Program Procedures for Obtaining Approval of a New Area of Specialization or a Change in an Area of Specialization in a Graduate Degree

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Request for New Specialization

The following describes the material which should be included in a proposal for a new area of specialization in an existing graduate degree or for a change in an existing area of specialization. Areas of specialization are recognized on a student's permanent record (transcript). Approval is required by the department or program curriculum committee, the College Curriculum Committee, the GCCC, Graduate Council, and by the Graduate Dean. The proposal should be sent to the Graduate Curriculum and Catalog Committee (GCCC) with documentation of approvals by the department and college:

Graduate Curriculum and Catalog Committee
1137 Pearson Hall
Iowa State University
Ames, IA 50011-2206

1. Name of the area of specialization. **PREDICTIVE PHENOMICS OF PLANTS (P3)**

2. Name of the major. **GENETICS AND GENOMICS (IG2)**

3. Graduate degrees to which it applies. **Ph.D.**

4. Name of the department(s) or program.
   INTERDEPARTMENTAL GENETICS AND GENOMICS

5. What is the change you are requesting? (Answer only if you checked the Change box)
   N/A

6. Other existing areas of specialization for the same major and same degree.
   COMPUTATION MOLECULAR BIOLOGY

7. Are areas of specialization optional or required? (Can a student choose the major without selecting an area of specialization?)
   OPTIONAL

8. Reasons for proposing the new area of specialization or change in the area of specialization.

In October of 2015, the Interdepartmental Genetics and Genomics (IG2) faculty voted in favor of establishing a specialization within Genetics and Genomics at the Ph.D. level entitled, "Predictive Phenomics of Plants" (also known as P3).

Faculty at Iowa State University received NSF NRT Research Traineeship Funding for this area of specialization. Students within this specialization will be trained in Engineering, Plant Sciences, and Data Sciences. www.predictivephenomicsinplants.iastate.edu The NSF NRT P3 Trainees will be predominantly majoring in Agricultural and Biosystems Engineering, Electrical and Computer Engineering, Bioinformatics and Computational Biology, Mechanical Engineering, Genetics and Genomics, and Plant Biology.

Value to the Ph.D. student: Recognition of intensive and innovative program on their transcript

Value to the program: Recruitment of students who will be trained to address major agronomic challenges of the 21st century.

Value to Iowa State University: "This specialization is designed to encourage the development and implementation of bold, new, potentially transformative, and scalable models for STEM graduate education

training including one NSF priority interdisciplinary research theme—Data-Enabled Science and Engineering (DESE)." (2015, Patrick S. Schnable, Agronomy).

Value to the world: Broaden the thinking on how to solve growing populations and climate change; and adapt agriculture to meet global needs (i.e. food security).

9. Requirements for the area of specialization (how are the requirements different for this area of specialization compared to other areas of specialization or to the major without an area of specialization). (For new specialization only.)

This is the listing of the courses required to complete a Ph.D. in Genetics and Genomics

IG2 Core Courses (4): http://www.genetics.iastate.edu/core.html

I. GDCB 510: Transmission Genetics

II. GDCB 511: Molecular Genetics

III. Genetics, Bioinformatics and Statistical Genetics (choose 1)

AN S 556: Current Topics in Genome Analysis
STAT 416: Statistical Design and Analysis of Gene Expression Experiments
STAT 516: Statistical Design and Analysis of Gene Expression Experiments
BCB 544: Fundamentals of Bioinformatics
BCB 567: Bioinformatics I (Fundamentals of Genome Informatics)
COM S 549: Advanced Algorithms in Computational Biology
COM S 550: Evolutionary Problems for Computational Biologists
COM S 551: Computational Techniques for Genome Assembly and Analysis
BCB 568: Bioinformatics II (Advanced Genome Informatics)
BCB 570 Bioinformatics IV (Comp. Functional Genomics and Systems Biology)
EEOB 561: Evolutionary and Ecological Genomics

IV. Evolution, Population and Quantitative Genetics (choose 1)

AN S 561: Population and Quantitative Genetics for Breeding
EEOB 562: Evolutionary Genetics
EEOB 563: Molecular Phylogenetics
EEOB 566: Molecular Evolution
EEOB 567: Empirical Population Genetics
GDCB 536: Statistical Genetics

Ph.D. students in Genetics and Genomics also take the following 1 credit seminars

GENET 692: Conceptual Foundations of Genetics
GENET 691: Faculty Seminar in Genetics (twice)
GENET 690: Graduate Student Seminar in Genetics (three times)
GENET 591: Workshop in Genetics (twice)
GR ST 565: Responsible Conduct of Research in Science and Engineering

This is a description of what is required to complete a specialization in Computational Molecular Biology within the Genetics and Genomics graduate major

Computational Molecular Biology Specialization:

Requires that the research project be in the field of computational molecular biology. Available for both MS and Ph.D. degrees.
Student completes IG2 core and seminars (see previous section).

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Student may substitute one Student Seminar of BCB 690 for GENET 690.
History: This specialization was approved at the time bioinformatics and computational courses were being developed and taught at Iowa State and prior to the approval of the Bioinformatics and Computational Biology (BCB) graduate major. Students may still complete this specialization if their research project has a computational molecular biology component. Bottom of Page 5 in the IG2 handbook: http://www.genetics.iastate.edu/handbook2014a.pdf

This is a description of what is required to complete a specialization in Predictive Phenomics of Plants within the Genetics and Genomics graduate major

Predictive Phenomics of Plants Specialization:

31 credits to complete the P3 specialization. Coursework includes:

- STAT 430 Empirical Methods for the Computational Sciences (3 credits)
- ME/BCB/GDCB 585X Fundamentals of Predictive Plant Phenomics (4 credits)
- BR C/BRT 507 Technology Led Entrepreneurship in Biorenewables (1 credit)
- GR ST 565 Responsible Conduct of Research in Science and Engineering (1 credit)
- Three Electives from two areas: Engineering Technical and Data Sciences Technical (total 9 credits) in addition to the three electives within the IG2 program (the P3 Program student's discipline of focus). Possible electives are listed here: http://www.predictivephenomicsinplants.iastate.edu/curriculum.html
- Students enroll in P3C (Collaborative) Graduate Seminar (ME 600 sec P3) (1 credit each semester)

How does this specialization requirements fit in with other core classes:

In general IG2 students complete their four core courses their first year of graduate study: Two courses in the fall and two courses in the spring. With the additional coursework to meet the P3 specialization, students could be able to complete both the IG2 core (12 credits) and the P3 core (13 credits) and electives (18 credits) in two years. One course, BCB 570, would meet both IG2 and P3 technical credits reducing the number of needed credits by 3. Students would take a mix of IG2 core and P3 courses throughout the first two years of training.

SAMPLE Curriculum for this specialization for first two years of training for graduate students in Genetics and Genomics that would complete the IG2 course core (4 courses) and P3 course core (5 courses) and electives (6 courses).

Fall I

GDCB 585X Fundamentals Predictive Plant Phenomics (P3 core)	4 credits
ME 600 (sec P3) P3C Graduate Seminar (P3 core)	1 credit
STAT 430 Empirical Methods Computational Sciences (P3 core)	3 credits
GDCB 510 (IG2 core I) Transmission Genetics	3 credits
GENET 691 Faculty Seminar in Genetics	1 credit

Spring I

GDCB 511 (IG2 core II) Molecular Genetics	3 credits
GR ST 565 Responsible Conduct of Research (P3 core)	1 credit
ME 600 (sec P3) P3C Graduate Seminar (P3 core)	1 credit
BCB 570 Bioinformatics IV (IG2 core III & P3 Tech Elective)	3 credits

Fall II

GENET 692 Conceptual Foundations of Genetics	1 credit
GENET 691 Faculty Seminar in Genetics	1 credit
ME 600 (sec P3) P3C Graduate Seminar (P3 core)	1 credit
B M E 450X Biosensing (P3 Tech Elective)	3 credits
GENET 591 Workshop in Genetics	1 credit

Spring II

GENET 690 Graduate Student Seminar in Genetics	1 credit
BR C/BRT 507 Technology-Led Entrepreneurship (P3 core)	1 credit
ME 600 (sec P3) P3C Graduate Seminar (P3 core)	1 credit
STAT 503 Exploratory Methods and Data Mining (P3 Tech Elective)	3 credits
EEOB 562 Evolutionary Genetics (IG2 core IV)	3 credits

10. Estimate the number of students who will graduate with this major and degree each year and the number who will graduate with this area of specialization. (For new specialization only.)

GENETICS AND GENOMICS Ph.D: 18
PREDICTIVE PHENOMICS OF PLANTS SPECIALIZATION: 2

11 What resources (faculty, courses, research facilities, library facilities, etc) are available to support the area of specialization? (For new specialization only.)

NSF NRT Ph.D. TRAINEESHIP AWARD #1545453 AUGUST 13, 2015
http://www.nsf.gov/awardsearch/showAward?AWD_ID=1545453 $2,866,938.00

Grant PI's and team members are dedicated to the success of this specialization through several different majors at Iowa State University:
http://www.predictivephenomicsinplants.iastate.edu/team.html
http://www.predictivephenomicsinplants.iastate.edu/details.html

Courses: Most coursework exists. ME/BCB/GDCB 585X has been approved with the first offering in Fall 2016 (4 credits). The P3C Seminar Series is offered through ME 600 (sec P3) Seminar.

12. What future financial support will be needed? (For new specialization only.)

After the NSF NRT grant ends, funding would likely be necessary to provide for the introductory course which includes lab elements (ME/BCB/GDCB 585X has been approved with the first offering in Fall 2016). Funding to support the laboratory portion could be provided by the programs or passed onto graduate students as course lab fees. This course would be available to students not enrolled in the specialization and depending upon yearly enrollment, offered in alternative fall semesters instead of yearly.

All other courses exist and will serve students inside and outside of the specialization.