



Graduate Interdisciplinary Program in
**Professional Science Master's in
Applied Biosciences**

**(PSM-ABS)
Student Handbook
2016-2017**

Updated 09/21/2016



Important note: The requirements and policies specified in this handbook only apply to students who enroll in the PSM-ABS program after April 2011. Students who entered the program prior to that time are governed by the 2008-2009 handbook. You can get a copy of the 2008/2009 by going to the webpage <http://appliedbiosci.arizona.edu>.

Contents

1.0	Introduction	3
2.0	Contact Information	3
3.0	Admissions	4
3.1	<i>Prerequisites</i>	4
3.2	<i>Admissions Procedures</i>	4
4.0	Overall Program Structure	5
4.1	<i>Curriculum</i>	5
4.2	<i>Timeline for a PSM-ABS Degree: 2-year Curriculum</i>	6
4.3	<i>Detailed Steps toward the PSM-ABS Degree</i>	7
5.0	Coursework requirements and Track Descriptions	13
5.1	<i>Controlled Environment Agriculture Track</i>	15
5.2	<i>Industrial Microbial Biotechnology</i>	17
5.3	<i>Diagnostic Laboratory Sciences</i>	20
5.4	<i>Medical Microbiology and Immunology</i>	23
5.5	<i>Molecular and Cellular Biology</i>	25
6.0	Other Program Requirements	27
6.1	<i>Advising</i>	27
6.2	<i>Master's Plan of Studies</i>	27
6.3	<i>Credit Transfers</i>	27
6.4	<i>Graduate College Paperwork</i>	28
6.5	<i>Satisfactory Academic Progress</i>	28
6.6	<i>Professionalism Requirements</i>	29
7.0	Faculty in the PSM-ABS GIDP	29
7.1	<i>Applied Biosciences Faculty</i>	29
7.2	<i>2016-2017 Executive Committee</i>	31
8.0	Industrial Advisory Board	31
9.0	Appendices	32
9.1	<i>Internship Policies and Procedures</i>	32
9.2	<i>GradPath User's Guide</i>	50

1.0 INTRODUCTION

The Applied Biosciences program at the University of Arizona is a Graduate Interdisciplinary Program leading to a Professional Sciences Master's (PSM) degree. The program is designed to prepare students to enter a competitive scientific workforce. It consists of foundational and practical training in various areas of applied biosciences, along with a professional component that includes internships and "cross-training" in workplace skills, such as business, research and regulatory affairs. During a two-year course of studies, students will gain a strong understanding of the applications of the biological sciences to real world problems, including those faced by public institutions and private industry.

2.0 CONTACT INFORMATION

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3.0 ADMISSIONS

3.1 *Prerequisites*

Students who wish to apply for the PSM degree in Applied Biosciences must have the following minimum qualifications:

- A Bachelors (or equivalent) degree with a major in an area of biosciences from an accredited institution
- A minimum 3.0 GPA
- A desire to pursue a professional career in the applied biosciences
- A GRE is not required but is helpful to evaluate the application. Please submit your scores if you had taken this exam.

3.2 *Admissions Procedures*

Students should apply directly to the specific PSM-ABS track that that they wish to pursue. The application should be submitted online only via the Graduate College Graduate Admissions Application website (<https://apply.grad.arizona.edu/users/login>). Be prepared to submit the following materials:

- All transcripts (official versions must be sent to the Graduate College)
- GRE scores if available (not mandatory)
- TOEFL scores (required for non-native English speakers)
- GPA for all undergraduate (and graduate) work
- A one-page statement of interests, which outlines your background (including any professional experience), your professional goals and why you are a strong candidate for the program
- At least 2 letters of recommendation, preferably from course professors, research directors, or supervisors from employment relevant to the PSM-ABS program

4.0 OVERALL PROGRAM STRUCTURE

The PSM-ABS program is designed to prepare students to competitively enter the scientific workforce. During the two-year course of study, students will gain a strong understanding of the applications of the biological sciences to real world problems, including those faced by public institutions and private industry. A minimum of 36 credit hours (units) is needed to complete this degree; 9 of these units are for the research internship and report. Students have a maximum of 6 years to complete the degree. Students may apply for, and be admitted to, any of the 5 tracks (“sub-plans”).

Applied Biosciences Tracks:

- Controlled Environment Agriculture
- Diagnostic Laboratory Sciences
- Industrial Microbial Biotechnology
- Medical Microbiology and Immunology
- Molecular and Cellular Biology

4.1 Curriculum

All Tracks have the following general structure:

Core Science Module	9 units
Science Electives Module.....	6 units
Professional Preparation Module.....	12 units
Internship Module (including the Final Report)	9 units
Total:	36 units

Please refer to the descriptions of the individual tracks (Section 5) for the approved lists of courses for these Modules. For new students, please contact the Director of Graduate Studies (DGS) of your track for advice on the selection of courses for your first semester.

4.2 **Timeline for a PSM-ABS Degree: 2-year Curriculum**

Please note that many students complete the Applied Biosciences curriculum as part-time students over a longer timetable. However, the time to completion of the PSM-ABS degree may not exceed 6 years, as per the UA Graduate College.

Before the start of the first semester

Prepare a *Tentative Plan of Studies* showing the min. 36 credits you are planning to take over the course of your studies

Discuss your *Tentative Plan of Studies* with the Director of Graduate Studies of your particular Track and secure his/her agreement.

First semester

9 units of coursework

Select *Primary Advisor*

Review *Plan of Studies* with DGS and/or Primary Advisor

Review plans for internship

Second semester

9 -12 units of coursework

Assemble the *Graduate Committee*

Submit *Committee Member Approval Form*

Review *Plan of Studies* and internship plans with Graduate Committee

Submit *Plan of Studies* through GradPath, after activating "Responsible Conduct of Research".

Apply for *Internship*

Submit *Internship Forms* (Can be obtained from ABS website), register for *Internship (ABS 593a)*

Summer

8 units of *Research Internship*

Third semester

6-9 units of coursework

Complete Internship Project, if necessary

Review *Plan of Studies* and plans for *Internship Report* with Graduate Committee

Fourth semester

6-9 units of coursework, including 1 unit of Internship Report

Activate Master's/Specialist Committee Appointment form in GradPath

Prepare and submit *Internship Report* to Internship Supervisor for approval

Submit approved *Internship Report* to Graduate Committee

Schedule and complete *Internship Report Presentation*

Finish revisions to *Internship Report* required by Graduate Committee

Graduate Coordinator will submit - Master's Completion of Degree, in GradPath.

4.3 Detailed Steps toward the PSM-ABS Degree

1. Immediately after admission: Sign and return your admission letter to indicate Intent to Matriculate

2. Immediately after admission: Summarize your career goals. Prepare a Tentative Plan of Studies

- a. See the list of courses for the relevant PSM-ABS track (section 5.0, Track Descriptions and Coursework requirements).
- b. Considering your career goals, assemble a Tentative Plan of Studies that lists all specific courses that you plan to take to complete the PSM in Applied Biosciences degree.
- c. A minimum of 36 units must be selected. These units must include:

Core Science Units	9 units
Science Electives	6 units
Professional Preparation Courses	12 units
Internship (includes Final Report)	9 units

3. After admission but before the start of the first semester: Meet with the DGS of the chosen PSM-ABS track. Register for classes

When admitted, the student's initial Primary Advisor shall be the DGS of their respective track. Before the first day of classes, a meeting shall be held between each student and the respective DGS of PSM-ABS. The purpose of this meeting is to review the student's tentative Plan of Study in light of their career goals. The student and the DGS will agree on the courses that the student will take in the first semester. Register for the appropriate classes for the first semester.

4. First semester, before enrollment for second semester: Meet with the DGS of the chosen PSM-ABS track (or Primary Advisor, if different)

The purpose of this meeting is to review study progress in light of the student's Plan of Studies. The courses that the student will take in their second semester will be selected. Plans for selecting an appropriate hosting agency and research topic for the Internship will also be discussed.

5. End of first semester: Select Primary Advisor

- a. Students may select a Primary Advisor different from their DGS, or may retain the DGS in that role upon mutual agreement.
- b. Students may also request to change their Primary Advisor at a later date, upon the consent of the DGS and the PSM-ABS Program Chair.
- c. Primary advisors must be selected from the PSM-ABS Faculty. If the student would prefer a Primary Advisor who is not a current member of PSM-ABS but is a tenured or tenure-eligible faculty or academic professional of the University of Arizona, then the student should

request the faculty member in question to apply for faculty membership to PSM-ABS.

6. Second semester: Selection of Graduate Committee members

- a. The Graduate Committee is composed of 3 or more members.
- b. The Graduate Committee includes the Primary Advisor and at least two other committee members. The other committee members may be ABS faculty, or special members. At least two members of the Graduate Committee (including the Primary Advisor) must be from the University of Arizona. The composition of the committee must be approved by the DGS and the Program Chair, and must follow Graduate College rules: <http://grad.arizona.edu/academics/program-requirements/mastersdegrees>
- c. Special members may be drawn from the ranks of University of Arizona faculty/academic professionals, or from mentors at local industries and internship locations. For example, students doing or planning to do an internship at sites including Roche-Ventana or MSDx may consider inviting the research mentor(s) to sit on their committee. These research mentors may also be added to the Graduate Committee as 4th or additional members at later dates. Special member requests must be agreed to by the DGS. Please contact the Program Coordinator with your request.
- d. Submit the Committee Member request form in GradPath.

7. Second semester: Apply for Internship

Students must complete 8 units of Research Internship. Your Primary Advisor, Committee members, DGS, PSM-ABS faculty, and other University of Arizona faculty are good sources for information, but your own research and initiative is absolutely necessary. Companies may or may not advertise internship positions; your best chance is to send out many applications allowing plenty of time for responses. You must start sending out applications early in the semester PRECEEDING the semester you plan to do your Internship (i.e. during early Spring if you plan a summer Internship). Some companies (for example Ventana) have even longer timelines for scheduling internships.

8. Second semester: Convene a Graduate Committee meeting

The purpose of this first full Graduate Committee meeting is to review the career goals, study progress, and Plan of Studies of the student, and to agree on any necessary changes in the Plan of Studies as the Committee sees fit. Another goal of the meeting is to review the student's progress towards selecting a hosting agency and research topic for their Internship. Submit Master's Plan of Studies in GradPath.

9. End of second semester: Submit Internship forms, register for internship units (ABS 593a)

Submit all applicable Internship forms to the Program Coordinator in time, and register for internship units. You should choose the ABS 593a section of your Primary Advisor. Signing up for internship units requires PSM-ABS consent.

10. Summer: Research Internship

- a. Students typically seek out their internship project during the second semester. However, the timing of this is flexible to meet the needs of the hosting agency and the student. Students should discuss the timing of the internship with the track Director of Graduate Studies, their primary advisor and their Committee.
- b. Students must work 45 hours for each unit of internship credit (ABS 593a) earned. Eight (8) units of ABS 593a internship work are required for the successful completion of the PSM-ABS Curriculum.
- c. Please keep in mind that many internship advisors may require additional training time before the start of the actual internship, in procedures specific to their lab and research. Consider this an investment of your time if it helps secure an internship project.
- d. Training for research with human subjects, animal subjects, biological samples, radiation, recombinant DNA/RNA species, chemicals and special population groups may be required before the start of the research internship project. Ascertain these requirements with your Primary Advisor and/or Internship Supervisor. Most training is available in UAccess (<http://www.uaccess.arizona.edu/>).
- e. The internship project may be conducted in a variety of settings. Internships are preferentially conducted at a company, clinic, government laboratory or other external (non-UA) partners approved by the student's Graduate Committee (referred to as "Company Internship"). Internships may also be conducted at a research laboratory within the University of Arizona (referred to as "UA Internship").
- f. Internships may be completed within a single semester, or within multiple semesters, as is most appropriate considering the student's Plan of Studies. The requirements of the Hosting Agency / UA Internship Supervisor should be accommodated by the student as best as possible. If the Internship is completed within multiple semesters, the student should register for the appropriate number of Internship units each semester.
- g. Internships may also be divided to two or more separate blocks conducted at different hosting agencies. Division of the internship into two or more blocks must be approved by the student's Graduate Committee. If the Internship is completed in multiple blocks, the student should register for the appropriate number of Internship units for each block.
- h. Day-to-day supervision of the interns is the responsibility of the Internship Supervisor at the host agency (Company Internships) or the UA laboratory (UA Internships). For Company Internships, unit credits are awarded by

the Primary Advisor of the student, based on the evaluation provided by the Internship Supervisor at the company, and also on independent observation and evaluation of the student's work by the Primary Advisor. For UA Internships, the Internship Supervisor will award unit credits.

- i. The Evaluation of the Intern form (completed by the Internship Supervisor) must be submitted by the student to the Primary Advisor before the last day of classes each semester when internship unit credits (ABS593a) are to be awarded. Remember that this form is necessary for your Primary Advisor in order to award Internship unit credits for Company Internships.
- j. The Internship Evaluation form (completed by the student) must be submitted by the student to the Program Coordinator before the last day of classes each semester when internship unit credits (ABS593a) are to be awarded.
- k. An Internship Report must be written, submitted to the student's Graduate Committee, defended during an Internship Report Presentation, and revised as required by the Graduate Committee, before the student may graduate with a PSM-ABS degree.

Required Internship Forms (Available on the PSM-ABS website)

To be completed and submitted BEFORE departmental consent is given to sign up for internship credits and to start the internship:

- PSM-ABS Internship Application Form
- Internship Letter Template
- Assumption of Risk and Release Form

To be completed and submitted BEFORE the end of the semester in which internship credits are to be awarded:

- PSM-ABS Internship Evaluation Form (Student)
- PSM-ABS Evaluation of the Intern Form (Supervisor)

11. Internship Report

- a. A concise report about the Internship must be completed before graduation. Students must sign up for 1 unit of Master's Report (ABS 909) under the section of their Primary Advisor in the last semester of their studies.
- b. The Internship Report will consist of the following elements:
 - A review of the status of the scientific field related to the research project of the student, and the significance of the research and the contributions of the hosting agency / hosting laboratory to the field;
 - Detailed description of the goals of the student's work and its significance/relationship to the overall goals of the hosting agency / hosting laboratory.
 - Detailed description of the research methodology, and the results achieved by the student.

- Discussion of the student's results and potential future work needed.
- c. The report should be of a minimum of 15 pages, but preferably not exceeding 30 pages if the internship was performed in a single block. If the internship was divided into two or more blocks with different hosting agencies, then the report should be subdivided into concise chapters describing each block of internship.
- d. The format of the internship report is specified by the student's Graduate Committee. Some Committees may require a student to submit their internship report in the same format as the one required by the University of Arizona Graduate College for Masters of Science theses. Other Committees may require the report to be written in the format needed for publication in the scientific literature, or in any other appropriate format.
- e. The Internship Report must first be evaluated and approved by the student's Internship Supervisor at the hosting agency / UA laboratory where the work had been performed. Please remember that companies and government agencies may have a multi-step chain of command for approving such reports to guarantee that no intellectual property rights or trade secrets are affected by the report. Non-UA host agencies may request certain materials to be redacted from the report, and these requests must be accommodated by the student.
- f. The Internship Report must next be submitted to the student's Graduate Committee. The Graduate Committee will have a minimum of two weeks (10 business days) to evaluate the Internship Report. The Committee must approve (or approve pending revision) of the Internship Report by a two-thirds vote before the Internship Report Presentation may be scheduled. Committee members shall indicate whether they need to see the revisions or whether they delegate this responsibility to the Primary Advisor. The Primary Advisor shall notify the Program Coordinator about the decisions of the Committee.
- g. Revisions to the Internship Report requested by the Graduate Committee must be completed before the PSM-ABS Degree can be awarded.

12. Internship Report Presentation

Upon approval (or approval pending revision) of the Internship Report by the Graduate Committee, an oral Internship Report Presentation must be scheduled by the student. The Presentation will consist of two parts:

- a. First part: A presentation of the Internship Report in the form of an oral lecture, followed by questions and answers, lasting no more than 1 hour. This section shall be open to the public. PSM-ABS students are strongly encouraged to attend the Presentations of their peers, schedules permitting. PSM-ABS faculty are encouraged to attend the Presentation, and other guests are welcome.
- b. Second part: A closed Graduate Committee section where members of the Committee may further discuss the Internship Report with the student, and may request additional revisions or clarify previous criticisms. This

Committee meeting also allows the members of the Committee and the student to discuss the experiences of the student in the PSM-ABS program, and the future plans of the student.

- c. The Presentation is meant to assess the ability of the student to discuss ideas, think through scientific pitfalls and defend experimental design and rationale. Students are encouraged to seek out input from other students and faculty in preparing for the Presentation through practices, lab meetings, journal clubs, etc.
- d. The members of the Graduate Committee shall have a vote (Pass/Fail) evaluating the student's Internship Report Presentation. The Major Advisor records the outcome of the vote and communicates the result towards the student and the Program Coordinator. A Pass requires two-thirds of the Committee members approving the Internship Report Presentation.

13. Final approval of the Internship Report

- a. The finished Internship Report, incorporating all revisions required by the Graduate Committee, must be made available to the Primary Advisor at least 3 business days before the deadline of the Graduate College for degree requirements.
- b. In cases where members of the Graduate Committee requested to see the revisions, the revised Internship Report must be made available to the Committee members at least 5 business days before the deadline of the Graduate College for matriculation. The Committee members shall notify the Primary Advisor whether the revisions had been made to their satisfaction. At least two-thirds of the Committee shall approve the revised Internship Report for a Pass.
- c. The Primary Advisor shall notify the Program Coordinator whether the Internship Report is complete and meets the requirements of the Graduate Committee.
- d. The Primary Advisor shall only award the 1 unit of Internship Report credit (ABS 909) when the written Internship Report is completed (with revisions if necessary) and the oral Internship Report Presentation is passed by the student.
- e. The final version of the Internship Report, approved by the Graduate Committee, must be submitted to the Program Coordinator before the deadline of the Graduate College for matriculation.

14. Graduation

Please see the academic calendar for specific due dates and other steps necessary for graduation with the PSM-ABS degree

(<http://grad.arizona.edu/academics/degree-certification/gradpath>).

5.0 COURSEWORK REQUIREMENTS AND TRACK DESCRIPTIONS

In all the PSM-ABS tracks, students are required to successfully complete 36 units (credit hours), within a maximum of 6 years. Of the 36 required units, 15 units are Core and Elective sciences courses, 12 units are Professional Preparation classes and 9 units are the Internship and the Internship Report.

Table A contains a list of approved courses in the Professional Preparation Module and the Internship Module. These Modules are common for all five PSM-ABS Tracks. Please note that classes with the UND designation are offered by the University of North Dakota and may entail additional fees. Please also note that not all classes are offered in every semester – scheduling classes is a prerogative of the offering department, and PSM-ABS has no control over this. Please check the most current online Course Catalog of the UA for class schedules.

TABLE A

Professional Preparation Module: Choose 12 Units			
You may take courses from the UND graduate program for transfer, but note that additional costs may apply.			
ABE 501/601	Research Methods in Biosystems Engineering	2	Spring
ABE 552	Globalization, Sustainability Innovation	3	Spring
ACBS 568A	Bioeconomy, Marketing and Business Principles	3	Fall
BCOM 510A	Communication for Managers and Professional Development	3	Fall
BCOM 510E	Communication for Managers	1-2	Fall, Spring, Summer
BNAD 501	Leadership and Teams	4	Summer
BNAD 509E	Business Law, Governance, and Corporate Ethics	3	Summer
BNAD 510	Foundations of Business for Scientists	3	Fall
BNAD 520E	Project Management	1	Spring/Summer
CALS 500A	Technology, Entrepreneurship and Commercialization	3	Spring
CBIO 595B	Scientific Writing, Presentation and Bioethics	2	Spring
CBIO 597C	Grant Writing for Graduate Students	1	Spring
CPH 506	Economic Foundations for Health Sciences	3	Spring
CPH 557	Foods We Eat ... - The US Regulatory Agencies	3	Fall
CPH 562	Health Services Administration	3	Fall/Spring

GIDP in Applied Biosciences, Student Handbook 2016-2017

CPH 569	Fundamentals of Health Budgeting and Financial Management	3	Fall/Spring
CPH 574	Public Health Policy and Management	3	Fall/Spring
CPH 575	Environmental and Occupational Health	3	Fall/Spring/Summer
CPH 675	Clinical Trials and Intervention Studies	3	Spring
CPH 695D	Regulatory Science	1	Fall/Spring
CTS 595C	Responsible Conduct of Research	1	Fall/Spring
ECOL 597G	Grant Writing in the Biological Sciences	3	Fall/Spring
ECON 554	Innovation and Technology Strategy	3	Fall
ENGR 512A	Management of Technology I	3	Fall/Spring
ENGR 514	Law for Engineers/Scientists	3	Spring
ENTR 520R	Innovation Principles and Environments	3	Fall- Available as of August 1, 2016
ENTR 548	Healthcare Entrepreneurship	3	Spring
ENTR 557	Project Management	3	Fall
ENTR 581A	Assessing Early Stage Medical Technologies for Commercialization	2	Spring
ENTR 633D	Law, Entrepreneurship and Innovation	2-3	Spring
ENVS 508	Scientific Writing for Environmental, Agricultural and Life Sciences	3	Spring
FIN 510A	Financial Management	2	Fall
GRAD 595D	Regulatory Issues in Laboratory Management	3	Spring- Available possibly Spring 2017
IMB 521	Scientific Grantsmanship	2	Fall, available 8/1/2016
MCB 575	Scientific Communication	3	Fall
MCB 695E	Science, Society, and Ethics	1	Spring
MGMT 520E	Legal and Ethical Values in Business	1	Summer
MIS 509	Business Communications	3	Fall
MIS 578	Project Management	3	Fall/Spring
MIS 578E	Project Management	2	Spring
MKTG 510	Marketing-Based Management	2	Fall
MKTG 579E	Marketing of Innovations	2	Fall
PCOL 584	Fundamentals in Industrial and Environmental Health	3	Fall
PHCL 595B	Scientific Writing, Presentation, and Bioethics	2	Spring
PHSC 513	Health Technology Assessment	3	Fall
PSYV 571	Psychology of Leadership	4	Fall/Spring
SIE 515	Technical Sales and Marketing	3	Fall/Spring
SIE 567	Financial Modeling for Innovation	3	Fall
SLHS 649	Survival Skills and Ethics	3	Spring

UND (University of North Dakota) Courses (Additional fees may apply)			
UND: MLS501	Quality Assurance in the Clinical Laboratory	2	Check UND
UND: MLS505	Financial Management of the Clinical Laboratory	2	Check UND
UND: MLS508	Leadership and Conflict Resolution in the Health Sciences	2	Check UND
UND: MLS509	Laboratory Education Methodologies	2	Check UND
UND: MLS517	Health Administration for the Clinical Laboratory Professional	2	Check UND

Internship Module: 9 Units Required			
ABS 593A	Research Internship	8	
ABS 909	Master's (Internship) Report	1	

5.1 Controlled Environment Agriculture Track

The Controlled Environment Agriculture (CEA) track of the PSM-ABS GIDP is designed to prepare students who wish to possess a graduate-level education that integrates science and engineering-based approaches to provide specific controlled environments for plant productivity while optimizing resources including water, energy, space, capital and labor, and more specifically incorporates knowledge in management and business. Graduates of this track will be prepared for careers in the controlled environment agriculture industries, academia and government.

The CEA is an agricultural production practice for year round continuous production of nutritionally high quality foods, with crop yields that can exceed field production by as much as 10-fold, and with the potentials to utilize local renewable energy resources, and optimize water, energy, space, capital, and labor resources with efficiency well above field traditional capabilities. This production technology, can employ crop production systems, provide harvest much less dependent on the season, and can generate higher crop yields, quality, safety, and nutritional value with consistency and predictability, while utilizing less land in an environmentally friendly way.

There has been significant advancements in agriculture due to enhanced cultivars by plant breeding, minimized use of chemicals and effects of pests by integrated pest management, improved production quality, produce uniformity and reduced labor via automation and mechanization. These continuous advancements in production practices and technology have maintained an acceptable food quality and low cost food supply, however, resulted in more demand for highly educated and skilled employees. The controlled environment agriculture systems are integrated systems consisting of hydroponics, mechanization and automation, climate control and production management processes, which demand continuous system monitoring and control. Thus, technical understanding and crop production skills are needed for specific crop needs and through understanding of plant and microclimate interactions are needed so the systems can be effectively operated and precisely controlled to improve¹⁵

growth, production quality, and resource use efficiency. This necessitates potential graduates to acquire technical, production, management, people and business skills.

Therefore, the CEA PSM-ABS track will prepare students for rewarding employment in the controlled environment agriculture sector with technology, science and engineering, business and management oriented education and training to prepare current and future employees to meet the needs of this important industry segment to successfully compete in the global market place.

In common with other PSM-ABS tracks, the CEA track requires the successful completion of 36 units (credit hours), within a maximum of 6 years. The CEA track includes a wide selection of courses. Other classes may be substituted for the classes listed in the attached Table with the agreement of the Director of the Graduate Studies (DGS), or the Primary Advisor and the Graduate Committee of the student. Initial selection of the appropriate courses within each cluster and for the study plan in general will be done by agreement between the student and the DGS, based on a draft study plan assembled by the student and submitted to the DGS. This plan should be based on the particular needs and interests of the student, considering the career path the student is pursuing. Fine-tuning and other necessary changes of the course plan shall be agreed upon by the Primary Advisor and the student's Graduate Committee.

Curriculum: PSM in Applied Biosciences - Controlled Environment Agriculture (CEA) Track			
Number	Title	Units	Semester Offered
Core Science Module: 9 Units Required			
ABE 575a	Physiology of Plant Production under Controlled Environment	3	Spring
ABE 579	Applied Instrumentation in Controlled Environmental Agriculture	3	Spring
ABE 583	Controlled Environment Systems	3	Fall
Science Electives Module: Choose 6 Units			
Courses not listed here may also be chosen but require an agreement with the Director of Graduate Studies or the Graduate Committee.			
ABE 523	Biosystems Analysis and Design	3	Spring
ABE 513	Applied Biostatistics	4	Fall
ABE 547	Sensors and Controls	3	Fall
ABE 556	Irrigation System Design	3	Every other Spring
ABE 582	Integrated Engineered Solutions in the Food-Water-Energy Nexus	3	Fall
AME 545	Renewable Engineering Systems	3	Spring
CHEE 574	Environmental Transport Processes	3	Spring
CHEE 577R	Microbiology for Engineers	3	Fall
CHEE 581A	Engineering of Biological Processes	3	Fall

EIS 597C	Greenhouse Pest Management: Methods and Practice	3	Spring
MATH 522	Advanced Applied Mathematics	3	Fall/Spring/Summer
MATH 571B	Design of Experiments	3	Spring
SIE 531	Simulation Modeling and Analysis	3	Fall/Spring
SIE 545	Fundamentals for Optimization	3	Fall
SLHS 649	Survival Skills and Ethics	3	Spring
ENVS 525	Environmental Microbiology	3	Fall
Professional Preparation Courses and Internship Units (see Table A, pages 13-15)			

5.2 Industrial Microbial Biotechnology

The Industrial Microbial Biotechnology (IMB) sub plan of the PSM in Applied Biosciences GIDP is designed to prepare students for careers in the biotechnology industries where microorganisms are used as either tools for manufacturing chemical or biological products, or as environmental or agricultural agents.

Since ancient times, microorganisms have been utilized for what we now recognize as biotechnology applications, starting with beer and wine-making, leavening dough for bread and pastries, and preserving food by pickling. The multibillion dollar modern fermentation and biocatalytic industries that grew out of these practices produce small molecule “natural products” to be used as drugs, pesticides and fine chemicals including biodegradable plastics, and provide us with amino acids, vitamins, solvents and other industrial chemicals. Microbial fermentation and biocatalysis (the use of microorganisms as catalysts for chemical reactions) also represent our best hopes to produce sustainable, environmentally responsible biofuels, and constitute a fast growing segment of the biotechnology industry. Microbial fermentation is also used to produce recombinant proteins such as drugs or industrial enzymes, and can be used to manufacture antibodies and nucleic acids for the diagnosis and treatment of disease. Drug discovery in the pharmaceutical and agribusiness industries, and the development of novel or cheaper industrial chemicals and reagents are unimaginable without utilizing microbial “chemical factories”.

Microorganisms are also used for environmental biotechnology applications, utilizing the unrivaled ability of microbes to biodegrade a wide variety of compounds. Bioremediation of contaminated former industrial sites, cleanup after natural disasters including oil spills, or everyday applications like waste water treatment, rely on chemical reactions catalyzed on the spot by live microorganisms. Similarly, integrated pest management in agribusiness can take advantage of biocontrol by live microorganisms to kill or suppress microbial, insect or nematode pests in an environmentally conscious manner that does not involve toxic chemicals.

The IMB track will prepare students for gainful employment in the fermentation, biocatalysis, drug discovery and manufacture, agribusiness, chemical manufacture, and environmental biotechnology industries where experts with knowledge of

microbiology, microbial genetics and biochemistry are in demand. Just like other tracks in the Applied Biosciences program, the IMB track involves a strong component of developing professional skills and understanding the legal and business environment of these industries, and involves a required internship in a professional biotechnology laboratory environment.

In common with other ABS tracks, the IMB track requires the successful completion of 36 units (credit hours), within the course of a minimum of 2 years and a maximum of 6 years.

The IMB track includes a wide selection of courses relevant to the mission of the Applied Biosciences PSM program and the IMB track. These courses are listed in the attached Table. Other classes may be substituted for the classes listed in the attached Table with the agreement of the DGS, or the Primary Advisor and the Graduate Committee of the student. Initial selection of the appropriate courses within each cluster and for the study plan in general will be done by agreement between the student and the DGS, based on a draft plan assembled by the student and submitted to the DGS. This plan should be based on the particular needs and interests of the student, considering the career path she or he is pursuing. Fine-tuning and other necessary changes of the course plan shall be agreed upon by the Advisor and the student's Committee, in agreement with the DGS.

Curriculum: PSM in Applied Biosciences - Industrial Microbial Technology (IMB) Track			
Number	Title	Units	Semester Offered
Core Science Module: Choose 9 Units			
BIOC 565	Proteins and Enzymes	3	Fall
BIOC 568	Nucleic Acids, Metabolism and Signaling	4	Spring
BIOC 573	Recombinant DNA Methods and Applications	4	Spring
ECOL 553	Functional and Evolutionary Genomics	4	Fall
ECOL 575	Freshwater and Marine Algae	4	Spring
ENVS 525	Environmental Microbiology	3	Fall
MCB 516a	Statistical Bioinformatics and Genomic Analysis	3	Spring
MCB 580	Introduction to Systems Biology	3	Fall
MIC 552	Antibiotics: A Biological Perspective	3	Fall
PLP 527r	General Mycology	3	Fall
PLP 528r	Microbial Genetics	3	Spring
PLS 548a	Plant Biochemistry and Metabolic Engineering	3	Fall

Science Electives Module: Choose 6 Units			
Electives can include any course from the Core Science Module as well. Courses not listed here may also be chosen but require an agreement with the Director of Graduate Studies or the Graduate Committee.			
ABE 513	Applied Biostatistics	4	Fall
ABE 581A	Engineering of Biological Processes	3	Fall
ABE 587	Metagenomics: From Genes to Ecosystems	3	Fall
ACBS 554	Host-Microbial Interactions	3	Spring
CHEE 577R	Microbiology for Engineers	3	Fall
CHEM 501A	Instrumental Analysis	3	Spring
CHEM 525A	Mass Spectrometry	3	Spring
CMM 577	Principles of Cell Biology	4	Fall
CPH 593A	Outbreaks and Environmental Microbiology	3	Summer
CPH 576B	Biostatistics for Research	3	Spring
ECOL 519	Introduction to Modeling in Biology	3	Fall
ECOL 553L	Functional and Evolutionary Genomics Lab	1	Spring
ENVS 526	Environmental Microbiology Lab	2	Fall
IMB 501	Medical Microbiology and Immunology	4	Fall/Spring
IMB 520	Pathogenic Bacteriology	3	Fall
IMB 565	Principles and Molecular Mechanisms of Microbe-Host Interactions	3	Spring
MCB 546	Genetic and Molecular Networks	4	Spring
MCB 585	Multidisciplinary Approaches to Solving Biological Problems	4	Fall
MIC 530	Food Microbiology and Biotechnology	3	Spring
PCOL 536A	Chemotherapy of Infectious Diseases	3	Spring
PCOL 601B	Proteomics	1	Fall
PLP 528L	Microbial Genetics Laboratory	2	Spring
PLP 546	Insect Pathogens: Biocontrol Agents & Biological Models	4	Spring
PHSC 530	Proteins and Nucleic Acids as Drug Targets	3	Fall
PHSC 596A	Medicinal and Natural Products Chemistry	1	Fall
PHSC 670	Principles in Drug Discovery, Design, and Development	3	Spring
PLP 550	Principles of Plant Microbiology	4	Spring
PLP 575	Advanced Mycology	3	Every other Spring
PLS 539	Methods in Cell Biology and Genomics	3	Fall
Professional Preparation Courses and Internship Units (see Table A, pages 13-15)			

5.3 Diagnostic Laboratory Sciences

The Diagnostic Laboratory Sciences (DLS) track of the PSM in Applied Biosciences GIDP is designed to prepare students for professional careers in the medical and biotechnology diagnostic industries surrounding *in vitro devices* (IVDs), a term used to describe medical devices and diagnostic laboratory test methods regulated by the US Food and Drug Administration (FDA). Graduates may seek employment in a wide variety of medical and scientific settings, including the diagnostics and pharmaceutical industries, the biotechnology industry, clinical and translational research units, and government agencies. Emphasis topics may include development of laboratory management skills, acumen in the legal and business environment of the diagnostic and biotech industries, compliance to federal regulations for healthcare or the diagnostic industry, or knowledge of the *in vitro device* processes and regulations. The track requires that students successfully complete an internship in a medical laboratory, a diagnostic or translational research group, a university compliance office for industry- or agency-funded research, or one of the associated bioscience companies.

Students will work closely with faculty members of the PSM-ABS program. These faculty members direct translational research programs, and collaborate with partners in the diagnostic and biotech industries. Their research involves the development of novel testing methods for disease detection, as well as basic science research programs that investigate mechanisms of disease, characterization of diseases such as cancer and infections, or development of disease interventions such as vaccines and antitoxins.

PSM-ABS DLS track and UND MLS Categorical Certificates

If students are motivated towards a career in a hospital laboratory as clinical laboratory scientists, they may discuss options with their faculty mentors to couple their PSM-ABS degree with completing a Medical Laboratory Science (MLS) Categorical Program at the University of North Dakota (UND). These Categorical Programs currently offer certificates in Clinical Chemistry (and Urinalysis); Clinical Hematology (including Hemostasis); Clinical Immunohematology (Blood Banking); and Clinical Microbiology. Upon completion of a categorical certificate, you are qualified for employment at the level of a Medical Laboratory Scientists **within** the specific category or domain. You would also be eligible to sit for the American Society of Clinical Pathology (ASCP) Board of Certification (BOC) exam in the corresponding area. For more information on the MLS program offered by UND, please refer to <http://www.med.und.edu/medical-laboratory-science/mls-categorical-overview.cfm> and contact a UND advisor. More information on clinical laboratory professions is available on <http://www.ascp.org/> and <http://www.ascls.org/>. Please note, however, that **MLS programs are NOT administered** by the University of Arizona or the PSM-ABS GIDP, thus enrollment to any UND MLS program, **tuition**, curriculum, degree options, MLS certificate requirements or any other aspects of those programs are fully controlled by UND.

Students who are pursuing a MLS Categorical Program Certificate at the University of North Dakota may transfer in **up to 16 units** of UND coursework specific to that certificate to be counted as electives towards their PSM-ABS master's requirements. This transfer coursework may be **undergraduate or graduate** level at UND. The courses that these students may transfer must have the **MLS** course prefix at UND.

Please note that students who transfer in at least 12 units of coursework from the UND MLS programs **cannot use** any other transfer coursework, coursework taken at UA in non-degree seeking status, or UA 400-level coursework to be counted towards their PSM-ABS degrees.

Curriculum: PSM in Applied Biosciences – Diagnostic Laboratory Sciences (DLS) Track			
Number	Title	Units	Semester Offered
Core Science Module: Choose 9 Units			
ACBS 543	Research Animal Methods	3	Fall
BIOC 568	Nucleic Acids, Metabolism and Signaling	4	Spring
CBIO 515	Mechanisms of Human Diseases	4	Spring
CBIO 552	Cancer Biology	4	Fall
CBIO 595A	Oncogenes and Signal Transduction	1	Fall
CBIO 596H	Cancer Biology Seminar Series	1	Fall/Spring
CBIO 597A	Experimental Design	1	Fall
CBIO 631	Pharmacogenetics/Pharmacogenomics	2	Fall
CMM 501	Human Gross Anatomy	4	Summer
CMM 502	Principles in Neuroanatomy	4	Every other Spring
CMM 504	Cell Biology of Disease	3	Summer
CMM 510	Human Histology: An Intro to Pathology*	3	Summer/Spring
CMM 525A	Functional Human Histology*	4	*Credit for CMM 510 or CMM 525A but not both.
CPH 576A	Biostatistics for Public Health	3	Fall/Spring
CPH 576B	Biostatistics for Research	3	Fall
MCB 572A	Cell Systems	4	Fall
MIC 552	Antibiotics: A biological perspective	3	Fall
NRSC 588	Principles of Cellular and Molecular Neurobiology	4	Fall
PHCL 512	Intro to Pharmacology	3	Fall
PHCL 601A	Pharmacology, General Principles	2	Fall
PLP 528R	Microbial Genetics	3	Spring
PSIO 511	Physiology for Biomedical Engineering	3	Spring

Science Electives Module: Choose 6 Units			
Electives can include any course from the Core Science Module as well. Courses not listed here may also be chosen but require an agreement with the Director of Graduate Studies or the Graduate Committee. You may take courses from the UND graduate program for transfer, but note that additional costs may apply.			
BIOC 585	Biological Structure I	4	Spring
CBIO 550	Drug Disposition and Metabolism	2	Spring
CBIO 596H	Cancer Biology GIDP Seminar Series	1	Fall/Spring
CBIO 602A	General and Systems Toxicology	3	Fall
CBIO 630A	Cellular Communication and Signal Transduction	3	Spring
CBIO 630B	Cellular Communication and Signal Transduction	3	Fall
CBIO 695C	Readings in Cancer Immunology	1-2	Fall
CMM 565A	Fundamentals of Light Microscopy and Electronic Imaging	3	Spring
CMM 577	Principles of Cell Biology	4	Fall
CMM 579	Art of Scientific Discovery	3	Fall
CMM 595A	Departmental Journal Club	1	Fall
CMM 595H	Problems in the Biology of Complex Diseases	2	Spring
CMM 596A	Seminar in Cardiovascular Development	1	Fall/Spring
CMM 695D	Human Genetic Disease Colloquium	3	Fall
CMM 696A	Departmental Faculty Seminar	1	Fall/Spring
CMM 696B	Graduate Student Seminar	1	Spring
CPH 573A	Basic Principles of Epidemiology	3	Fall/Spring
CPH 573B	Epidemiologic Methods	3	Fall/Spring
CPH 576A	Biostatistics for Public Health	3	Fall/Spring
CPH 660	Infectious Disease Epidemiology	3	Spring
ECOL 557	Medical-Veterinary Entomology	3	Spring
IMB 501	Medical Microbiology and Immunology	4	Fall/Spring
MIC 503R	Biology of Animal Parasites	3	Spring
MIC 520	Pathogenic Bacteriology	3	Fall
MCB 516A	Bioinformatics and Genomic Analysis	3	Spring
MCB 572A	Cell Systems	4	Fall
MCB 573	Recombinant DNA Methods and Applications	4	Spring
PHCL 512	Introduction to Pharmacology	3	Fall
PHCL 553	Neuropharmacology	3	Spring
PHCL 586A/B	Introduction to Medical Pharmacology	1	Fall/Spring
PLP 528L	Microbial Genetics Laboratory	2	Spring

PLS 539	Methods in Cell Biology and Genomics	3	Fall
IMB 605	Medical Immunology and Infectious Disease	4	Fall
IMB 519	General Immunological Concepts	4	Fall
SLHS 649	Survival Skills and Ethics	3	Spring
UND: MLS502	Erythrocytes in Health and Disease	2	Check UND
UND: MLS503	Leukocytes in Health and Disease	2	Check UND
UND: MLS513	Advanced Clinical Immunology for Laboratory Professionals	2	Check UND
UND: MLS518	Molecular Diagnostics	2	Check UND
UND: MLS522	Clinical Bacteriology	2	Check UND
UND: MLS523	Clinical Virology, Mycology and Parasitology	2	Check UND
Professional Preparation Courses and Internship Units (see Table A, pages 13-15)			

5.4 Medical Microbiology and Immunology

The primary objective of the Medical Microbiology and Immunology (MMI) track, one of five sub-plans of the PSM Applied Biosciences GIDP, is to instruct and prepare students for an occupation in the diverse field of biomedical sciences. The focus in the MMI track is training students to attain a graduate level biomedical education with an emphasis on medical microbiology, immunology, and virology.

The disciplines of microbiology and immunology started centuries ago with the development of the simple microscope (the 1600's). Using this new scientific tool and the seminal work by major microbiologist's in the 1800's, led to the vanquishing of the theory of spontaneous generation as the source of disease. The ultimate cause of the disease was shown, using hypothesis-based scientific investigations, to be microorganisms or bacteria, and became known as "The Germ Theory" of disease. These foundations in Medical Microbiology led to queries into how one could prevent disease by vaccination and by the use of antisera (antibody). These studies used antibodies raised against the bacterial toxins in animals. The antitoxin serum led to the use of passive immunization to protect and cure infectious diseases and vaccines against these deadly agents. This work was seminal in the development and futures discoveries in the field of immunology. Major research and discoveries in the areas of medical microbiology and immunology have played a major part in the rapid advances in genomics, bioinformatics, and biotechnology. These technologies have also had a major impact on recent advancements in MMI.

This program is unique in incorporating the MMI-biomedical science training along with the linking and integration of important knowledge from the disciplines of management, business, and law. All students in the PSM program are required to complete an internship, in our case, in the area of MMI. Students do internships with biotechnology companies based in the Tucson-Phoenix corridor, or in academic research laboratories, and obtain invaluable on-the-job training, experience, and knowledge. This real world

expertise obtained in the internship is unique and different from classroom learning or taking on-line courses.

This innovative curriculum will give students the ability to take various career paths upon graduation. This could include doing research at “the bench”, to manage a laboratory at a university or in industry. With knowledge gained in business and legal fields, our trained scholars can also become involved in the business side of biomedical science. Graduates from this track will be ready for such diverse professional vocations in the areas of: biotechnology, biomedical research, pharmaceuticals, local or national government, academic institutions, plus positions in immunologic and microbiologic biotechnology companies.

The MMI subplan is working in alliance with the Certificate Program in Microbiology and Immunity (MIGCP) which is housed within the Department of Immunology. Upon admission to the PSM-ABS MMI track, the 15 units completed by the student for the MIGCP certificate may be transferred as fulfillment of the Core Science and Science Electives Modules of the MMI subplan.

Curriculum: PSM in Applied Biosciences-Medical Microbiology and Immunology (MMI) Track			
Number	Title	Units	Semester Offered
Core Science Module: Choose 9 Units			
ABE 613	Applied Biostatistics	4	Fall
CMM 504	Cell Biology of Disease	3	Summer
IMB 501	Medical Microbiology and Immunology	4	Spring
IMB 519	General Immunological Concepts	4	Fall
IMB 520	Pathogenic Bacteriology	3	Fall
IMB 533	Medical and Molecular Virology	4	Spring
IMB 548	Basic Immunological Concepts	3	Fall
IMB 565	Principles and Molecular Mechanisms of Microbe-Host Interactions	3	Spring
IMB 566	Cellular Immunology	4	Spring
IMB 580	Molecular Virology	3	Spring
IMB / CMM 605	Medical Immunology and Infectious Disease	4	Fall
IMB 696A	Research Seminar	1	Fall/Spring

Science Electives Module: Choose 6 Units

Electives can include any course from the Core Science Module as well. Courses not listed here may also be chosen but require an agreement with the Director of Graduate Studies or the Graduate Committee.

ABE 613	Applied Biostatistics	4	Fall
CPH 573A	Basic Principals of Epidemiology	3	Fall/Spring/Summer
CPH 576A	Biostatistics for Public Health	3	Fall/Spring
CPH 576B	Biostatistics for Research	3	Spring
CPH 660	Infectious Disease Epidemiology	3	Spring
BIOC 568	Nucleic Acids, Metabolism, and Signaling	3	Spring
BIOC 565	Proteins and Enzymes	3	Fall
CMM 504	Cell Biology of Disease	3	Summer
CMM 588	Principles Cellular &Molecular Neurobiology	4	Fall
ENVS 525	Environmental Microbiology	3	Fall
IMB 696A	Research Seminar	1	Fall/Spring
MIC 503R	Biology of Animal Parasites	3	Fall
MIC 595A	Critical Evaluation of Scientific Literature	1	Fall
MCB 516A	Bioinformatics and Genome Analysis	3	Spring
MCB 573	Recombinant DNA Methods and Applications	3	Fall/Spring
PLP 528L	Microbial Genetics Laboratory	2	Spring
PLP 528R	Microbial Genetics	3	Spring
PLS 539	Methods in Cell Biology and Genomics	3	Fall

Professional Preparation Courses and Internship Units (see Table A, pages 13-15)

5.5 Molecular and Cellular Biology

The Molecular and Cellular Biology (MCB) sub-plan of the Professional Science Master’s in Applied Biosciences GIDP is designed for students who wish to possess a graduate-level education that integrates knowledge in the biological sciences, management, business, and law. Students graduating in this track will be prepared for professional careers in government, academia, or in industry in such fields as biotechnology, pharmaceuticals, bioinformatics, medical research, and agriculture.

The discipline of Molecular and Cellular Biology is the study of life processes. What types of activities are carried out by cells, and how do cells make these activities work? Students develop a deep understanding of current ideas and problems in molecular and cellular biology and to build foundational skills in logic, reasoning, self-expression, and communication.

MCB researchers utilize model systems that allow them to query the most basic of questions about nature, whether they be at the molecular level, at the level of a cell or₂₅

organism, or in the development of clinical application of new human disease therapies. Faculty with specializations in MCB represents a diverse group of faculty members' research interests including cancer biology, neurobiology, heart development and disease, plant development, evolutionary biology, cell signaling, gene expression, RNA biology, genetic networks and systems biology, and genome stability. Professional Science Master's students in the MCB track will be able to select courses corresponding to these fields and other course work for the track, to tailor their studies to their personal preferences and career goals.

Curriculum: PSM in Applied Biosciences - Molecular and Cellular Biology (MCB) Track			
Number	Title	Units	Semester offered
Core Science Module: Choose 9 Units			
BIOC 565	Proteins and Enzymes	3	Fall
BIOC 568	Nucleic Acids, Metabolism and Signaling	4	Spring
BIOC 585A	Biological Structure 1	2	Fall
BIOC 585B	Biological Structure 2	2	Spring
CBIO 515	Mechanisms of Human Disease	4	Spring
CBIO 552	Cancer Biology	4	Fall
CBIO 553	Advanced Topics in Cancer Biology	4	Spring
CMM 577	Principles of Cell Biology	4	Fall
ECOL 553	Functional and Evolutionary Genomics	4	Fall
MCB 516A	Statistical Bioinformatics and Genomic Analysis	3	Spring
MCB 546	Genetic and Molecular Networks	4	Spring
MCB 572A	Cell Systems	4	Fall
MCB 573	Recombinant DNA Methods and Applications	4	Spring
MCB 580	Introduction to Systems Biology	3	Fall
MCB 695E	Science, Society and Ethics	1	Spring (8 weeks)
PLP 528R	Microbial Genetics	3	Spring
Science Electives Module: Choose 6 Units			
Electives can include any course from the Core Science Module as well. Courses not listed here may also be chosen but require an agreement with the Director of Graduate Studies or the Graduate Committee.			
CBIO 550	Drug Disposition and Metabolism	2	Spring
BIOC 555	Methods of Physical Biochemistry	3	Every other Fall
CPH 576A	Biostatistics in Public Health	3	Fall/Spring
IMB 519	General Immunological Concepts	4	Fall
IMB 548	Basic and Advanced Immunology	3	Fall
MCB 525	Cancer Discoveries	4	Spring
MCB 595A section 001	Topics in Molecular Biology (journal club)	1	Fall/Spring
MCB 595A section 002	Topics in Molecular Biology (seminar)	1	Fall/Spring

NRSC 588	Principles of Cellular and Molecular Neurobiology	4	Fall
PLS 539	Methods in Cell Biology and Genomics	3	Fall
PLS 548A	Plant Biochemistry and Metabolic Engineering	3	Fall
PLS 580	Medicinal Plants	3	Every other Fall
MIC 552	Antibiotics: a Biological Perspective	3	Fall
PLP 616	Plants, Disease and Arizona Agriculture	1	Fall (ends in January)
PHYS 531	Molecular Biophysics	3	Fall
Professional Preparation Courses and Internship Units (see Table A, pages 13-15)			

6.0 OTHER PROGRAM REQUIREMENTS

6.1 Advising

When admitted to a track, the student's initial advisor shall be the DGS of that track.

By the beginning of the 2nd semester, the student must select a Primary Advisor (who may be the DGS of the track) and at least two other faculty members who will form his/her committee. The composition of committee must be approved by the DGS and must follow Graduate College rules: <http://grad.arizona.edu/academics/program-requirements/masters-degrees/masters-committees>

6.2 Master's Plan of Studies

Working with their advisor, students must start a tentative Plan of Studies before they register for their first semester. The Plan of Studies is a living, working document updated and fine-tuned by the student, the Primary Advisor, and the Graduate Committee throughout the studies of the student with PSM-ABS. The Plan of Studies must be submitted through GradPath in the third semester, and updated later if necessary. (<http://grad.arizona.edu/degrecert/mpos>)

6.3 Credit Transfers

PSM-ABS students may take graduate-level online courses at the University of North Dakota (UND) Medical Laboratory Science program as Plus courses or Electives towards their PSM-ABS degree. These students should register as "non-degree" students at UND, while maintaining enrollment at the UA. UND credits obtained must then be transferred to the UA. If there is no enrollment at the University of Arizona, the student will need to file a Leave of Absence (LOA).

The Graduate College places *limits* on the number and kind of transfer credit that can be applied to the PSM-ABS degree. As a general rule, transfer coursework **may not exceed a total of 12 units**. Transfer coursework may come from these three categories:

- a) No more than **7 units** may be transfer courses from other institutions (such as UND), and these must be graduate courses at the home institution.
- b) No more than **12 units** of UA non-degree graduate coursework are allowed.
- c) No more than **6 units** of UA 400-level coursework are allowed, but only if the student was admitted prior to Fall 2014 and the courses had not been counted toward their bachelor's degree.

For full descriptions of these limitations please refer to the following:

<http://grad.arizona.edu/academics/program-requirements/masters-degrees/credit-requirements>

Please note a special rule for PSM-ABS students who are pursuing a MLS Categorical Program Certificate at the University of North Dakota. By special arrangement with the UA Graduate College, students may transfer in **up to 16 units** of UND coursework specific to that certificate to be counted as electives towards their PSM-ABS master's requirements. This transfer coursework may be undergraduate or graduate level at UND. The courses that these students may transfer must have the MLS course prefix at UND. Please note that students who transfer in 12 or more units of coursework from the UND MLS programs **cannot use** any other transfer coursework, coursework taken at UA in non-degree seeking status, or UA 400-level coursework to be counted towards their PSM-ABS degrees.

6.4 Graduate College Paperwork

See the following URL for additional Graduate college requirements on Masters Degrees, including important information about paperwork that needs to be filed on a regular basis.

<http://grad.arizona.edu/academics/program-requirements/masters-degrees/completion-of-masters-requirements>

GradPath (<http://grad.arizona.edu/GradPath>) is the **UA Graduate College electronic degree audit process** that makes tracking and monitoring simple. Students are able to fill in and submit forms online through UAccess Student. For example, the Plan of Study and Committee request forms are submitted through Gradpath. The automated workflow engine routes the electronic forms to everyone who needs to see or approve them (primary advisor, DGS, Committee, Graduate College, ...). Each approver is notified by email when a form is awaiting review and approval. To access GradPath, you will need to have completed FERPA training. You can do your training online or see the bottom right of the UAccess log-in page. (*more information on GradPath is on page 43*)

6.5 Satisfactory Academic Progress

Each semester, students in the Applied Biosciences PSM must demonstrate satisfactory academic progress towards their degree.

- a) **Students must maintain a minimum 3.0 GPA. If the student falls below this level for two semesters in a row, they will be disqualified.**
- b) Required courses must be completed with a minimum B grade. Students achieving a C or lower in a required class must take that class again.
- c) Students may not take more than 6 years to complete the degree.
- d) Students must show that they are making progress towards completing the degree in a timely manner. Students should regularly meet with their advisors (at least once a semester, preferably more). The following benchmarks are a good guide. Petitions to vary from this plan should be with good cause and be submitted in writing for consideration by the Executive Committee of the program. Core required courses should be completed as early as possible in the course of study (See 4.3, Steps to Degree).

6.6 Professionalism Requirements

As this is a professional degree, students are also expected to prepare certain professional documents to be used for applications to internships and jobs:

- A resume and/or curriculum vitae
- A statement of interests and professional goals (usually about 1 page)

Students are also expected to pursue professional opportunities when possible, such as attending talks by industry leaders, volunteering and participating in both academic and industry conferences etc. Potential employer's value engaged employees and participating in these ways demonstrates your engagement.

7.0 FACULTY IN THE PSM-ABS GIDP

7.1 Applied Biosciences Faculty

Director of Graduate Studies			
Molnar, Istvan	Associate Professor, SNRE, Natural Products Center	imolnar@cals.arizona.edu	621-9932
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Ahmad, Nafees	Professor, Immunobiology	nafees@email.arizona.edu	626-7022
Kacira, Murat	Associate Professor, Agricultural and Biosystems Engineering	mkacira@cals.arizona.edu	626-4254
Anne Wertheimer	Assistant Professor, Medicine-Arizona Center on Aging	awerth@email.arizona.edu	626-5850

PSM-ABS Associated Faculty			
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Zarnescu, Daniela	Assistant Professor Molecular and Cellular Biology	zarnescu@email.arizona.edu	626-1478

7.2 2016-2017 Executive Committee

Name	Email	Affiliation
Molnar, Istvan	imolnar@cals.arizona.edu	School of Natural Resources & Environment
Fares, Johnny (Hanna)	fares@email.arizona.edu	Molecular & Cellular Biology
Friedman, Richard	rfriedman@email.arizona.edu	Immunobiology (on leave)
Ahmad, Nafees	nafees@email.arizona.edu	Immunobiology (Interim)
Kacira, Murat	mkacira@cals.arizona.edu	Agricultural and Biosystems Engineering
Wertheimer, Anne	awerth@email.arizona.edu	Arizona Center on Aging

8.0 INDUSTRIAL ADVISORY BOARD

Name	Email	Title/ Affiliation
August, Paul	pAugust@icagen.com	Senior Director, Icagen Tucson Research Center
Charlie Chen	cchen@icagen.com	Senior Research Investigator, Icagen Tucson Research Center
Bell, Anita	anitab@azinnovation.com	Acting Director, Arizona Center for Innovation
Brigham, Lindy	Lindy.brigham@buffelgrass.org	Executive Director, Southern Arizona Buffelgrass Coordination Center
Ossanna, Nina	nossanna@gmail.com nina@biosaz.org	Chair, BIOSA (Bioindustry Organization of Southern Arizona)
Wesselhoft, Marie	mwesselhoft@msdx.com mwesselhoft@gmail.com	President, MSDx, Inc.
Zutshi, Reena	Reena.zutshi@luceome.com	President and CEO

9.0 APPENDICES

9.1 Internship Policies and Procedures

9.1.1. ABS593A Internship - Syllabus

CATALOG DESCRIPTION:

Specialized work or service on an individual basis, consisting of training, practice, and competency in a function of a technical, business, or governmental establishment.

MORE DETAILED COURSE DESCRIPTION

The primary goal of an internship is to give students an opportunity to apply lessons learned in the classroom to a real-world experience set in a professional practice-oriented environment. The intern's work is overseen by a professional in the field of interest. In particular, the internship should give the student a practical perspective on problems and applications in the biosciences. In addition to offering students the opportunity to demonstrate and develop their technical skills, the internship allows students to develop professional skills such as teamwork, effective communication, social interaction and professional networking, as well as an understanding of business procedures, leadership, and critical thinking. Finally, it should provide students with work experience within a semi-formal academic framework that carries with it official course credit from The University of Arizona.

EVALUATION

Internships are evaluated by both corporate/organizational evaluative criteria (if applicable) and academic criteria. The final grade for the class is determined by the Primary Advisor of the student and is based on 1) An independent evaluation of the work performed by the student, 2) Input from the student's Internship Supervisor at the hosting agency or at the University of Arizona laboratory where the internship had been performed. The final grade will be calculated according to the following formula:

Submission of all required forms and documents	5%
Evaluation by Internship Supervisor	65%
Independent evaluation by the Primary Advisor	30%

APPLICATION AND PROCEDURES

This course is governed by the document "Policies, Procedures and Best Practice Guidelines for Internships: ABS, Internship in Applied Biology". Information on administration, application, regulations, and forms can be found in that document.

9.1.2. Policies, Procedures and Best Practice Guidelines for Internships¹

I. INTRODUCTION²

The Master of Science degree in Applied Biosciences at the University of Arizona includes a professional internship as one of the requirements for completion of the degree.

These policies are designed for the use of the student, Primary Advisor, and the student's Internship Supervisor at the host agency or at the UA laboratory. They shall be considered binding unless a variance is agreed upon by all parties. A petition is approved by the Chair of the PSM-ABS GIDP based on recommendations by the Primary Advisor and/or the Director of Graduate Studies of the student.

General questions regarding internship matters should be directed to the program coordinator for the ABS program.

These policies are intended to be consistent with the University of Arizona non-binding guidelines on internships:

<http://www.registrar.arizona.edu/forms/InternshipGuidelines3-05.pdf>

Where the two documents vary, the ABS program policies shall prevail.

II. PURPOSE OF THE INTERNSHIP

i) The primary goal of an internship is to give students an opportunity to apply lessons learned in the classroom to a real-world experience set in a professional practice-oriented environment, with the intern's work overseen by a professional. In particular, the goal of the internship is to give the student a practical perspective on problems and applications in a growing discipline known as "Applied Biosciences".

ii) The internship has the following secondary goals:

- a) To improve communication between the university and practicing professionals in the local and national bioscience community.
- b) To give the faculty an opportunity to evaluate the ABS program through feedback from interns and hosting agencies.
- c) To help students compare their abilities and interests with requirements in particular fields.
- d) To help students evaluate potential employers
- e) To contribute to the effectiveness of the hosting agency, through delivery of high-quality work and new perspectives.

III. MINIMUM ELIGIBILITY QUALIFICATIONS FOR STUDENTS

Before applying for an internship, students are required to:

1. Be enrolled in the PSM-ABS GIDP.
2. Be in **good academic standing** with the University of Arizona and have maintained at least a 3.00

¹ This version revised April 25, 2011

² Portions of this document have been copied wholesale from the registrar's office guidelines, the School of Public Policy guidelines and the Eller undergraduate internship guidelines. 33

grade point average (major and cumulative) at the University of Arizona prior to enrolling in an internship.

IV. INTERNSHIP POLICIES

1. "Company Internships" may be located in private companies, for profit organizations, non-profit organizations, governmental agencies, and healthcare facilities. Internships may also be located within an academic organization such as a University, college or school. "UA Internships" may be conducted in a laboratory that is part of the University of Arizona.
2. Internships may be paid or non-paid, regardless of credit awarded. International students should consult with the International Scholar's office before pursuing an internship in order to investigate the visa requirements, including practical training waivers required of them and the effect these requirements will have on their future visa status.
3. Hours of employment. 1 unit = 45 hours of internship work per Arizona Board of Regents (ABOR) policy. ABS Students are expected to complete 8 units for their Degree.
 - a) The total number of units may be divided into work contracts (blocks) with different hosting agencies, each worth a minimum of 1 unit.
 - b) Internships are typically conducted on a full time basis, but split appointments and part time appointments are also acceptable with permission of the student's Primary Advisor and Degree Committee, in agreement with the Director of Graduate Studies of the appropriate study track or the Program Chair.
4. The Internship is normally undertaken in the summer between the first and second year. However, the timing of this is flexible to meet the needs of the hosting agency and the student. Students should discuss the timing of the internship with the Primary Advisor, the Graduate Committee or the Director of Graduate Studies. Note that the assumption of a full-time continuing position upon the completing of the PSM course requirements will not normally serve to fulfill the internship requirement.
5. Terms of employment, including duties, pay and other remuneration and costs shall be described in a **Letter of Agreement**. This letter must be signed by a duly designated representative of the hosting agency, the student, and the Primary Advisor. This letter is not a contract, but is meant to ensure that the expectations of all parties are consistent. The letter should contain the following details:
 - a. **Purpose of the Internship** - A brief statement that describes the purpose of the internship and includes a statement on how the academic goals of the student and the mission of the hosting agency will be balanced.
 - b. **Status of the Intern** – A brief description of the intern's status within the agency: expected number of hours per week, hourly wage or salary (if any), eligibility for benefits or not, eligibility for promotion or not, etc. If significant costs will fall on the student then these too must be detailed.
 - c. **Minimum Qualifications** - A statement that describes the minimum qualifications required of the intern. Minimum qualifications should include education, work experience, personal qualities, and special skills and knowledge.
 - d. **Job Description** – A broad statement of the job function that describes the intern's duties and responsibilities, including the identification of a "chain of command" for reporting purposes. Also include the name and position title of the expected supervisor.
 - e. **Organization - Specific Guidelines and Requirements for Interns** – A detailed list of what the organization expects from the intern and a definition of the organization's obligations to the intern. The former may include items such as the intern's specific job functions and/or the intern's professional responsibilities with regard to the organization's policies for office conduct, etc. The latter may include items such as conditions of continued

employment, potential for full-time employment after graduation, mentoring by full-time professionals in the organization, formal communication lines between the supervisor and intern, etc.

- f. **Restrictions on access to the productive output of the intern.** See point 6 immediately below
6. PSM-ABS students will prepare an Internship Report during the last semester of their studies. This portfolio shall include detailed descriptions of the work they performed in the course of their duties as an intern. In the event that the internship involves work on (1) patented material, (2) corporate secrets or (3) governmentally clearance-restricted material, then the agreement letter should include any clearance/secret documents that the Committee has to sign, and a *clear* statement of the limitations on the access to information. The student's Graduate Committee must be provided with sufficient materials so that they can judge the quality of the student's work.
7. Students are expected to be good corporate citizens and perform as directed by their supervisor at the hosting agency. However, hosting agencies are expected to assign no more than 10% of the student's time to clerical or other duties not directly related to an ABS project. The student's duties and responsibilities should be commensurate with his/her experience and training.
9. Internship-related work that involves research involving human subjects or involving animals must be approved by the appropriate subcommittee of the Office for the responsible conduct of research: <http://orcr.vpr.arizona.edu/>.

V. APPLICATION PROCEDURE

1. In the semester before the internship begins the student should discuss potential hosting agencies for the work with their Primary Advisor. The student should contact the potential hosting agency to inquire about internship availability and terms, and agree with the hosting agency to conduct the internship.
2. At the soonest possible time but before the applicable registration deadline for the semester in which the internship is conducted, the student and the Internship Supervisor at the hosting agency / UA host lab should formulate a **Letter of Agreement**. This Letter of Agreement should contain a clear statement of duties, costs, remuneration, and any patent/secret restrictions on the work as detailed above. The Letter of Agreement should identify the Internship Supervisor of the student at the hosting agency (Company Internship), or the UA tenured or tenure eligible faculty member or academic professional who will act as the Internship Supervisor (UA Internship). For UA Internships, the Primary Advisor may serve as the Internship Supervisor.
3. Students shall discuss with their Internship Supervisor at the work site the possible risks and dangers associated with the planned internship, then complete and sign the **Internship Assumption of Risk Release Form**.
4. The student should submit the **Letter of Agreement**, signed by the student and the Internship Supervisor, to the Primary Advisor for approval and signature.
5. The student will then submit to the Program Coordinator:
 - The fully signed **Letter of Agreement**
 - A **Change of Schedule Form**, signed by the Primary Advisor, indicating the appropriate number of units for the section of their Primary Advisor within ABS593a.
 - The signed **Internship Assumption of Risk Release Form**.

All three forms need to be submitted to the Program Coordinator before the student may register for internship units (ABS593a). Registration for the ABS593a units must be completed by the applicable registration deadline for the semester in which those credits will be earned. (Note:

Internship credits will not be awarded retroactively for internship duties performed at an earlier time).

6. The student should pay any registration fees and tuition associated with the credits to be earned, and if they receive financial aid, consult with the Financial Aid and/or Scholarship Office prior to registering.
7. If the student's internship involves doing research with human subjects (e.g., interviewing, collecting data), the student and faculty advisor are jointly responsible for ensuring that the proposed research follows all applicable University of Arizona requirements of the Human Subjects Protection Program, including project review (if necessary) and Human Subjects training as appropriate to the student's assignment. Check the Human Subjects Protection Program to determine if training is needed: <http://www.irb.arizona.edu/faqs.html>

VI. EVALUATION.

1. Before the end of the semester during which the internship was carried out, the student should make arrangements with their Internship Supervisor for completing the ***Evaluation of the Intern form***.
2. No later than the last day of classes for the semester during which the internship was carried out, the student shall complete and submit to the Program Coordinator an ***Internship Evaluation form***.
3. No later than the last day of classes for the semester during which the internship was carried out, the student shall submit to their Primary Advisor an ***Evaluation of the Intern form***, completed by their Internship Supervisor at the hosting agency or at the UA laboratory where the work was performed.
4. On the basis of the information provided in the ***Evaluation of the Intern form***, and the independent observations of the work of the student by the Primary Advisor, the Primary Advisor will assign one of the following grades:
 - S**-superior performance
 - P**-pass, average performance
 - E**-fail

The grade of **I** may be awarded only at the end of a term, when all but a minor portion of the work has been satisfactorily completed. The grade of **I** is not to be awarded in place of a failing grade or when the student is expected to repeat the course; in such a case, a grade other than **I** must be assigned. Students should make arrangements with the Primary Advisor (or in case of UA Internships, the Internship Supervisor) to receive an incomplete grade before the end of the term.

Letter grades of **S**, **P** do not count towards the student's GPA. However **E** grades do, and are considered to be unacceptable for a master's level student. Such poor performance may result in sanctions from the program, particularly if they are coupled with poor performance in other requirements in the program.

3. The student and hosting agency evaluations may be used by the program in the matching of future interns and agencies and to improve the internship as a learning experience.

VII. SUPERVISION

1. For UA Internships, day-to-day supervision of the internship is carried out by the UA tenured or tenure eligible faculty or academic professional who acts as the Internship Supervisor. For UA Internships, the Primary Advisor may also act as the Internship Supervisor. For Company Internships, day-to-day supervision is provided by the company representative who is named as the Internship Supervisor by the hosting agency in the Letter of Agreement.
2. The Primary Advisor and the Internship Supervisor should maintain communication during the internship. Any problems should be quickly resolved by communication among the student, the Primary Advisor and the Internship Supervisor.
2. The intern should report to the Primary Advisor periodically throughout the internship. This informal report should include (a) a brief comment on the allocation of the intern's time during that period (b) progress toward objectives, and (c) discussion of any significant difficulties or concerns with the internship.

VIII. SUGGESTIONS FOR THE INTERN

1. The internship is an essential part of the PSM-ABS Program. It is intended to provide a bridge between theory and practice, by giving students an opportunity to test classroom knowledge and skills in an operating environment.
2. An internship gives the agency an opportunity to get to know the student, but it carries no presumption of leading to a permanent position in that agency.
3. The student, in consultation with the Primary Advisor and the Internship Supervisor, is responsible for preparing for the internship, including, if required a proposal with specific task objectives. These objectives should be detailed in the Letter of Agreement.
4. An intern should not be viewed as either an outside consultant or an insulated researcher, but as a regular employee with a special, temporary work assignment. As such, the intern is expected to meet at least the same standards of performance as other agency employees.
5. The development of good working relations with supervisors and associates is a necessity for a successful internship. The intern and supervisor should also remember, however, that the internship is part of the PSM-ABS program of study, and therefore has academic goals which must also be met.
6. The intern should keep daily notes to assist in preparation of the final Internship Report.
7. Regular informal reports to the Primary Advisor will help keep the intern on track toward a satisfactory final report, and will give the intern a chance to benefit from the Primary Advisor's knowledge and experience in a timely manner.
8. The intern must recognize that they are representing The University of Arizona as an ambassador to the community and abide by the Student Code of Conduct and Code of Academic Integrity.
9. The intern should understand and follow the policies, procedures, rules and regulations of the hosting agency.
10. The intern should be prepared to perform their internship duties for the hours and duration specified. Completion of any non-academic requirements imposed by the sponsoring organization supervisor is by agreement between the student and the supervisor.

11. The student should talk to the Internship Supervisor regarding expected University holidays. Keep in mind many organizations do not follow the University calendar.
12. The student should ensure that their Internship Supervisor is able and willing to submit an evaluation on their behalf. Some organizations have personnel policies prohibiting supervisors from providing a written intern evaluation. If this is the case, special arrangements must be made for their Internship Supervisor to speak directly with the Primary Advisor about their performance.

IX. SUGGESTIONS FOR THE HOST AGENCY

An internship provides organizations with effective outreach to qualified and motivated students. The primary goal of the internship, as stated above, has educational and mentoring components that can be satisfied only through a formal partnership between the organization and University of Arizona PSM-ABS Program. It is the intent of the program that this partnership provides a meaningful learning experience to students as prospective professionals. In this manner, the organization becomes an important asset in the development of interns. As a secondary benefit, the organization has access to well-qualified students as potential candidates for full-time employment after graduation. As a tertiary benefit, the program allows supervisors to evaluate prospective long-term employees under actual work conditions at minimal cost. Initial contacts through the internship may lead to recruitment and eventual hiring, upon graduation, of an employee who has experience with the employer's operating procedures. In addition, multiple internships with the same student over his/her academic career may enable the intern to function at a higher level that will free full-time professional staff for more complex work.

By accepting an intern, the host agency recognizes that it shares responsibility for the success of the internship. The intern will rely on the agency's active participation and support, and will expect to receive assistance, advice and guidance.

By accepting an intern, the host agency agrees to provide a Letter of Agreement which sets out the terms of the internship and assigns an Internship Supervisor to the student.

The following suggestions will help ensure a successful internship:

1. Provide relevant education/training to the intern if it extends beyond the skills they have acquired in the PSM-ABS program.
2. Maintain the intern status of the student, to be distinguished from employment status.
3. In the early stages of the internship, the intern should get a comprehensive overview of the agency's goals, products, and philosophy, including an introduction to its major policies and procedures.
4. The agency Internship Supervisor should inform agency personnel of the purpose, role and expected performance of the intern.
5. The intern should be organizationally placed near the agency Internship Supervisor, to aid in observation of, and participation in, a wide range of activities. Whenever possible, the intern should be permitted to attend meetings of senior staff and research teams.
6. Intern work assignments should be educational and challenging, as well as useful for the agency. The intern should not be assigned routine office or clerical work, unless such work is a necessary, subordinate part of a more responsible assignment.

8. The intern should be supervised by a responsible professional to whom there is reasonable access. If possible, the intern should be assigned a desk and other office facilities near the supervisor.
9. The Internship Supervisor should contact the Primary Advisor of the student or the Chair of the PSM-ABS program whenever the progress of the internship is in question.
10. At the end of the internship, the hosting agency supervisor should complete the **Evaluation of the Intern** form and send it with the student to the Primary Advisor in a closed envelope. If this violates the hosting agency's policies, an alternative means of evaluation should be worked out in advance.

X. ROLE OF THE PSM-ABS PROGRAM.

The internship reflects the essential partnership between faculty and those practicing the profession in the larger community. The program's role in the partnership is to send students who will be good UA ambassadors to the community and to ensure that students will have a quality "hands on" learning experience. An internship also enhances the lines of communication between faculty and professionals in business, industry and government. The internship is an excellent complement to the program's curriculum.

1. The PSM-ABS program should communicate internship opportunities to all eligible graduate students, and should develop and maintain relationships with appropriate agencies. However, finding appropriate internships is primarily the responsibility of the student.
2. The program must ensure that program and university level internship policies are followed, including:
 - a) Selecting students who are in good academic standing.
 - b) Ensuring that students are NOT awarded internship credit for previous positions.
 - c) Ensure that interns are NOT used as free labor in for-profit organizations/facilities that are owned or operated by the faculty member who will award the internship credit and grade. If internships are permitted in such a facility, the interns should be compensated as an employee of the organization.
 - d) Inform students of the necessity of complying with pertinent program and workplace policies and procedures.
 - e) If the student's internship involves doing research with human and animal subjects make sure that ORCR training is provided as appropriate to the student's assignments.
 - f) Require Primary Advisors to document communications with the student and with the work supervisor regarding internship activities.
 - g) Notify the student that, unless other agreements are made between the parties, the Primary Advisor and program will not be responsible for any financial obligations incurred by the student for his/her participation; this includes, but is not limited to, travel and housing arrangements.
 - h) Notify the student that neither the instructor nor the University will be responsible for the payment of any medical care for injuries alleged to have resulted from the student's work experiences.

XI. PRIMARY ADVISOR'S SUPERVISORY RESPONSIBILITIES:

1. The Primary Advisor should maintain regular communication about the student's work activities during the internship with the Internship Supervisor at the hosting agency or UA laboratory. Any conflicts should be quickly resolved by communication among the student, Primary Advisor and Internship Supervisor.
2. The Primary Advisor should ensure that the internship experience is related to the curriculum by building regular interactions with the student into their schedule. Communication with the

student is an important component that elevates the work to a meaningful learning experience.

3. The Primary Advisor should maintain vigilance in overseeing the student's internship experience, regardless of the work location. Periodic on-site visits are preferable, but if personal visits are not feasible, the Primary Advisor should regularly converse with the intern via phone or e-mail.
4. The Primary Advisor should require the intern to report on a regular basis throughout the Internship. These reports should include:
 - a brief comment on allocation of the intern's time during the period,
 - progress toward objectives,
 - discussion of any significant difficulties or concerns with the internship.
5. Primary Advisors must be responsive to informal interim internship reports. Reports should be reviewed on a timely basis, and the faculty advisor's reaction should be communicated to the intern and if necessary, the intern's supervisor.
7. The Primary Advisor determines the unit grades at the end of each semester when internship work is performed by the student. The grade is based on the ***Evaluation of the Student Intern form***, completed by the Internship Supervisor, but will also take into account interim reports and other relevant information about the student's work and professional conduct.

ABS INTERNSHIP GUIDELINES (TO BE GIVEN TO HOST AGENCIES)

I. INTRODUCTION

The Professional Science Master's degree in Applied Biosciences at the University of Arizona includes an internship as one of the requirements for completion of the degree. We are pleased that you are interested in participating in this part of our program. These guidelines are for the supervisor in the host agency or organization. They are intended to help make the internship as productive as possible for all concerned.

Questions regarding internship matters should be directed to too the intern's Primary Advisor at the University of Arizona.

II. PURPOSE OF THE INTERNSHIP

i) The primary goal of an internship is to give students an opportunity to apply lessons learned in the classroom to a real-world experience set in a professional practice-oriented environment, with the intern's work preferably overseen by a professional. In particular, the goal is to give the student a practical perspective on problems and applications in Applied Biosciences. In addition to offering students the opportunity to demonstrate and develop their technical skills, it allows students to develop professional skills such as teamwork, effective communication, social interaction and professional networking, an understanding of business procedures, leadership, and critical thinking. Finally, it should provide students with work experience within a semi-formal academic framework that carries with it official course credit from The University of Arizona.

ii) The internship has the following secondary goals:

- a) To improve communication between the university and practicing professionals
- b) To give the faculty an opportunity to evaluate its graduate ABS program through feedback from interns and hosting agencies
- c) To help students compare their abilities and interests with requirements in particular fields.
- d) To contribute to the effectiveness of the hosting agency, both through high-quality work and through bringing in new perspectives.

III. SUGGESTIONS FOR THE HOST AGENCY

An internship provides organizations with an effective outreach to qualified and motivated students. The primary goal of the internship, as stated above, has educational and mentoring components that can be satisfied only through a formal partnership between the organization and University of Arizona. It is the intent of the program that this partnership provides a meaningful learning experience to students as prospective professionals. In this manner, the organization becomes an important asset in the development of interns. As a secondary benefit, the organization has access to well-qualified students as potential candidates for full-time employment after graduation. As a tertiary benefit, the program allows supervisors to evaluate prospective long-term employees under actual work conditions at minimal cost. Initial contacts through the internship may lead to recruitment and eventual hiring, upon graduation, of an employee who has experience with the employer's operating procedures. In addition, multiple internships with the same student over his/her academic career may enable the intern to function at a higher level that will free full-time professional staff for more complex work.

By accepting an intern, the host agency recognizes that it shares responsibility for the success of the internship. The intern will rely on the agency's active participation and support, and will expect to 41

receive assistance, advice and guidance.

By accepting an intern, the host agency agrees to provide a Letter of Agreement which sets out the terms of the internship and assigns an Internship Supervisor to the student.

The following suggestions will help ensure a successful internship:

1. Provide relevant education/training to the intern if it extends beyond the skills they have acquired in the ABS program.
2. Maintain the intern status of the student, to be distinguished from employment status.
3. In the early stages of the internship, the intern should get a comprehensive overview of the agency's goals, products, and philosophy, including an introduction to its major policies and procedures.
4. The agency Internship Supervisor should inform agency personnel of the purpose, role and expected performance of the intern.
5. The intern should be organizationally placed near the agency Internship Supervisor, to aid in observation of, and participation in, a wide range of activities. Whenever possible, the intern should be permitted to attend meetings of senior staff and research teams.
6. Intern work assignments should be educational and challenging, as well as useful for the agency. The intern should not be assigned routine office or clerical work, unless such work is a necessary, subordinate part of a more responsible assignment.
8. The intern should be supervised by a responsible professional to whom there is reasonable access. If possible, the intern should be assigned a desk and other office facilities near their supervisor.
9. The Internship Supervisor should contact the Primary Advisor or the Chair of PSM-ABS whenever the progress of the internship is in question.
10. At the end of the internship, the Internship Supervisor should complete the **Evaluation of the Intern** form and send it in a closed envelope with the student to the Primary Advisor. If this violates the hosting agency's policies, an alternative means of evaluation should be worked out in advance.

We look forward to working with you on a productive and beneficial internship.

**University of Arizona Internship
ASSUMPTION OF RISK AND RELEASE FORM**

ABS593A Internship in Applied Biosciences

THIS IS A RELEASE OF LEGAL RIGHTS -- READ AND UNDERSTAND BEFORE SIGNING

Student Participant: _____

Date of Birth: _____ **Student ID:** _____

Hosting Agency for the Internship: _____

I hereby agree as follows:

RISKS OF PARTICIPATION

I recognize that there are dangers and risks to which I may be exposed by participating in this internship. The following is a description and examples of specific, significant, non-obvious dangers and risks associated with the internship, as explained by the on-site supervisor:

I agree to assume all of the risks and responsibilities that are in any way associated with the internship.

HEALTH & SAFETY

I understand and agree that the University and its governing board, administrators, and employees (the "Releasees") do not have medical personnel available at the Sponsoring Organization, which is the site location for my internship. I understand and agree that the Releasees are granted permission to authorize emergency medical treatment, if necessary, and that such action by the Releasees shall be subject to the terms of this Agreement. I understand and agree that the Releasees assume no responsibility for any injury, damage or cost which might arise out of or in connection with such authorized emergency medical treatment.

I have consulted with a medical doctor with regard to my personal medical needs. There are no health-related reasons or problems that preclude or restrict my participation in this internship. I have arranged, through medical insurance or otherwise, to meet any and all needs for payment of medical costs while I participate in the internship.

I understand that neither the Releasees nor the Sponsoring Organization are obligated to provide transportation in connection with the internship. I understand that I am expected to carry my own automobile liability insurance coverage.

STANDARDS OF CONDUCT

I will comply with the University's Student Code of Conduct and Code of Academic Integrity, as well as the standards of conduct for employees of the Sponsoring Organization. I waive and release all claims against the University that arise at a time when I am not under the direct supervision of the University or that are caused by my failure to remain under such supervision or to comply with such codes and academic standards.

I agree that the University has the right to enforce the standards of conduct described at: <http://studpubs.web.arizona.edu/policies/cofc.htm>,

As well as at:

<http://studpubs.web.arizona.edu/policies/cacaint.htm>,

and that the University will impose sanctions, up to and including expulsion from the internship or from the University, for violating these standards or for any behavior detrimental to or incompatible with the interest, harmony, and welfare of the University, the program's internship program, the Sponsoring Organization, or other student participants.

The University has the right to make changes in the format and administration of the internship. I understand that the University has no control over the operations or premises of the Sponsoring Organization, and that I will be under the supervision of a representative of that organization while I am participating at the internship.

ASSUMPTION OF RISK AND RELEASE OF CLAIMS

Knowing the risks described above, and in consideration of being permitted to participate in the internship, I agree, on behalf of my family, heirs, and personal representative(s), to assume all the risks and responsibilities surrounding my participation in the internship. To the maximum extent permitted by law, I release and indemnify the Releasees from and against any present or future claim, loss or liability for injury to person or property which I may suffer, or for which I may be liable to any other person, during my participation in the internship (including periods in transit).

I have carefully read this Release Form before signing it. No representations, statements, or inducements, oral or written, apart from the foregoing written statement, have been made. This agreement shall become effective only upon receipt by the University of Arizona in the GIDP in Applied Biosciences and shall be governed by the laws of the state of Arizona, which shall be the forum for any lawsuits filed under or incident to this agreement or to the internship.

Signature of Student Participant

Date

Signature of Parent/Guardian (*if student is under age 18*)

Date

SAMPLE LETTER OF AGREEMENT

(Company Letterhead)

Date:

To: Graduate Interdisciplinary Program, Professional Science Master's in Applied Bioscience (PSM-ABS)

From: Company Representative
Company Name and Address

To the Chair of the PSM-ABS:

This is a letter of agreement between (an employee of *Company X, City State*) outlining the following specific attributes of the PSM-ABS internship for *Student X* at the University of Arizona, Tucson, AZ.

- 1) purpose of the internship
- 2) status of the intern
- 3) job description
- 4) minimum qualifications

Purpose of Internship:

Short Background:

Overall Project Goal:

Specific Aims/Objectives of the Project:

Primary Methods Used:

Measurable Project Milestones with Corresponding Dates:

Additional Educational Requirements if any:

Status of the Intern:

- 1) No costs will be incurred by the intern. No salary is paid to the intern (or if salary, list specifics here). No medical benefits are provided to the intern.
- 2) Appropriate safety, human subjects, and medical privacy training will be given to the intern prior to work that may require such training

Hours of Expected work:

Expected work hours/week:

Expected length of internship in weeks:

Total expected hours of internship:

Total expected credit units for internship (1 unit = 45 work hours):

Job Description:

Student reports to:

- 1) Primary Advisor at Company for internship work: Name within the company/organization
- 2) Secondary Advisors: List names and contacts
- 3) Committee members, if known: List name Dept. and contact information

Conflict of interest of advisors: If any

Minimum Qualifications:

e.g.

- 1) Common sense, pro-active approach to work, a solid scientific background with high degree of passion for business aspects of science.
- 2) Successful engagement with company employees during internship period.
- 3) Etc.

Respectfully,

Signature

Primary advisor at company, degree

Title:

Address

Phone

FAX

Email

PSM-ABS Student Intern

Signature

Address

Phone

FAX

Email

Primary Advisor of Student

Signature

Name, Title

**University of Arizona
Internship Evaluation Form
(To be completed by the Intern)**

ABS593A Internship in ABS

This form is for you (the student) to assess your internship experience. **Complete this form before the last day of classes at the semester when the internship is performed and ABS593a units are to be accrued. Give the form to the Program Coordinator.**

Intern Name: _____

Sponsoring Organization: _____ **Sponsoring Supervisor:** _____

Place an X in the box of the number that best reflects your level of agreement/disagreement with each of the following statements. **1 = Strongly Agree; 5 = Strongly Disagree**

I achieved my learning goals during the internship.	1	2	3	4	5
I received training in a profession/field related to my studies.	1	2	3	4	5
I experienced some of the realities of working in the profession/field.	1	2	3	4	5
I successfully completed my assigned responsibilities and duties.	1	2	3	4	5

Evaluate the following aspects of your internship by placing an X in the box of the number that best reflects your experience. If the aspect does not apply, leave it blank.

1 = Outstanding; 5 = Unsatisfactory

Work Environment:

Clarity of organizational structure	1	2	3	4	5
Access to necessary materials and/or equipment	1	2	3	4	5
Collegiality/friendliness of the employees	1	2	3	4	5
Attitude of respect for interns	1	2	3	4	5

Support and Feedback:

From your supervisor	1	2	3	4	5
From other employees with whom you interacted	1	2	3	4	5

Opportunity to be Creative:

Willingness of others consider to your ideas	1	2	3	4	5
----------------------------------------------	---	---	---	---	---

Interaction with Others:

Opportunity to contribute to a team project	1	2	3	4	5
Questions were encouraged and answered.	1	2	3	4	5
Access to one or more mentors (supervisor or employees)	1	2	3	4	5

Overall Evaluation of Internship (circle one):

Superior Excellent Satisfactory Unsatisfactory

Additional comments:

Intern's Signature

Date

**University of Arizona
Evaluation of the Intern Form**

This form, **to be completed by the intern's on-site supervisor**, is meant to provide constructive feedback to the student and course instructor about the student's relative strengths and weaknesses as demonstrated in the internship. Please complete the form, enclose it in an envelope, and send it with the student to the Primary Advisor. The deadline is the last day of classes of the semester in which the internship was performed.

Student Name: _____ **Semester(s) of Internship:** _____

Sponsoring Organization: _____ **Organization Supervisor:** _____

The supervisor should evaluate the intern as objectively as possible by circling the number in each range that best describes the intern's performance for that characteristic. If the quality in question is irrelevant to the work the student has been performing, please circle "N/A" (not applicable).

Work hours completed by the student during this internship: _____ **hrs/week for** _____ **weeks,**
totaling _____ **hrs.**

Attitude	Excellent	5	4	3	2	1	Poor	N/A
Dependability	Excellent	5	4	3	2	1	Poor	N/A
Ability to Learn	Excellent	5	4	3	2	1	Poor	N/A
Skills and Accuracy in Work	Excellent	5	4	3	2	1	Poor	N/A
Quantity of Work	Excellent	5	4	3	2	1	Poor	N/A
Quality of Work	Excellent	5	4	3	2	1	Poor	N/A
Relations with Others	Excellent	5	4	3	2	1	Poor	N/A
Initiative	Excellent	5	4	3	2	1	Poor	N/A
Communication Skills – Written	Excellent	5	4	3	2	1	Poor	N/A
Communication Skills – Oral	Excellent	5	4	3	2	1	Poor	N/A
Organizational Skills	Excellent	5	4	3	2	1	Poor	N/A
Attendance	Excellent	5	4	3	2	1	Poor	N/A
Punctuality	Excellent	5	4	3	2	1	Poor	N/A
Flexibility	Excellent	5	4	3	2	1	Poor	N/A
Observance of Rules, Policies and Procedures	Excellent	5	4	3	2	1	Poor	N/A
Leadership	Excellent	5	4	3	2	1	Poor	N/A
Creativity	Excellent	5	4	3	2	1	Poor	N/A
Responsiveness to Criticism	Excellent	5	4	3	2	1	Poor	N/A
Other Skills Unique to Position								
1.	Excellent	5	4	3	2	1	Poor	N/A
2.	Excellent	5	4	3	2	1	Poor	N/A
3.	Excellent	5	4	3	2	1	Poor	N/A

9.2 GradPath User's Guide

Introduction

GradPath is the new system for creation, routing and approval of Graduate College degree certification forms. All forms that graduate students are required to submit to the Graduate College will now be in GradPath, replacing the paper forms that had been used.

How to access GradPath

Students, graduate coordinators and faculty will all use GradPath in different ways, so they have different ways to get into GradPath, within UAccess Student. This is a quick overview of the ways each type of user accesses GradPath.

Students

Students will enter GradPath using a link on the UAccess Student Center, the main page used by students. A student entering GradPath using this link will first open a "landing page" with information about GradPath and other topics of general interest. The Graduate College can also use this page to convey timely information to the graduate student population.

When the student proceeds from the landing page into the GradPath forms, he or she sees the "navigation page," on which the set of required forms for their degree is listed. For each form the student has three buttons: View Current, Create New and Modify. Some forms have prerequisites, so they would not have a "live," clickable button on the navigation page until the prerequisites have been met. (Example: To submit the doctoral defense committee appointment form, a student must have passed the oral comprehensive exam and have a Plan of Study filed.) The student can open and view any form he or she has created or submitted in GradPath – a saved form that was not submitted can be edited for submission. (The system recognizes which steps a student completed on paper, but those forms are not visible in GradPath.)

Note – A student must complete and submit the Responsible Conduct of Research confirmation form in GradPath before any of the other required forms will be available. The RCR confirmation "self-approves" – it does not need to be routed for anyone to approve. As soon as a student completes the RCR form and submits it, he or she can return to the navigation page to access the other forms.

Navigation page:

ID 013975

Self-Service page instructions. (30018,57)

PHD - Soil, Water & Environ Sci (Active in Program)			
Responsible Conduct of Research Statement (SWESPHD)	VIEW CURRENT	Create New	i
Plan of Study (SWESPHD)	VIEW CURRENT	Create New	Modify
Comp Exam Committee Appointment Form (SWESPHD)	View Current	CREATE NEW	Modify
Announcement of Doctoral Comprehensive Exam (SWESPHD)	View Current	Create New	Modify
Results of Comprehensive Exam (SWESPHD)	View Current		i
Prospectus Approved (SWESPHD)	View Current		i
Doctoral Dissertation Committee Appointment (SWESPHD)	VIEW CURRENT	Create New	Modify
Announcement of Final Oral Defense (SWESPHD)	View Current	Create New	Modify
Results of Final Oral Defense (SWESPHD)	View Current		i
Other forms			
Transfer Credit Form	View Current	CREATE NEW	Modify

GradPath Forms – General features

When you open a form prepared by a student in GradPath, the first thing you will notice is the form’s status, displayed in the upper right corner. Each form has text describing the form and its use. Below that every form displays the student’s personal information, including ID number.

UAccess STUDENT

Favorites | Main Menu > Academic Advisement > UA Graduate College Forms > UA Plan of Study Form

Plan of Study Approval Status:

The Plan of Study is an agreement among you, your department, and the Graduate College specifying which courses you will count toward the requirements of your degree. Your plan identifies (1) courses you want to transfer from other institutions; (2) courses already completed at The University of Arizona which you want to apply toward your graduate degree; and (3) future course work you plan to take to fulfill degree requirements. Your Plan of Study will be routed for approval to your major professor and your department. A doctoral student declaring a minor must also route the form to the minor advisor and department for approval.

Bio Demo Data	
Name	Goldsmith, David
UA Email	dmh7@u.arizona.edu
Telephone	520/924-1234
Address	9531 N. Tucson Ave Tucson, AZ 85722

ID 005

[Update Personal Information](#)

Below this information, each form will display the student’s Program Data, showing the degree for which the form has been submitted, as well as the expected graduation term reported by the student.

Most forms have a box below the Program Data where the student is prompted to enter the expected graduation term. (For doctoral students we ask the student to report the

expected graduation term earlier in their program than in the past.) The expected graduation term on the student's record is updated when the form has final approval. The student is also provided the contact information for his or her degree auditor.

While each form of course collects different information, one other feature common to all GradPath forms is that any user (the student or anyone reviewing or approving/denying the form) can leave a comment for the student and other users. Any comment saved on a form stays with the form, and may be viewed by the student, other reviewers, or the graduate coordinator or degree auditor. Students also have a "Return" button on each form that returns them to the navigation page.

Finally, when you view any GradPath form, at the bottom of the form you will see the routing "monitor," which is essentially a flow chart showing the approval path the form must follow. If a form is pending a decision from an approver, you can see whose approval is pending. You can also click on any of the approvers displayed in the monitor to see the e-mail address where the notification message was sent.

NOTE: If a student cannot find/select the person they need to select as advisor or a member of their committee, please contact your degree auditor. In some cases, faculty members' names on their HR record (and thus in UAccess/GradPath) appear differently than the name they commonly use – e.g. Jim Smith may be officially Richard J. Smith. You or your degree auditor may be able to help a student find a name in the system that could not be located. Otherwise, your degree auditor can explain whether a special member request is needed or if a different step should be taken.

Important Changes to Degree Certification Procedures

Master's/Specialist students:

- i. All master's and specialist students **must** submit the Master's/Specialist Committee Appointment form, even if the student **does not** have a committee. We need to review and approve the thesis committee for a student completing a thesis. Other students will have the opportunity to report a committee if they have one; otherwise they will simply confirm the advisor reported on the Plan of Study is still accurate.
- ii. The procedure for the department/program to report completion of degree requirements has changed. The committee members and director of graduate studies/department head will **not** need to approve or report anything. Completion of degree requirements will simply be reported by the **graduate coordinator**. The procedure is described below in the "GradPath Forms Not Submitted by Student" section.

Students Who Began with Paper Forms

A student who has filed one or more Degree Certification forms on paper, following the old procedures, **does not** need to re-submit those forms in GradPath. While all students must submit the Responsible Conduct of Research form in GradPath in order to open the rest of the forms, a student who has had paper forms approved should find the subsequent form(s) available in GradPath once the RCR form is completed. If you or any of your students notice that this is not working correctly, please contact your degree auditor.