The Professional Master's Degree in Applied Biosciences

Student Handbook

2008-2009



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Requirements for the Professional Master's Program in Applied Biosciences

Curriculum

36 hours minimum required (2 years full time, 6 years maximum)

Course #	Course Name	Units
	Core Science Courses (Required) Since students may specialize in any relevant biological discipline, the core courses will be determined by the advisor and committee At least 12 units of graduate level graded science courses must be completed	12
MCB 568 MCB 589 or PLS 627 or PLP 528 MCB 595B	¹ Electives- Major – (see Electives section) Nucleic Acids Cancer Genetics Advanced Genetics Microbial Genetics Journal Club (1 unit) – or any biology department journal club	4 3 3 3
MATH 509c PLS 595d ENGR 512A ENGR 512B ENGR 554 LAW 655G LAW 664 MCB 595F	Electives - Other Statistics for Research Regulatory Issues for Laboratory Management Management of Technology I Management of Technology II Law for Engineers/Scientists Law and Science Biotech Startup Co: Law, Science & Business Issues Topics in Entrepreneurship for Scientists	3 3 3 3 2-3 1-3
BNAD 510 MIS 578	Business Courses Required Business Fundamentals for Scientists Project Management	3
XXX 5/699 XXX 693	Internship Options Independent Study Internship Thesis/Report	1-5 3-6
MCB 910	Project Report / Thesis	1-8

¹ Electives are chosen based on the specialization the student chooses, and can either be in a core science, or other business and/or management courses.

Business Courses

The two courses that are required from the Eller College are BNAD 510 and MIS 578. These courses were designed for the Professional Master's Program and require special admittance. In a addition, MCB 595f Topics in Entrepreneurship for Scientists is available for students for credit. Students are encouraged to attend this class to meet industry leaders. Other business and law courses are available. To sign up for these classes, contact Lindy Brigham.

Electives

Electives are chosen from a broad range of subjects depending on the student's interests and career choices. Options include courses from Molecular and Cellular Biology, Cancer Biology, Biochemistry, Physiology, Entomology, Pharmacology and Toxicology, Neurosciences, Ecology and Evolutionary Biology, Plant Sciences, Plant Pathology and Microbiology and Veterinary Sciences. Students should start working with an advisor as soon as possible to identify a specialization to follow and develop a Plan of Study.

Program Specializations

The Applied Biosciences program is intended to be 'self-guided' in the sense that students develop their own curriculum based on their career aspirations and qualifications needed by industry. Students may mix and match from any of the life sciences and ancillary courses offered. However, the following 'options' are possible guidelines for students to follow based on past students experiences. The curriculum for each option is outlined in the document Applied Biosciences Specialization Options.

Coursework taken prior to acceptance into the program

The total number of units of coursework taken as an undergraduate, in graduate non-degree status and transferred from other institutions can be no more than 12. Please refer to the form entitled <u>'Evaluation of Transfer Credit'</u>. This form is due at the Graduate College before the end of the first year in residence.

General limits on the 12 units taken prior to acceptance into the program:

- Not more than 6 units of University of Arizona undergraduate coursework at the 400 level can be accepted into a master's program, **only if they were not used toward the undergraduate degree**.
- No more than 12 units of coursework taken in graduate non-degree seeking status may be used toward a master's degree.
- Transfer work may not exceed 20% of the required number of units for the master's degree being sought.

For further details, please consult the Graduate College website.

http://grad.arizona.edu/current-students/program-requirements/masters-degrees/credit-requirements

Other requirements

Internship

<u>The Internship</u> should expose the student to a hands-on experience in an environment that may be of interest to them for a career, whether it is in industry or in a research laboratory. Credit will be based on an academic project associated with the internship. In some cases, the academic project may be the thesis or final project for the entire program. The internship is waived for students who are currently full-time employees in industry; however, a written record/project associated with their work experience is required. All students registered for Internship credit must submit an Internship Report regardless of whether the internship is used for the final Project Report.

Final Project Report or Thesis.

Some type of culminating written record of the student's internship project or research is required. It may be in the form of a Master's thesis or a significant report typical of those used in a specialty, such as a technical report, user manual, or portfolio. The project will be defined by the student's advisor and committee. Good organizational and writing skill should be demonstrated in the production of this document. The student will defend and/or present their final project/thesis for their committee and peers.

Advisor:

Upon admittance to the Applied Biosciences program, the initial advisor will be Lindy Brigham. The student will work with Dr. Brigham to determine their initial course schedule, career goals, and identify a major advisor. The major advisor is responsible for approving the student's Plan of Study and will work with them to develop the internship experience and final project report. A major advisor should be selected by the end of the first semester.

Committee

The committee consists of the student's advisor and two other members of the academic community. The advisor generally suggests appropriate committee members based on the students career goals. In the Applied Biosciences program it is usually helpful to have at least one committee member with ties to industry. While the advisor and one other committee member must have an official appointment at the University of Arizona, the third committee members may come from the community or other institutions. Members from outside the University must be approved by the Graduate College (http://grad.arizona.edu/current-students/program-requirements/masters-degrees/masters-committees) Students may not schedule a final defense without at least one prior meeting with their full committee.

Information sources and deadlines

It is the student's responsibility to be aware of and plan for the requirements of the Graduate College.

The two documents required by the Graduate College are:

1. Plan of Study.

https://grad.arizona.edu/Current_Students/

Start this document as soon as you sign up for classes, it will be used as a working document until it is finalized. It will usually be completed after your second semester after working with you advisor. Fill out on line and print it out. Have your advisor sign it, then the Head of Molecular and Cellular Biology in LSS 444, and submit to the Graduate College.

2. Completion of Degree.

https://grad.arizona.edu/Current_Students/

In the final semester, check the deadline for this document. Fill out on line. Bring it to your final defense. Your committee members will sign it. Then bring it to Lindy Brigham for final review. The final signature required is Kate Dixon. Then take it to the Graduate College.

University Email Accounts:

All students are required to have a University of Arizona email account. This is the official mechanism for communication. If you use other email addresses, have your UA email forwarded to that address.

http://computing.arizona.edu/accounts/index.shtml

PSM listservs:

Upon your acceptance into the program, you will be put on two listservs that are used to send information on issues pertinent to the program.

<u>PSM@listserv.arizona.edu</u> Is a general listing of students, alumni, members of the University of Arizona who have a connection to or interest in the PSM, and community members who have an interest in the program through industry or government connections.

PSM-students@listserv.arizona.edu is for the students enrolled in any of the PSM programs.

Satisfactory Academic Progress.

(This document is on file in the Graduate College to ensure students have an adequate understanding of the expectations of the program.)

The Professional Science Master's programs are designed to prepare students for employment in science based businesses. To that end, students are expected to participate in the opportunities offered for professional development and connections to industry.

When a student fails to achieve a minimum 3.0 GPA or does not demonstrate satisfactory academic progress toward completion of degree according to the Program's written policies, the Program will request that the Graduate College convert the student to non-degree graduate status.

Professional Opportunities:

- 1. Resumes. Students will develop a professional resume within their first semester.
- 2. *Industrial Colloquium*. All students will attend the weekly colloquium for a minimum of 4 semesters. One of these semesters must be for credit.
- 3. *Industry meetings*. Students are expected to attend at least one industry meeting when volunteer opportunities are available.

Coursework:

- 1. *Time limits*. All course work must be completed within 6 years of the start of the program.
- 2. Required courses. All students must complete the required coursework with a minimum of a 3.0 GPA and minimum of 3.0 for each required course. Substitutions for the core required courses must be requested in writing.

Other Requirements:

- 1. *Internship*. All students must complete an internship in a facility deemed suitable by their committee.
- 2. *Internship report*. The student will submit a 1 to 2 page report on their internship at the end of the semester in which they are enrolled for internship units.
- 3. *Final Project Report*. In most cases, the internship experience will form the basis of the student's final project report. The scope and form of the report will be determined by the students committee.
- 4. *Final Project Defense*. Students are expected to give a formal, public seminar as part of their final defense.

The Role of Advisor for the Professional Master's Degree Student:

The advisor is to be chosen in the first semester of the program. Accepted students who have already chosen their area of specialty may identify and contact faculty before the start of their first semester. Students who have not chosen a specialty will be assigned a temporary advisor at the beginning of their first semester.

The advisor's responsibility is to guide the student in their choice of course work, lab experience if necessary including rotations, and internship selection. The **Plan of Study** should be filled out in the first semester as a tool to defining the students overall plan. It should be finalized and submitted to the Graduate College in the students second semester. The Plan may be amended at any time after submission.

While there are three required science courses, exceptions may be made on a case-by-case basis depending on the student's interests and career goals. The advisor may determine the appropriate course work for the student.

At the master's level, the committee consists of the advisor and two other members. Non-tenure track faculty and persons outside the university may be included with written permission. (Request to Approve Membership on Graduate Student Examination Committees) The other committee members should help round out the student's educational experience and help in areas outside the advisor's expertise. For instance, members may be from other academic units, business units, the business school, or an outside company.

The students are required to produce and defend documentation of their level of achievement in the program, work comparable to the thesis. This work is usually based on the internship experience of the student and it is therefore critical that the students work with their advisor on the procurement of the internship, the expectations of the internship and the specifications of the final documentation. Internships are usually with commercial ventures, but may be in academic or other governmental labs where appropriate. Examples of final projects are case-studies, standard operating procedure manuals, other user manuals, market analyses, grant proposals or any documentation deemed appropriate. In the final semester, the student will present their work in a public forum and defend the work to their committee.

The final documentation required is the **Completion of Degree** form to be signed by all committee members when the final project meets their expectations.

Students are required to attend the Industrial Colloquium series every week.

It is up to the advisor to determine which departmental programs the student should participate in including seminars and journal clubs. It is the student's responsibility to be aware of deadlines and requirements.

The Coordinator for the Applied Biosciences Program will work with all advisors and students to answer questions, help find internships, and help determine the nature and scope of the final project.

Checklist for Advisors:

1st Semester

- Meet with student and outline plan
- Have student fill out **Plan of Study**
- Help student select other committee members
- Have student start research for internship options
- Have potential transfer credit evaluated:

(http://grad.arizona.edu/current-students/program-requirements/masters-degrees/transfer-credit-for-masters)

2nd Semester

- Help student procure internship
- Have student file Plan of Study

Summer

- If not done before, outline expectation for final project scope and documentation.
- Evaluate student report on internship.

3rd Semester

- Make final determination about scope and expectations for final project.
- Make final adjustments to students course work.

4th Semester

- Help student finalize project and prepare for presentation
- Confer with committee on expectations and format for student's final defense.
- After defense, sign **Completion of Degree** form

Professional Master's Degree Project Report

The purpose of the Final Project Report is for you and your committee to assess what you learned from the program and give you experience writing for business. The process of writing it should help you to put together all the pieces of the program and help **you** to evaluate what you have learned. While this report is not a thesis, it should be as comprehensive and rigorous as one. The level of detail and analysis should be comparable. The only difference is that you are doing a VERY interdisciplinary project and this is reflected in the flexibility of the guidelines.

As you design the report, keep in mind the stated purpose of this program and why you enrolled.

Possible Forms the Report May Take – Examples:

- 1. Report on your Internship
 - a. Your internship should entail a real project. Documentation involved in this project can form the basis of the final project report.
 - b. If the project does not entail specific documentation, write up the rationale and results of the project.
 - c. If you are doing a report on your internship in a science based company, the basic format of the report should be a history of the organization, the mission of the organization, the science involved, how your project fits into the mission of the organization (your research may be included as a journal article or short communication within this report). Each part may have be more or less detail depending on the focus of the report. Be sure you explain at the outset the scope of the report and the issues you will be dealing with. It is always helpful in any writing to understand who your audience is and what you are trying to tell them. What contributions did you make to the organization? By the science you did, your role/job within the organization, how your job connects to others within the organization.
- 2. Case study
- 3. Regulatory/QA/Biosafety
 - a. Standard Operating Procedures Manual
 - b. Submit an IND or NDA to the FDA
- 4. Grant Proposal
 - a. NIH SBIR
 - b. Regional grants in economic development
- 5. Business plan
 - a. If you are doing the certificate in Entrepreneurship, your business plan is the basis of the final report.
 - b. Other options may exist in different areas

The report should show the scope and depth of what you have learned in your internship experience.

Please consult with your committee on your report and make sure they are all in agreement on the scope and direction as you go along.

Applied Biosciences Faculty

Faculty may be drawn from any of the life science disciplines. The following faculty have participated in the program.

Faculty	Department	Title	Connections
David Adelman	Law Instruction	Associate Professor	Law of Biotech
Felix Ayala-Fierro	Dial Corporation	Sr. Toxicologist	Industry
Thomas O. Baldwin	Biochemistry	Professor, Department Head	
Jennifer K. Barton	Biomedical Eng., Electrical and Computer Eng.	Associate Professor	ARL, BIO5
David Besselsen			
G. Tim Bowden	Radiation Oncology	Professor	
Gail Burd	MCB	Associate Dean	
James K. Collins	Vet Science &	Professor, Department	Veterinary applications
	Microbiology	Head	
Mathew H Cordes	Biochemistry BMCB	Assistant Professor	
Michael Cusanovich	Biochemistry	Professor	BIOSA, ARL
Pierre A. Deymier	Materials Science and Engineering	Professor	Nanotechnology
Kathleen Dixon	Molecular and Cellular	Professor, Department	
	Biology	Head	
Robert T. Dorr	Pharmacology	Professor	Amplimed Corporation
Suzanne Dubuque	Office of Technology Transfer	Licensing Associate / Life Sciences	Tech Transfer
George Frisvold	Agriculture and Resource Economics	Associate Professor	
Jay G. Gandolfi	Pharmaceutical Sciences	Professor, Dept Head	Dial Corporation
Eugene W. Gerner	Cell Biology and Anatomy	Professor	
Robert Gillies	Biochemistry and Molecular Biophysics	Professor	Biomedical Imaging
Thomas M. Grogan	Pathology	Professor	Ventana Medical Systems
Raphael P Gruener	Sci and Tech Park	Scientist in Residence	UA Science and Technology Park
Roberto Guzman	Chemical and Environmental Engineering	Associate Professor	Nanotechnology
Marilyn Halonen	Pharmacology	Professor	
Michael F. Hammer	ARL -interdisciplinary EEB, Anthropology	Associate Research Scientist	Forensics
Sherry Hoskinson	Eller Center	Director	Entrepreneurship
James B. Hoying	Arizona Research Labs	Associate Professor	Nanotechnology
Victor J. Hruby	Biochemistry, Chemistry, ARL	Professor	Drug Discovery
Laurence Hurley	Pharmacology and Toxicology	Professor	BIO5
Elaine L. Jacobson	Pharmacology and Toxicology	Professor	Niadyne, Inc.
Myron Jacobson	Pharmacology and Toxicology	Professor	Niadyne, Inc.
Richard A. Jorgensen	Plant Sciences	Associate Professor	Editor of the Plant Cell - previous connections with industry Ag Biotech
James King	Psychology	Professor	

Walter Klimecki	Arizona Respiratory Center	Associate Research	BIO5
		Scientist	
Chieri Kubota	Plant Sciences	Associate Professor	CEAC
Thomas J. Lindell	MCB	Associate Professor	MCB Advisor
T Philip Malan	Pharmacology,	Professor	Clinical Trials
	Anesthesiology		
Srinvas Manne	Physics	Associate Professor	Physics
Marilyn M. Marshall	Research Support Office	Quality Assurance Officer	Quality Assurance
Jesse D. Martinez	Radiation Oncology	Associate Professor	
John J. McGrath	Aerospace & Mechanical	Professor	BIO5
	Engineering		
Thomas P. Miller	Medicine	Professor, Medicine	
David Mount	Molecular and Cellular	Professor	
	Biology		
Raymond B Nagle	Pathology, Cell Biology	Deputy Director, Cancer	Ventana Medical Systems
	and Anatomy	Center; Professor	Science Advisor
Carolyn Napoli	Plant Sciences	Associate Research	Bioinformatics
36 1 4 37 1	D 4 1	Professor	CU: 1 TT: 1
Mark A. Nelson	Pathology	Professor	Clinical Trials
Nina Ossanna	Office of Technology	Sr. Licensing Associate	UA Office of Technology
Laland C. Dianan	Transfer	D. C.	Transfer, BIO5
Leland S. Pierson	Plant Sciences	Professor	Office of Biosafety
Garth Powis	Pathology	Professor	PROLX Pharmaceuticals,
Donnis T. Pou	Plant Sciences, Arid Lands	Professor	Corp Faculty Associate,
Dennis T. Ray	Fiant Sciences, And Lands	Floressor	•
Lisa M. Rimsza	Dothology	Associate Professor	Academic Programs
Gary Schwartz	Pathology Psychology	Professor	
Dan Stamer	Ophthalmology	Associate Professor	
Mimi (Suzanne) Stratton	Cancer Center	Research Professor	Clinical Trials
John B. Sullivan Jr.	Surgery	Associate Professor	Cimical Thais
Frans E. Tax	Molecular and Cellular	Associate Professor	
Tuns E. Tux	Biology	Associate Froressor	
Mary L Trammell	Office of Technology	Senior Licensing Associate	BIO-SA, Technology
many 2 Transmen	Transfer	Semor Erechsing Passociate	Transfer
Todd Vanderah	Pharmacology	Assistant Professor	1101101
Koen Visscher	Physics, MCB	Associate Professor	Nanotechnology
Daniel D. Von Hoff	Cancer Center division,	Professor	Translational Genomics
	Medicine, MCB		Institute
Samuel Ward	MCB	Professor	
Marie Wesselhoft	Arizona Center for	Director	Life Science Incubator
	Innovation		
Stu Williams	Biomedical Engineering	Professor, Director	Biomedical Engineering
	2 3		Program, ARL,
Donna M. Wolk	Clinical Pathology	Assistant Professor,	VA Hospital - Molecular
		Director	Diagnostics Lab
Ray Woosley	Pharmacology, Medicine	Professor	C-Path Institute

Internship and Employment Opportunities:

Internships:

Local: (Tucson and Phoenix)

High Throughput Genomics (Tucson, AZ)
Integrated Biomolecules (Tucson, AZ)
Protein Therapeutics (Tucson, AZ)
Ventana Medical Systems (Tucson, AZ)
Rowpar Pharmaceuticals (Phoenix, AZ)
Niadyne Inc. (Tucson, AZ)
Molecular Diagnostics Lab VA Hospital
(Tucson, AZ)
Protein Therapeutics (Tucson, AZ)
AmpliMed Corporation (Tucson, AZ)
Oncotheryon (ProlX) (Tucson, AZ)
T-Gen (Phoenix, AZ)
C-Path (Tucson, AZ)
Medipacs (Tucson, AZ)

U of A:

Science and Technology Park Arizona Center for Innovation Office of Technology Transfer Institutional Biosafety Program Arizona Cancer Center (Tucson, AZ)

Non-local:

Genentech (CA) Los Alamos Laboratories (Biology, Physics, Math)

Internship Programs

Dial Corporation (Phoenix, AZ)

Employment:

Local:

*Molecular Diagnostics Lab VA Hospital (Tucson, AZ)

*AmpliMed Corporation (Tucson, AZ)
ImaRX, (Tucson, AZ)
Ventana Medical Systems (Tucson, AZ)
Cord Blood Registry (Tucson, AZ)
BioVigilant Systems Inc.

*Rowpar Pharmaceuticals (Phoenix, AZ)
Alliance Medical Corp. (Phoenix, AZ)
Arizona Department of Public Safety

*Critical Path Institute (Tucson, AZ)

*Genomics USA (Tucson, AZ)

^Innovis Technologies (Tucson, AZ)

U of A:

*Office of Technology Transfer
*Arizona Research Laboratories
BIO5 Institute
Arthritis Center
Human Subjects Protection Program

Non-Local:

Astra Zeneca (Gothenberg, Sweden)
Lawrence Livermore Laboratories
University of Michigan - Tech Transfer
Goldman Sachs (London, UK)
USDA National Animal Disease Center
(Ames, IA)
Scripps Institute (La Jolla, CA)
Diversa Corporation (San Diego, CA)
BioMarin Pharmaceutical Inc. (Novato, CA)
Baylor University Medical Center (Houston, TX)

- * Hired intern
- ^ CEO is PSM graduate

(as of August, 2008)