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Course Requirements:
The following required courses are taken during the first year of study: Genomics, Bioinformatics I and II, the Huck Institutes’ Colloquium, the Huck Institutes’ Ethics in the Life Sciences course, and Independent Studies (See Bioinformatics and Genomics Curriculum for the course schedule). These courses provide incoming students with a foundation for further study in bioinformatics and genomics. Additional courses may be recommended by the first year advisor (one of the co-chairs for the BG option) or other BG faculty to complement the student’s background, and research interests.

Responsible Conduct of Research Training Requirement: NEW for Fall 2009!
Starting in Fall 2009, all new students in the Bioinformatics and Genomics graduate program must complete an online Responsible Conduct of Research (RCR) training course during their first year. The online course is offered through the CITI (Collaborative Institutional Training Initiative) Program and supplements the in-class, discussion-based RCR training provided in IBIOS 591, Ethics in the Life Sciences, a required 1-credit course typically taken during the second year. Together, these two courses satisfy RCR training requirements mandated by Penn State’s SARI (Scholarship and Research Integrity) Program, an RCR initiative organized through the Office for Research Protections (administrative unit within the Office of the Vice President for Research).

First year students should register for the online CITI RCR course as soon as possible in the Fall semester. To register, go to the Penn State SARI website, Online Training Program page (http://www.research.psu.edu/training/sari/program) where you will find instructions and a link for the CITI Program website (http://www.citiprogram.org/). Select Pennsylvania State University as the participating institution and register for the CITI Biomedical Sciences course. Students must work on their own to complete the course modules and pass the on-line quizzes. All modules must be completed by the end of the first Spring semester; and a copy of the student’s Completion Report must be submitted to the Program administrative office before June 15th.

Rotations/Mentor Selection:
Students will be required to be associated with research laboratories as a part of Independent Studies. Students will participate in three lab rotations beginning in their first semester. The choice of rotation laboratories will be made in consultation with the co-chairs of the BG Option. Each lab rotation may last between 4-8 weeks. During this period, students are expected to participate in a research project and other activities typical of a research laboratory. At the completion of each lab rotation, a report must be submitted to the program co-chair describing their research project. The purpose of these rotations is to identify a primary thesis advisor typically by end of Spring semester. The selection of primary advisor will be based on the preferences of both the student and mentor and will take into consideration shared research interests. Students may also schedule lab rotations at Hershey campus during summer months. Additional lab rotations may be permitted at the discretion of program co-chairs.

Candidacy Exam:
The candidacy exam will be administered after completion of the core courses in the first semester of the second year. The goal of the candidacy examination is to evaluate the student's ability to solve problems in the three major areas of the BG option (computational, evolutionary and functional genomics) including the ability to think in an integrated manner to determine if the student has the potential to successfully complete the Ph.D. program. Based on this evaluation, the candidacy exam committee may recommend the student to take remedial actions to address any areas of deficiency.
The candidacy exam will have both written and oral components. The student will choose a research topic for the written component along with one or more papers on that topic in consultation with the candidacy exam committee. The student is encouraged to address a question that is interdisciplinary, requiring both biological and computational approaches. The topic should not be based upon the student’s research; or a thesis proposal. The student will write a synopsis that will identify a problem within the topic area, discuss how the problem could be resolved, and will propose future research within that problem area. The synopsis should be written in a research paper format in 11-point font, with single spacing, of about five to ten pages length, including references. The paper may also include original graphics and tables. All aspects of the document should be directly and clearly relevant to the question being addressed. This document will serve as the basis for the oral portion of the candidacy exam. The oral exam will consist of a 15-20 minute presentation by the student followed by a question-answer session which may last for 2 hours.

The student candidacy exam committee will include three advisors, each representing three major areas of the BG option (computational, evolutionary and functional genomics). The candidacy committee will be chaired by a BG Option faculty other than the student’s primary thesis advisor. The composition of the student candidacy exam committee and choice of research topic for examination must be approved by program co-chair. The timetable for completion of the written and oral portions of the examination will be agreed upon by the student and the candidacy exam committee. The ideal timeframe will be two weeks to finish the written examination, with the oral examination to follow one week after the written portion is submitted to the examining committee.

Comprehensive Exam:
The comprehensive exam will test the ability of the student to articulate a testable hypothesis and present a rational approach to supporting this hypothesis. The comprehensive examination will be administered by a committee composed of the three advisors plus an outside faculty member who is not in the primary advisor’s home department. Student’s primary thesis advisor will chair the comprehensive exam committee. The comprehensive exam will be an oral defense of a written proposal for the planned thesis research. Experience in writing research proposals is an invaluable part of graduate training in the BG option. Thus, students in the BG option will develop the proposal for their comprehensive exam to fit the format and guidelines for an NSF or NIH doctoral dissertation improvement proposal. It is expected that the proposal will be submitted to the agency at the time of or soon after the comprehensive examination. The comprehensive exam will begin with a 15 – 20 minute overview of the proposal and of any preliminary data that the student has obtained to support the proposal. The comprehensive exam should be taken after the second academic year upon the student’s successful completion of the core courses, and the candidacy exam, and any additional courses required by the advisory committee. The proposal should be submitted to the examination committee at least two weeks prior to the exam.

Thesis Committee:
After the comprehensive exam, the thesis committee will be composed of the three advisors plus at least one additional faculty member who is not from the same home department as the primary advisor. All members of the thesis committee must have official Graduate Faculty status with PSU Graduate School. It is preferred that the fourth committee member be the same ‘outside’ faculty member who served on the student’s comprehensive exam, although this is not mandatory. The thesis committee will also serve as the Doctoral defense committee. The final exam is an oral defense of the written thesis which is required prior to conferral of the Ph.D.

Post-Comprehensive Progress Reports:
Subsequent to the Comprehensive Examination, all BG students will be required to provide his/her Doctoral Committee with a yearly progress report to be delivered prior to the anniversary date of the comprehensive exam. The report is to consist of a 5 to 12 page summary of progress made during the last year and a prospectus of upcoming work. This report is to be discussed with the committee members, preferably by an annual meeting of the entire committee. Students must submit copies of their reports as well as a signature page documenting the
fact that they have discussed the report with all members of their committee to the IBIOS graduate program office and BG option director(s) within three weeks of the anniversary date of their comprehensive exam.

**Teaching Requirement:**
A minimum of one semester of teaching is required of all BG students. It is preferred that students serve as a teaching assistant and enroll for credit in the required Supervised Experience in College Teaching course in the Fall and/or Spring semesters of their second year. An English competency requirement must be satisfied by non-native English speakers before any teaching duties are assigned. The Supervised Experience in College Teaching booklet lists the courses available and the teaching duties. Students are asked to prioritize their top three course selections from the booklet during the semester prior to each official assignment.

**Internship (optional):**
Students may spend up to one semester in an internship at a medical center, government laboratory or in an industrial environment. Non-traditional settings are also available. The IBIOS Graduate Program Office will provide assistance in securing a suitable internship. Typically students who wish to participate in an internship do so during the summer of their first year. Internships can be conducted later, with the agreement of their advisors, but they must arrange for their own financial support. Students will register for one credit of IBIOS 595 while conducting the internship.

**Thesis Requirement:**
Submission of a written thesis and its defense before the thesis committee are the program’s final requirements. The thesis must be approved in writing by the thesis committee and the option co-Director on that campus. Students must follow the thesis guidelines outlined by the Graduate School. The final approved thesis must be deposited with the Graduate School and the Huck Institutes of the Life Sciences in advance of graduation.
Topics for Discussion Prior to Joining a Laboratory
1. Time Commitment Expected in the Lab
2. Funding Source and Grade Level
3. Vacation and Leave Policy
4. Possibility of Internship and/or TA
5. Access to Advisor
6. Possibility (expectations) for publications and conference presentations

Student-Faculty Compact
(adapted from the Recommendation of The Committee on Graduate Student and Faculty Issues, The Graduate Council, The Pennsylvania State University, 2009 and The Document approved by the Penn State Hershey Graduate Program Directors May 6, 2006 and updated April 22, 2010)

Purpose:
Student-Faculty Compacts are useful to encourage good communications and to enhance the working environment in student-advisor/mentor relationships. Compacts provide a basis for discussion between students and advisors/mentors regarding mutual responsibilities and future plans.
“The compact serves as both a pledge and a reminder to advisors and their graduate students that their conduct in fulfilling their commitments to one another should reflect the highest professional standards and mutual respect.”

Items that should be discussed by students and potential mentors prior to choosing a permanent laboratory situation.

Expectations of the Advisor towards Graduate Students in a Laboratory
1. Professionalism/Honesty/Ethics
   a. The Graduate Student will:
      i. Perform research and other educational activities conscientiously, maintain good research records and catalog and maintain all tangible research materials that result from the project.
      ii. Respect all ethical standards when conducting research including compliance with all institutional and federal regulations.
      iii. Show respect for and work collegially with my co-workers, support staff and other individuals with whom I interact.
      iv. Do your best to satisfy all project deadlines outlined by the advisor.

2. Communication
   i. Outline a defined program of research with the advisor that will include well defined goals and timelines. Organize time to meet these deadlines.
   ii. Have open and timely discussions with the advisor on a regular basis regarding the status of the research.
   iii. Seek regular feedback on performance and expect annual performance evaluations.
   iv. Understand that you have a responsibility with the advisor to write up, in a timely manner, research findings for publication and presentation at professional meetings.
Expectations of the Graduate Students in a Laboratory of the Advisor

1. Training and Education
   a. The Advisor will:
      i. Set a mutually agreed upon set of expectations and goals at the beginning of the outset of the student’s admission to the laboratory. These will be reviewed and revised periodically as the student progresses through the program.
      ii. Acknowledge that the purpose of the training that graduate students receive is to prepare them to become independent professionals.
      iii. Work to prepare students for required program examinations and committee selections.
      iv. Read the student’s thesis and other writing thoroughly and carefully and in a timely manner.
      v. Provide the student with the required guidance and mentoring as needed.
      vi. Encourage the interaction of the student with other students and faculty, both intra and extramurally and encourage attendance at professional meetings to network and to present research findings.

2. Communication
   i. Meet with the student periodically over the course of each academic semester and no less than once per semester to review goals and progress.
   ii. Acknowledge contributions to the development of any intellectual property and define future access to tangible research materials according to institutional policy.
   iii. Discuss, in advance, appropriate authorship and co-authorship roles on all relevant publications and presentations

Exiting a Student-Faculty Relation

“Student-faculty relations are sustainable in large measure because of a compatible fit between the student and the faculty member. On occasion, the fit may be less than either a student or a faculty advisor initially anticipated, resulting in one or the other seeking to end the relation, even though the student is making satisfactory progress based on the perspectives of all concerned. Neither party should view these situations negatively; rather they represent mid-course corrections intended to improve the student’s academic and professional mentoring by faculty. The party wishing to leave the student-faculty relation should request a meeting with the other party, and possibly the student’s committee, to discuss his/her concerns and recommendations. If an alternative advisor has not been identified prior to this meeting, consideration of possible options would be appropriate. In the end, advancing the student’s academic program should be the prime objective for changing advisors.”
Bioinformatics and Genomics (BG) Curriculum

Year 1 - Fall Semester
- IBIOS 590. Huck Institutes’ Colloquium (2)
- IBIOS 591. Ethics (1)
- IBIOS 551. Genomics (3)
- CSE 598F / STAT 598F. Bioinformatics I (3)
- IBIOS 598E. Genomics Journal Club (1)
- IBIOS 596. Independent Studies, Lab Rotations (1)
- Register for CITI on-line RCR course (see p. 3)

Spring Semester
- IBIOS 590. Huck Institutes’ Colloquium (2)
- IBIOS 596. Independent Studies, Lab Rotations (1)
- IBIOS 598E. Genomics Journal Club (1)
- BIOL 597A/CSE 598F/STAT 597A. Bioinformatics II (3)
- Elective (3)
- Submit CITI RCR Course Completion Report to Program Office

Summer
- IBIOS 595. Internship (1) (optional)

Year 2 - Fall Semester
- IBIOS 600. Thesis Research (variable credits)
- IBIOS 602. Supervised Experience in College Teaching (1)
- BG Electives (0-6 credits)
- Candidacy Examination

Spring Semester
- IBIOS 600. Thesis Research (variable credits)
- BG Electives (optional; 0-6 credits)

Year 3
- IBIOS 600. Thesis Research (9)
- Comprehensive Examination

Years 4-5
- IBIOS 601. Thesis Preparation (0)

BG Elective Courses: Examples of electives- not limited to this list
- BIOL 405. Molecular Evolution (3)
- BIOL 428. Population Genetics (3)
- BIOL 497D. Practical Bioinformatics (3)
- BIOL 497G/597G. Computer Programming in C: Biological Applications (3)
- BIOL 505. Statistical Methods in Evolutionary Genetics (3)
- BMMB 597C. Computers for Biochemists and Molecular Biologists (3)
- CSE 598E/STAT597E. Data Mining I (Fall) and II (Spring) (3 each)
- IBIOS 593. Molecular Biology Lab (3)
- IBIOS 597C. Advanced Lab Techniques (1)
Courses available for all Huck Institutes’ Graduate Programs

IBIOS 590. HUCK INSTITUTES’ COLLOQUIUM (2) Students are introduced to a wide variety of topics of contemporary and future importance in the life sciences. A particular focus is placed on topics where science is likely to impact on society (and society on science). Topics are drawn from the area introduced by the speaker and can span the entire spectrum from basic research to the social, legal, moral and ethical implications of the science. A significant challenge in Colloquium is to organize and coordinate a presentation using contemporary presentation software, such as PowerPoint, in an environment in which part of the audience is present at a remote site. Students are required to attend the lectures and the dinners following the lectures. Students also participate in the group presentations during discussion sessions and submit written reports. Reports may be submitted to the co-chairs of the graduate program/option who may add them to the student’s permanent record. Students receive A-F quality grades.

IBIOS 591 ETHICS IN THE LIFE SCIENCES (1) Students examine integrity and misconduct in life sciences research, including issues of data collection, publication, authorship, and peer review. Students receive A-F quality grades.

IBIOS 595 INTERNSHIP (1, optional) For students interested in exploring academic, government, medical, law, or business corporate approaches to research. This is an external work assignment relevant to individual research or career goals. Students receive an R (satisfactory/passing) or U (unsatisfactory/failing). Only R credits are counted for credit totals. Students typically participate in an internship the summer of their first year. Contacts, positions, applications, course registration, course requirements, and grading are processed through the Eberly College of Science Cooperative Education Program (814-865-5000). Additional credits of IBIOS 595 are at the expense of the student. Interested Huck Institutes’ graduate students are to discuss the opportunity with their graduate program/option chair and/or their faculty advisor to help determine the best timing for this experience.

IBIOS 596 INDEPENDENT STUDIES: LABORATORY ROTATIONS (1-3 per semester pending graduate program) For students exploring potential Ph.D. projects and faculty advisors. Students receive an R (satisfactory/passing) or F (unsatisfactory/failing). Only R credits are counted for credit totals.

IBIOS 600 THESIS RESEARCH (1-9 per semester pending graduate program) For students who have been matched with a faculty advisor AND have not taken/passed their comprehensive exams. Students may receive A-F grades or R/F grades at any time. By the time students pass their comprehensive exams, up to 12 credits worth of IBIOS 600 may have the A-F quality grade.

IBIOS 601 THESIS PREPARATION (0 per semester) For those students who passed their comprehensive exams. This course appears on the transcript but does not have any grade or credit associated with it.

IBIOS 602 SUPERVISED EXPERIENCE IN COLLEGE TEACHING (1) Students receive either a lecture, lab, or recitation class to help teach. Students also participate in the Huck Institutes teaching assistant training sessions and receive A-F grades on their transcripts from their faculty course supervisors. Please note that these grades are not computed in with the overall GPA. International graduate students must pass an English proficiency exam before any teaching duties are assigned.
**English Requirement for International Students**

The English Requirement for International students is that prescribed by the Graduate School. Depending on the graduate program, all entering international students, whether or not they hold a Teaching Assistantship, will be required to take a Test of Spoken English (TSE) which is administered by the University's Center for English as a Second Language (ESL).

Given at the beginning of fall and spring semesters, international students are required to pre-register for the TSE. The test scores from the TSE are posted on the University's Administrative Information System (AIS) computer. Below is the course of action for the various TSE score ranges.

- **> 250** approved for teaching and the ESL requirement will be satisfied.
- **230-249** required to schedule and pass ESL 118G.
- **200-229** required to pass ESL 117G*. These students will not be permitted to teach in a classroom situation, and may instead be assigned to grading and/or proctoring duties.
- **<200** required to schedule and pass with the grade of A ESL 115G, before ESL 117G*. These students will not be permitted to teach in a classroom situation, and may instead be assigned to grading and/or proctoring duties.

* At the end of this course, students are re-tested. Based upon these test results, students are either approved for teaching, placed in a subsequent ESL course, or asked to retake the course.

Students, who are required to enroll in ESL courses, must complete the ESL requirement by the end of the second semester of residency. Students who fail to satisfy this requirement may be terminated from the respective graduate program, at the discretion of the graduate program chair.

**Safety Training Sessions / Examinations**

Within the first semester of residence, all students are required to take/pass the radioisotope safety and chemical waste disposal training sessions offered at the respective campus.

**Grade Point Average**

Credit hours are earned only for the grades A, B, and C. However, all A and F grades are included in the computation of the grade point average. Grade points are assigned as follows:

- **A = 4** (above average graduate work)
- **B = 3** (average graduate work)
- **C = 2** (below average graduate work)
- **D = 1** (failing graduate work)
- **F = 0** (failing graduate work)

Grades D and F are not acceptable for graduate credit. If a course is repeated, then both grades are used in computing the cumulative grade point average.

**Unsatisfactory Scholarship**

Students are required to have a minimum grade-point average of 3.0 for the doctoral candidacy examination, admission to the comprehensive examination, thesis defense, and graduation. One or more failing grades, a cumulative grade-point average below 3.0, or failing any of the examinations may be considered evidence of
unsatisfactory scholarship and be grounds for dismissal from the University (see the Appendix III of the Graduate Programs Bulletin www.psu.edu/bulletins/whitebook/$appendices.htm).

**Assistantships and Student Status**

Students with teaching or research graduate assistantships must be registered as full time students to maintain stipend eligibility. Full time status is considered either a minimum of nine credits each fall and spring semester (pre-comprehensive exam) or XXX 601 (0 credits, post-comprehensive exam). The assistantship appointments typically originate with the department of the faculty advisor. If no faculty advisor has been identified, as likely the situation with first year doctoral students, students should consult with their respective Graduate Program Chair.

**Thesis Submission and Exit Interview**

Upon completion of the degree, students are to provide the Graduate Program with a paper copy of their thesis. Students also participate in both the University and Huck Institutes’ Exit Interview Process. For the latter, students may meet with the Graduate Program Chair or appropriate representative.

**Activate Intent to Graduate**

Students must present their thesis in accordance with the Penn State University guidelines as described in the THESIS GUIDE Requirements for the Preparation of Master's and Doctoral Theses*. Current copies can be obtained from the Thesis Office:

115 Kern Building  
University Park, PA 16802  
Phone: 814/865-5448  
Web site: http://www.gradsch.psu.edu/gs_overview/thesisguide

At the beginning of the semester that students wish to graduate, they are to either:

1. Access eLion via www.eLion.psu.edu, if in the PSU computer system  
   or
2. call Graduate Enrollment at 1-814-865-1795, if not in the PSU computer system

**Internships (optional)**

As members of the Huck Institutes of the Life Sciences, all graduate students may participate in a three month internship in academia, industry, or government and receive credit on their transcript by enrolling in IBIOS 595 (1). Non-traditional settings are also available. Students interested in this opportunity should initiate discussion early on with their advisor and Graduate Program Chair to help determine the best timing for this experience (typically the first or second summer).

**Teaching**

Depending on the graduate program, teaching experience may be required or optional. For a teaching experience beyond a departmental funding means or as a requirement, the Huck Institutes of the Life Sciences Supervised Experience in College Teaching Booklet lists courses available and corresponding teaching responsibilities at the respective campuses. Besides an opportunity to develop teaching skills in a classroom setting, students also participate in the Huck Institutes teaching assistant training sessions and receive credit on their transcript by signing up for IBIOS 602 (1). Students interested in this opportunity should initiate discussion early on with their advisor and Graduate Program Chair to help determine the best timing for this experience.
Doctoral Thesis Committee Composition

According to the Graduate Degree Programs Bulletin published by the Graduate School regarding Doctoral Committees:  (http://www.psu.edu/bulletins/whitebook/Gradreqs.htm)

- 4 person minimum of approved PSU Graduate Faculty.

- 2 members must be inside the major and 1 member must be outside the major. Note - the outside member must be member of the approved PSU Graduate Faculty. The outside member for intercollege graduate programs may be inside the major but committee membership must have representation from more than one department. The outside member may not be a co-funded faculty from the same department, have budgetary ties, or conflict of interest (aka co-author paper) with any of the other committee members.

- A person not affiliated with PSU may be added as a special member (beyond the 4 members of the approved PSU Graduate Faculty) upon recommendation of the head of the program and approval of the graduate dean. A memo plus the individual's C.V. must be drafted with approval signature spaces for the Graduate Program Chair plus Ms. Cynthia Nicosia (Director, Graduate Enrollment).

- Have committee chair or one of the co-chairs be a member of the approved PSU Graduate Faculty. Typically this is the faculty advisor or someone in the graduate program.

- The doctoral candidate and three committee members must be physically present for the comprehensive exam and defense. No more than one person may be present via telephone. Telephone or video conference arrangements must be approved by the Dean of the Graduate School. A form letter is available for this special request.

- Need approval of 2/3 of the committee members for passing comprehensive exam and defense dissertation.

- **Need to submit paperwork 3-4 weeks prior to your scheduled comprehensive exam and defense. Please contact the appropriate staff member:**
  
  **University Park: Janice Kennedy** 101 Life Sciences Bldg.; 814-865-3155; jkk5@psu.edu
  
  **Hershey Campus: Kathy Shuey** H133 HMC; 717-531-8982; kes6@psu.edu

- Please note- Graduate Programs may have additional committee composition criteria.
Masters (M.S.) Degree

Masters students must have a minimum of 30 credits and a 3.0 overall GPA (see Graduate Degree Programs Bulletin (http://www.psu.edu/bulletins/whitebook/$gradreqs.htm)

If pursuing a masters thesis option, up to 6 XXX 600 credits may be A-F graded and 12 credits need to be in the major at the 400-600 level (excluding XXX 600). The students select a thesis committee (upon consultation with faculty advisor), write a thesis, and defend their work.

If a Graduate Program offers a non-thesis option, graduate students should consult with their chair for details. 18 credits need to be in the major at the 500-600 level.

If pursuing a masters non-thesis option, the student must have a first authored manuscript (based on his/her research) that has been either accepted and/or published in a peer reviewed journal. 18 credits need to be in the major at the 500-600 level. The manuscript is given to at least the faculty advisor and the Option Chair for evaluation.

IBIOS 595 (Internship) and IBIOS 596 (Rotations) credits all count toward the 30 credits. However, any IBIOS 602 (Teaching) credits do not count toward the 30 credits. If all course credits and requirements are met, students do not have to be registered for classes while writing and/or defending their work.

Activate Intent to Graduate
At the beginning of the semester that a student wishes to graduate . . . . . .

. If in PSU’s computer system: access e-Lion at www.elion.psu.edu
  If not: call 1-814-865-1795 to reach Graduate Enrollment
This publication is available in alternative media on request.

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