 DBI, 15 Innovation Way
Newark, DE 19711 U.S.A.
Phone: 302-831-3404
Fax: 302-831-3447
Email: tehanson@udel.edu

Robin W. Morgan
Professor and Chair
Department of Biological Sciences

October 21, 2014

Dear Robin,

This letter supports your application for Permanent Status for the Professional Science Master's Degree program in Biotechnology. I am confirming that the following courses will be offered and available for enrollment by students in the program:

MAST618	Marine Microbial Ecology
MAST625	Microbial Physiology and Diversity
MAST697	Bioinformatics Programming for Biologists
MAST689	Environmental and Systems Bioinformatics

I hope that your students will take advantage of the unique opportunities that these courses offer. Let me know if there is anything else I can do to help.

Sincerely,

Thomas E. Hanson
Professor and Associate Director
Marine Biosciences Program

UNIVERSITY OF DELAWARE

DEPARTMENT OF BIOLOGY
OFFICE OF THE CHAIR

University of Delaware
Newark, Delaware 19716-2590
Ph: 302/831-6977
Fax: 302/831-2281

Robin W. Morgan, Ph.D.
Professor and Chairperson
Department of Biological Sciences
118C Wolf Hall
Telephone (302) 831-6977
Fax No. (302) 831-1033

September, 8, 2014

Dr. Suresh G. Advani
Professor and Chairperson
Department of Mechanical Engineering

Dear Dr. Advani:

The Professional Science Masters (PSM) in Biotechnology is a graduate degree that UD has offered since fall of 2010. As such, it is ending its probationary period and is now up for permanent program review by the university.

As part of this review, we are required to obtain letters of support stating that your department will continue to allow PSM in Biotechnology students to enroll in the classes listed as required or elective in the curriculum (see http://www.bio.udel.edu/psm-biotechnology-degree for the current approved curriculum). For elective courses, we anticipate that enrollment pressure on your courses will seldom be more than 2-3 students per course/per semester, and usually will be much less. PSM in Biotechnology enrollments have ranged between 5-10 total students per semester since the program's inception.

The courses from your unit that are listed in the PSM curriculum are:

MEEG612
Biomechanics of human movement
MEEG682
Clinical biomechanics
MEEG683
Orthopedic Biomechanics
MEEG684
Biomaterials and tissue engineering
MEEG685
Control of human movement
MEEG686
Cell and tissue transport

Due to the university deadlines for the permanent program approval application, it would be greatly appreciated if we can get your letter by October 1, 2014. If you need any further information to consider this request, please do not hesitate to contact me.

Best regards,

Robin W. Morgan

Professor and Chair
Department of Biological Sciences

I am happy to support PSM students to enroll in classes listed above

Advani

Suresh Advani
Chair, Mechanical Engg.

UNIVERSITY OF DELAWARE | Alfred Lerner College of Business & Economics

DEPARTMENT OF ACCOUNTING & MIS

21 October 2014

Dear Professor Morgan,

The Department of Accounting and Management Information Systems enthusiastically supports the permanent status for the PSM Program in Biotechnology. PSM students may enroll in our MISY 840 Project Management and Costing course, which is usually offered as an elective on an annual basis.

We look forward to continued support of the PSM program.

Sincerely,

Scott Jones
Professor & Chair
Department of Accounting & MIS

SCHOOL OF NURSING

McDowell Hall
University of Delaware
Newark, Delaware 19716-3710
Ph: 302/831-1253
Fax: 3021831-2382
E-mail: ud-nursing@udel.edu

September 17, 2014

Robin Morgan, PhD
Chairperson
Department of Biological Sciences

Dear Dr. Morgan:

On behalf of the School of Nursing, I support the inclusion of NURS 621, Advanced Pathophysiology, as an elective course in the curriculum for the Professional Science Masters (PSM) in Biotechnology. We will allow PSM in Biotechnology students to enroll in this course based on availability of seats following enrollment of our graduate students for whom this is a required course. We wish you continued success with your program.

Sincerely,

Kathleen Schell, PhD, RN
Director, School of Nursing
College of Health Sciences

PHYSICAL THERAPY

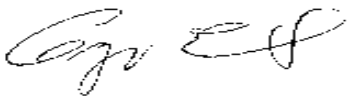
540 South College Avenue
University of Delaware STAR Campus
Newark, Delaware 1913

Dr. Robin W. Morgan
Professor and Chair
Department of Biological Sciences

Dear Dr. Morgan:

I am in support of the permanent status of the Professional Science Masters in Biotechnology graduate degree program, and agree to continue to allow PSM in Biotechnology students enroll in PHYT623 Clinical Neuroscience.

Sincerely,



Gregory Hicks, PT, PhD
Chair and Associate Professor
Department of Physical Therapy

UNIVERSITY OF DELAWARE

College of Agriculture & Natural Resources

DEPARTMENT OF PLANT & SOIL SCIENCES

Dr. Blake C. Meyers
Edward F. and Elizabeth Goodman Rosenberg Professor
Chair of Department
153 Townsend Hall
Newark, DE 19716-2170
Phone: (302) 831-3418
Email: meyers@dbi.udel.edu

Sept. 16, 2014

Robin W. Morgan, Ph.D.
Professor and Chairperson
Department of Biological Sciences
118C Wolf Hall

Dear Robin,

This letter is in response to your question about the support by my department (Plant & Soil Sciences) for the Professional Science Masters (PSM) in Biotechnology, a graduate degree that UD has offered since fall of 2010. It is my understanding that it is ending its probationary period and is now up for permanent program review by the university.

My department will continue to allow PSM in Biotechnology students to enroll in the classes listed as required or elective in the curriculum. We have the capacity in all of the classes that we offer as part of my department's commitment to the PSM, and the students are certainly welcome to take advantage of some of the unique expertise that we offer.

As you mentioned, the courses from your unit that are listed in the PSM curriculum are as follows:

PLSC603	Soil physics
PLSC619	Soil Microbiology
PLSC629	Introduction to Fungi
PLSC635	Plant Developmental Biology
PLSC636	Plant Genes and Genomes
PLSC608	Environmental Soil Chemistry

I wish you the best for your efforts in this area, as it's an important topic of growing interest. Let me know if there's anything more I can do to help, and I look forward to our continued, positive interactions over this and other aspects of curriculum and research.

Sincerely,

Blake C. Meyers, Ph.D.
Professor & Chair

UNIVERSITY OF DELAWARE | College of Agriculture & Natural Resources
DEPARTMENT OF APPLIED ECONOMICS & STATISTICS

Titus O. Awokuse
Department Chair
213 Townsend Hall
Newark, Delaware 19716
Phone: 302-831-1323
Fax: 302-831-6243
Email: kuse@udel.edu

October 14, 2014

Dr. Robin Morgan
Professor and Chair
Department of Biological Sciences
University of Delaware
Newark, DE 19716

Dear Dr. Morgan:

Re: Letter of Support for the Professional Science Masters (PSM) in Biotechnology

As the Chair of the Department of Applied Economics and Statistics (APEC), I write in support of the application for permanent status for the Professional Science Masters (PSM) in Biotechnology graduate degree offered by the Department of Biological Sciences since 2010. Our department will continue to support this program by allowing PSM students to take relevant courses offered by APEC. We are in support of your plan to continue to use several of our courses (STAT XXX) as part of the courses for the degree. My department is excited to be a part of this initiative and looks forward to having more of your students in the classroom. Please contact me if I can be of additional assistance in this process.

Sincerely,

Titus O. Awokuse
Professor and Chair

UNIVERSITY OF DELAWARE

School of Public Policy & Administration

INSTITUTE FOR PUBLIC ADMINISTRATION
CENTER FOR COMMUNITY RESEARCH & SERVICE
CENTER FOR HISTORIC ARCHITECTURE & DESIGN
CENTER FOR APPLIED DEMOGRAPHY & SURVEY RESEARCH

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September 24, 2014

Dr. Robin W. Morgan, Chair
Department of Biological Sciences
CAMPUS MAIL

Dear Dr. Morgan:

I am responding to your September 8, 2014 letter to Dr. Jerome R. Lewis regarding continuing to allow Professional Science Masters (PSM) in Biotechnology to enroll in designated UAPP courses as electives in your Program.

We certainly have no objections to your graduate students enrolling in UAPP 697, UAPP 698, UAPP 761 and UAPP 827. In fact, their participation enriches the overall learning experiences for all those in these classes.

Please contact me directly (jflynn@udel.edu/302-831-4658) if I can provide any further information or support for your permanent program approval application.

Regards,

James P. Flynn

James P. Flynn, Director
Master of Public Administration Program

Cc: Prof. Leland Ware, Interim Director
School of Public Policy and Administration