Graduate Program Review Report

I. Introduction

A. College, Department and Date

Interdepartmental Genetics Program, May 2008.

B. Person(s) responsible for preparing the report:

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C. Brief description of the Department.

The Genetics Graduate Program provides an opportunity for students to receive advanced degrees in Genetics. Students receive state-of-the-art training in the basic principles and applications of classical and molecular genetics and genomics for careers in research, teaching, and industry. The program is diverse and includes 29 faculty from the Departments of Agronomy, Animal Science and Industry, Biochemistry, Entomology, Horticulture, Forestry and Recreational Resources and Plant Pathology; the Division of Biology; and the College of Veterinary Medicine. As a result, research opportunities are diverse and include plant and animal breeding, population and evolutionary genetics, quantitative genetics, molecular and developmental genetics, and genomics and bioinformatics. Interdisciplinary interactions are fostered and encouraged based upon a common interest in genetics. Such interactions often bridge basic and applied genetics and merge diverse fields such as agriculture and computer sciences. Thus, the Genetics Graduate Program offers students a truly interdisciplinary and interactive environment in which to pursue their scientific interests. After meeting the core curriculum requirements, students in the program are encouraged to choose an emphasis, which enables them to specialize in a particular sub-discipline of genetics. At present, the following emphases are available: Arthropod Genetics; Genetics of Plant-Microbe Interactions; Molecular, Cellular, and Developmental Genetics; and Quantitative Genetics. The Genetics Program has an important role in the University by serving students who seek degrees in Genetics and faculty who want to attract this type of student.

D. Brief history of the Department:

The Genetics Graduate Program at KSU is an interdisciplinary organization that provides the nucleus of faculty for teaching and research in genetics. This program was initiated in the early 1960s by Dr. Thad Pittenger and Dr. E.G. Heyne in Agronomy based on the needs of some students and faculty. Since that time, the Genetics Graduate Program has typically had ~30 faculty members who have volunteered their time and energy to the program.

E. Degrees offered:

The Genetics Graduate Program offers M.S. and Ph.D. degrees in Genetics (CIP code 26.0801).

II. Departmental Purpose

A. Brief mission statement.

The primary mission of the interdepartmental Genetics Graduate Program at KSU is to educate students who understand the basic processes of classical, molecular, developmental, population and evolutionary genetics and cytogenetics of prokaryotic and eukaryotic systems. Genetics graduates will understand the intersection of genetic and genomic sciences and be able to apply genetic/genomic resources in research. They will be familiar with the principal experimental and theoretical methods used by geneticists and molecular biologists, and recognize the advantages and limitations of these approaches. They will be able to formulate genetic hypotheses, design experiments and test predictions made by these hypotheses with observed data. Genetics graduates will be expert in an area of specialization, and Ph.D. students will conceive and perform original genetic research in this area. Equally important, genetics students will understand the historical, social and ethical context in which genetics and genomics have developed and are continuing to develop, and implications that these fields have for society as a whole.

B. Brief statement of the centrality of the Department and its academic degrees to the College, University, and State.

The Genetics Program is a small but high-impact program that comes at no extra cost to Kansas State University. Genetics is fundamental to many other disciplines, including biology, plant and animal breeding, plant pathology, entomology, biochemistry and biotechnology. Genetics is at the heart of the revolution of biotechnology. The Genetics Program provides the only option for KSU students wishing to obtain advanced degrees with an in-depth knowledge of genetics in addition to a specialty area. Collaborative genetics-related projects at K-State have excellent national and international reputations. These include the Wheat Genetic and Genomic Resource Center, the KSU Center for Sorghum Improvement, the KSU Sorghum Translational Genomics Program, the KSU Tribolium Genetics Program, the Ecological Genomics Program and the Molecular Virology Program.

C. Brief statement of the uniqueness of the Department's academic degrees to the College, University, Regents System, State, Region, and Nation.

Within the University, the Genetics Program is the only provider of degrees in Genetics at the M.S. and Ph.D. levels. Therefore, the Genetics Program offers students an alternative choice of an academic discipline not offered in other departments or programs.

Within the Regents System, the University of Kansas offers M.S. and Ph.D. degrees in Genetics with an orientation towards the Medical Sciences. The KSU Genetics Graduate Program offers unique opportunities for training, especially in the agricultural sciences that are critical to the state of Kansas, our region and our nation.

Within the state: Kansas ranks second in total cropland in the US and first among the states in production of wheat and sorghum. The Genetics Graduate Program at KSU includes faculty in centers of excellence in genetics and genomics of wheat and sorghum, plus faculty specializing in genetic research on other crops such as corn and soybeans. Other KSU Genetics faculty specialize in genetics/genomics of major pathogens and pests (viruses, bacteria, filamentous fungi, nematodes and insects) that threaten agricultural crops. Specialization in these important areas is not available elsewhere in our Regents System.

Within our region and nation: As shown in Appendices A and B, the KSU Genetics Graduate Program is training geneticists who are highly competitive for academic, governmental and industrial jobs within our state, region and nation.

D. Brief account of the Department's goals for academic degrees for the next 7 years. These goals are:

1) To work to obtain stable funding for financial support of Genetics students independent of faculty grants as recommended by the External Review Panel in 2003 (See section IV below). This would allow the KSU Interdepartmental Genetics Program to take the next step and become a premier program that is competitive with larger, well-funded programs (for example, see the Genetics Program website for Iowa State University (http://www.genetics.iastate.edu/homepage.html).

2) To attract more domestic students. We currently attract many high quality international students and some domestic students based on the excellent international reputations of our faculty. It is important to increase our visibility and to attract US students who had not previously thought about the opportunities afforded by an advanced degree in Genetics at KSU. However, recruiting significant numbers of excellent domestic students will require stable funding for Genetics student support. Currently domestic students interested in an advanced degree in Genetics are attracted to programs at many other universities with financial support awarded directly to the student. This allows the student to “rotate” through different genetics laboratories to find the best fit for their interests and career goals.

3) To work to overcome a major disincentive for Department Heads to support their faculty in training Genetics students, that is barriers to counting Genetics students both in the Genetics Program and in their departments. With department resources (in the form of grant money awarded to faculty) going to Genetics students, Department Heads rightly expect all students to be included in department headcounts. At the same time, the Genetics Program needs credit for training students.

4) To work to overcome a disincentive for Genetics faculty members in some departments to accept Genetics students. This disincentive involves departmental resources that are available to help support graduate students in the home department, but are not available to support Genetics students.

5) To enhance communication and social interactions among Genetics students and faculty by fully implementing an annual Genetics Student Symposium and an annual Genetics picnic. Such activities have occurred since the external review, but not on a regular basis. Genetics students are closely linked with their home Departments, as they should be. However, more scientific and social interaction within the Genetics Program would help to promote the Genetics community at KSU.

III. Program Descriptions

A. Identify the major instructional, scholarship, and service responsibilities of the Department. Include interdisciplinary programs where appropriate.

The curriculum for the Genetics Program includes a full range of courses leading to the M.S. and Ph.D. degrees. These cover cytogenetics, molecular cytogenetics, developmental genetics, molecular genetics, bacterial, fungal and viral genetics, plant genetics, somatic cell genetics, gene cloning, animal and plant breeding, quantitative genetics, host-pathogen interactions, nucleic acids, protein structure and function, biotechnology, organelle genetics, molecular systematics, animal genetics, mutagenesis, population and evolutionary genetics, gene expression and molecular pathogenesis. All of these courses are already offered in the participating departments for purposes of their own graduates. The Genetics Program allows its students the opportunity to select the genetics-oriented classes from diverse participating departments. This enables students to obtain an extensive, broad education in genetics not possible for students in the individual departments who must satisfy the course requirements within these departments.

B. Provide a brief description of the facilities and equipment for the Program

Since genetics students are housed in several home departments, they have access to the excellent research and teaching facilities available at Kansas State University. These include the Plant Biotechnology Center, Sequencing and Genotyping Facility, NMR Facility, Metabolomics Center, electron microscopes, real-time PCR machines, insectaries, greenhouses, etc. The interdisciplinary nature of our programs provides access to many of these facilities to all students in the program.

C. Provide information on any special information resources and services (e.g., library collections).

Because the Genetics Program is an interdepartmental association of faculty, all resources in the participating departments are available to Genetics students. No specialized resources are required. The Genetics program does not have independent funding resources for special resources.

D. Briefly indicate the Department's contributions to general education.

The Genetics Program only offers graduate level degrees. Therefore, the Genetics Program does not contribute directly to general education.

E. Briefly indicate the Department's role in providing instructional services to students outside the Department.

The Genetics program is multi-disciplinary and therefore, by definition, provides instructional services to students outside the department. One new course, Population Genetics (PLPTH 768), whose deficiency at KSU was highlighted by the external genetics review, was created in Plant Pathology, and it now draws both genetics and non-genetics students from diverse departments across campus. The distribution of Genetics Graduate Program courses according to home department is:

Agronomy: Principles of Crop Improvement (AGRON 630); Plant Genetics (AGRON 770); Quantitative Genetics in Relation to Plant Breeding (AGRON 830); Applied Plant Breeding (AGRON 860); Topics in Plant Breeding (AGRON 910); Topics in Plant Genetics (AGRON 930); Advanced Plant Breeding I (AGRON 970); Advanced Plant Breeding II (AGRON 980).

Animal Science and Industry: Advanced Animal Breeding (ASI 749); Behavior of Domestic Animals (ASI 655).

Biology: Eukaryotic Genetics (BIOL 705); Genetics of Microorganisms (BIOL 675.); Advanced Cell Biology (BIOL 707); Modern Molecular Approaches (BIOL 860); Advanced Cellular and Developmental Biology (BIOL 868); Top/Ecological Genomics (BIOL890); Advances in Plant Stress Signaling (BIOL 802); Advanced Plant Systematics (BIOL 870); Evolutionary Ecology (BIOL 875); Top/Ecology Of Fungi (BIOL890); Top/Ecological Genomics (BIOL890).

Biochemistry: Molecular Signal Transduction (BIOCH 911); Nucleic Acids (BIOCH 920); Advanced Topics in Insect Biochemistry (BIOCH 907); Advanced Topics in Insect Biochemistry (BIOCH 907).

Entomology: Plant Resistance to Insects (ENTOM 745); Insect Genetics (ENTOM 910); Molecular Entomology (ENTOM 799); Conceptual Issues in Evolution (ENTOM 950, co-taught with BIOL 875); Insect Anatomy and Physiology (ENTOM 875); Molecular Entomology (ENTOM 830); Conceptual Issues in Evolution (ENTOM 930).

Plant Pathology: Population Genetics (PLPTH 768); Plant Molecular Biology (PLPTH 880); Plant Tissue Culture and Regeneration (PLPTH 911); Introduction to Plant Resistance to Pests (PLPTH 635); Plant Resistance to Diseases (PLPTH 755); Molecular Plant–Microbe Interactions (PLPTH 910); Fungal Genetics (PLPTH 927); Ecology and Epidemiology of Plant Pathogens (PLPTH 905); Introduction to Plant Resistance to Pests (PLPTH 635); Biotechnology (PLPTH610/AGRON 610); Introduction to Genomic Bioinformatics (PLPTH 890); Chromosome and Genome Analysis (PLPTH 915); Ecology and Epidemiology of Plant Pathogens (PLPTH 905).

IV. Self-Evaluation of Faculty and General Programs

The Genetics Graduate Program has always been criticized for its small size, even though it functions without additional university resources. In 2003, an External Review was organized to determine if the program should continue and, if so, what changes should be made to improve the program. The review team consisted of microbial geneticist Dr. Rowland Davis (University of CA, Irvine), animal geneticist Dr. Daniel Pomp (University of North Carolina, Chapel Hill) and plant geneticist Dr. David Sleper (University of Missouri, Colombia). The summary from the review report reads:

"In summary, the Genetics Program at KSU has had a long and productive history, and steps should be taken to not only continue this legacy, but to significantly improve the program for the future. The program has an important and integral role to play not only in graduate training, but in support of a diverse and strong set of research programs in a wide range of disciplines that are steeped in the science of genetics. The Review Team is very excited about the future prospects of the program and is convinced that it will provide great benefits for Kansas State University.

The Review Team was left with a number of favorable impressions, including:

1) A high quality faculty with a critical mass who are very supportive of the Genetics Program and wish to see it strengthened.

2) Broad interdepartmental involvement and support.

3) High quality students.

4) A highly flexible and visible graduate program of study on campus that allows students to pursue their interest in genetics.

5) The Genetics Program serves as a valuable recruiting tool for graduate students.

6) The Genetics Program is well known and provides external prestige for KSU.

7) AES administers are highly supportive of having a high quality Genetics Program.

The Review Team was also left with a number of unfavorable impressions, including:

1) Lack of funding and secretarial support for the program.

2) The Genetics Program lacks direction and focus.

3) Several faculty appeared to be indifferent in regards to the program.

4) No core curriculum for graduate students.

5) No bylaws, rules, standardization, structure, or a sense of community."

The review team suggested major changes to improve the program, and most of these changes were implemented by the faculty immediately following this review:

1. Bylaws were drafted that detail the structure and operation of the program.
2. A new chairperson and a steering committee with members from participating departments were elected.
3. Faculty membership was renewed in order to recruit new faculty and to remove inactive members. All current faculty have applied and been admitted since this reorganization.
4. A Web page was created with links to member laboratory pages (http://www.oznet.ksu.edu/genetics/) so that prospective students would have easy access to this information.
5. The curriculum was revised to require 3 core courses for all Genetics students. Students admitted in the Fall of 2004 or thereafter are required to take Genetics of Microorganisms - BIOL 675; Eukaryotic Genetics - BIOL 705; and Population Genetics - PLPTH 768. This change ensures that graduates are well-versed in all areas of genetics, not just specialized in one aspect. All of the courses included in the program are important for students in other programs; no courses are offered only for Genetics Program students.

   We have been unable to implement one of the major recommendations of the review team. They strongly suggested we find financial support for the program, for support of students and for administrative/clerical support. Currently, the Plant Pathology Department generously donates clerical support for the program, but no additional sources of support have been identified. This lack of financial support limits the number of students enrolled. Essentially all Genetics students are supported from grants to their major professor. Some participating departments offer financial resources to help their faculty support graduate students, and these funds are not available for Genetics Students. So lack of similar financial resources in the Genetics program is a major disadvantage that discourages faculty from training Genetics students. Stable, independent financial support for the Genetics Program by KSU would allow the Genetics program to grow and to take the next step toward excellence characteristic of a top-10 academic institution.

Quality of the faculty in the Genetics Graduate Program. All faculty members currently participating in the Genetics Program have reapplied since the external review in 2003, and all members have a commitment to the Genetics Program (http://www.oznet.ksu.edu/genetics/faculty_and_research_interests.asp). Genetics faculty members include internationally-recognized researchers and teachers who are actively receiving grant funding and publishing in prestigious journals. Other faculty are internationally-recognized plant breeders who produce the crop varieties that farmers plant. Five of the current 29 faculty are University Distinguished Professors, and many faculty have won state, national and international awards. Numerous potential students apply to the program based on the international reputations of our faculty.

Comparison of Genetics Graduate Program statistics to the minimums set by the Board of Regents (See Table below). Although the five year average for majors and degrees granted for the PhD degree in the Genetics Program exceeds the Board of Regents minimum standards, the corresponding values for the MS degree fall short of these target standards.

Table 1: Comparison of Genetics Graduate Program statistics to the minimums set by the Board of Regents

Category*	BOR Minimum	Genetics
Number of MS Majors (5-Year Average)	20	**4**
Number of Doctoral Majors (5-Year Average)	5	11
Number of MS Degrees Granted (5-Year Average)	5	**2**
Number of Doctoral Degrees Granted (5-Year Average)	2	3
Number of Faculty with Terminal Degrees**	8***	29

Reasons For the Deficiency in M.S. Students:

1. The Genetics Program actively recruits Ph.D. students. Generally, there are more opportunities for graduates with Ph.D. degrees, especially in academia. Nevertheless, there are attractive career opportunities for M.S. graduates and retaining the M.S. option is very important to both the Genetics Program and to Kansas State University.
2. Typically, less than one-third of the potential students in any year apply for the Genetics M.S. Program. More students apply directly for Ph.D.s, because in Genetics today, many students obtain Ph.D.s directly without first receiving a M.S. degree. There are more opportunities in academia for graduates with Ph.D. degrees.
3. As mentioned, Genetics graduate students can only be accepted if we find them a faculty sponsor with a project and funding by research grants. Most research projects require Ph.D. students who typically spend a longer periods doing research.

4. Faculty demand for Genetics students has gone down recently due to the difficult funding climate for competitive research, especially in the agricultural sciences.

Reasons the Genetics M.S. Degree Must Be Retained at KSU:

1. A Genetics M.S. degree is the correct option for some career choices and students seeking these careers will choose to go to other universities if this degree is not available. Examples include research technician or analyst positions in industry that require in-depth training in genetics. These jobs are not available to students with Ph.Ds. (Also see Section V.A.).
2. The success of our M.S. graduates proves that there is employment demand for graduates with Genetics M.S. degrees. Our M.S. graduates have immediately obtained excellent jobs (See Appendices A&B).
3. Elimination of the M.S. option will damage our ability to attract and enroll Ph.D. students. Some students wishing to obtain a PhD do not immediately qualify for this program. Obtaining an M.S. degree allows these students to grow into a PhD program or to obtain employment using their M.S. degree.
4. Our Genetics Program is an excellent recruiting tool for the university. Many students currently in other departments were attracted to the Genetics Program, and they later transferred to these other departments. For example, Sherry Miller applied to genetics in Summer 2005, was a KINBRE Star student in Fall 2005 and joined the Biology program in January 2006.
5. Some Genetics faculty have research positions that are best filled by M.S. students, and their research programs would be at a disadvantage if this degree were eliminated.
6. The M.S. degree must remain as an option for students who have trouble completing the PhD program. Not all students succeed in a PhD Program. Although this a rare outcome, the M.S. degree must remain available to these students.
7. Without an M.S. option, the KSU Genetics Program would be less competitive than genetics programs at other universities, such as Iowa State University (http://www.genetics.iastate.edu/homepage.html).

The M.S. Degree Program in Genetics Does Not Require Extra Resources

1. As is true for most academic programs, training at the PhD level in Genetics enables training at the M.S. level without additional resources.
2. There are no courses that are only taught for Genetics M.S. students (http://www.oznet.ksu.edu/genetics/degree_option_requirement.asp). The M.S. students take a subset of the courses that are required for Ph.D. students. And in fact, there are no courses at KSU that are only taught for Genetics students.

3. Financial support for Genetics students generally comes from grants to faculty members, money that might not be available if a project requires a Genetics M.S. student, and that option were not available.
4. Administrative chores associated with the Genetics Program do not change depending on whether a student receives a Ph.D or M.S. degree.

In summary, the M.S. degree program in Genetics does not require extra resources beyond those already spent for other programs at the university. Elimination of this degree option would not save money for the university. Nothing would change except that our Genetics Program would become less attractive to students and even less competitive compared to Genetics Programs in other universities. To repeat the words of the external review panel in 2003 (favorable impressions 5 and 6), the Genetics Program serves as a valuable recruiting tool for graduate students and as a source of external prestige for KSU. Loss of the ability to grant a Genetics M.S. degree will directly hurt the KSU Genetics Program, and will hurt student recruitment for the entire University. With significant benefits at no additional cost, it is critical that the Genetics M.S. option remain available.

V. Self-Evaluation of Academic Degree (s)

A. Briefly describe the quality of the academic CIP degree

M.S. degree: Although the Genetics Graduate Program focuses on training Ph.D. students, it also offers M.S. training to a small but important number of students whose career goals do not require the extra training necessary for a Ph.D. For example, excellent jobs as technicians and analysts can be found in industry for M.S. level students. These jobs require the in depth genetics training available only through the Genetics Program and they are not available to graduates with Ph.Ds. Notable examples are:

1. Lisha (Breuer) Kelo, from Basehor, KS, received a Genetics MS degree in 2004. She is employed at Eli Lilly Co. in Indianapolis as an Associate Biologist. Her main research focus there is diabetes and obesity. In December 2007 she received a Scientific Excellence award from Eli Lilly for work on a gene under development as a drug target for diabetes.
2. Suzhi Wang is a 2006 graduate who is now employed as a bioinformaticist at Washington University in St. Louis, Mo. She received her bioinformatics training from the two Genetics faculty who specialize in this area of growing importance to the biotechnology industry in the central U.S.
3. Lauren Smith from Shawnee Mission, KS, received a M.S. degree in 2008 and immediately obtained a position directing the molecular markers laboratory for sorghum research at Bayer Cropscience, a major agricultural products company in Texas.

Given their career goals, these students would have gone elsewhere if KSU did not offer a Genetics M.S. degree. Other genetics M.S. students who have sought jobs after graduation have also found excellent positions (see Appendices A&B). These successes of our students demonstrate the high quality of our Genetics M.S. degree. One interesting finding is that there tend to be more female students in the M.S. program, compared to equal to higher numbers of males in the Ph.D. program (Appendix C). This critical graduate education option must be retained at KSU.

Ph.D. degree: The Genetics Graduate Program focuses on training of Ph.D. students. Most of our applicants are interested in obtaining a Ph.D., and most Genetics faculty who are funding their students from research grants require Ph.D. students to complete their research. Training Ph.D. students is also important because the institution from which a scientist receives their terminal degree receives most of the recognition for their training. KSU genetics students who have graduated with a Ph.D. have been very successful in their chosen professions. As shown in Appendix A, four of Ph.D. graduates listed are now professors at major US universities, The University of Wisconsin, Purdue University, Colorado State University and Washington State University. The professor at WSU holds a prestigious endowed chair. Six students who graduated with Ph.D. degrees between 1999 and 2007 are currently assistant professors at North Carolina State University, the University of Georgia, the University of Idaho and Texas A & M University in the US and at Kyoto University in Japan. At least two graduates are highly successful plant breeders with the USDA/ARS and one is very successful in industry. Their successful careers demonstrate that graduates of our Genetics Graduate Program were well trained and highly motivated. Successes like these account for the favorable comment #6 of the External Review Panel that "*The Genetics Program is well known and provides external prestige for KSU.*"

B. Briefly describe the quality of the students in the CIP degree

One finding of the External Review panel in 2003 was that the students in the Genetics Program were high quality. Another indicator of high quality is the numbers of awards that genetics students have won by competing at the University level and at national and international meetings (Appendix D). Genetics M.S. students graduate with at least one publication. For PhD students with over 2 years in the program, the number of publications ranges from 0 to 5, with the best case being 4 first author publications plus one more. The publications are in well-respected journals in the various fields. As expected, publications, and especially first author publications, tend to come late in a graduate student's career. Poster presentations range from 0 to 11 for a more senior student. Senior students have given 2 or 3 invited talks at national meetings. The average grade point averages for all Genetics students combined in the last 2 semesters (Fall, 2007 and Spring, 2008) are 3.72 and 3.74 respectively. All of these factors plus the successful employment records of our graduates (Appendices A & B) attest to the quality of students in the Genetics Graduate Program.

C. Briefly indicate the student demand for the CIP degree

Since we began keeping records in 2004, we have documented approximately 30 inquiries per year from potential students interested in the Genetics Graduate Program. Typically, half of these result in completed applications every year. The number of completed applications is probably reduced because we inform these potential applicants that the Genetics Graduate Program does not have funding for students and therefore acceptance depends on an interested faculty member with funds to support the student. Table 2 below shows the numbers of completed applications for the PhD and MS programs since 2006, listed according to home country of the student. Of these, 23 to 33% are M.S. applications. Acceptance levels vary from 8 to 25% depending on availability of faculty with funding for a Genetics student. We also have some students who are accepted in other departments and then request to transfer to Genetics because they are more interested in the genetics curriculum, and some students who were KSU undergraduates before applying to the Genetics Program.

Table 2: Numbers of completed applications (accepted applications) for the Genetics PhD and MS programs

Year	Degree	USA	India	China	Mexico	Greece	Turkey	Malaysia	Nepal	Thailand	Butan
2006	PhD	3 (1)*	6 (1)	2	-	1	1	-	-	-	-
	MS	4 (2)	-	-	-	-	-	-	-	-	-
2007	PhD	1	2	3	-	-	-	-	1	1	-
	MS	2 (1)	2	-	-	-	-	-	-	-	-
2008	PhD	1	2	2	1	-	-	1	-	-	-
	MS	-	3	-	-	-	-	-	-	-	1

*3(1) indicates 3 completed applications and 1 of these was accepted as a Genetics student.

D. Briefly indicate the employment demand for students in the CIP degree.

The employment history for Genetics students who graduated between 1986 and 2004 illustrates the employment demand for these students over time. Opportunities for students with advanced Genetics degrees remains high. Genetics graduates who have sought employment in the last 2 years have obtained desirable jobs at competitive salaries (Appendix B). This includes 2 with industry jobs and 5 with university jobs. In one notable case, a 2007 Ph.D. graduate was hired without postdoctoral experience for the competitive position of Assistant Professor of Cotton Genetics and Breeding at North Carolina State University. The success record of our graduates reflects well on the Genetics Program, on the various home Departments and on Kansas State University. With the growing impact of biotechnology and genomics in our everyday lives, the need for graduates with in-depth training in genetics will only increase.

VI. Assessment of Student Learning (ASL) – A cumulative report since 2006.

A. List the student learning outcomes that were assessed during the period of the review.

Please note that the first two SLOs differ in the degree of expectations for the M.S. degree and for the Ph.D. degree. However, since the initial indicators are the same for both degree programs, we have considered them together. See Appendix E for the complete list of Genetics SLOs.

(a.) For M.S.: Understand the basic processes of genetics in prokaryotic and eukaryotic systems, including gene transmission, mutation, expression and regulation. (**For Ph.D.:** Understand the basic processes of classical, molecular, developmental, population and evolutionary genetics and cytogenetics in prokaryotic and eukaryotic systems, including gene transmission, mutation, expression and regulation.).

(b.) For M.S.: Perform genetic research in an area of specialization. Demonstrate ability to follow instructions; plan and execute experiments; collect information in an organized and timely manner; analyze the data and draw conclusions regarding the hypothesis to be tested. (**For Ph.D.:** Become expert in an area of specialization, conceive and perform original genetic research in this area, and prepare results of the research for publication in a scientific journal.)

(c.) For M.S. and Ph.D.: Develop oral and written communication skills that include the ability to publish research and to communicate the importance and excitement of genetic research to others outside the field, including those with a limited scientific background.

B. For each learning outcome, describe the measures used (over a three-year period approximately one-half of the measures used are to be direct measures, and at least one direct measure must be used for each student learning outcome), the sample of students from whom data were collected, the timetable for the collection, and the forum in which the measures were administered.

For SLO (a) above, we are tracking the final grades in the three core courses: Genetics of Microorganisms - BIOL 675; Eukaryotic Genetics - BIOL 705; and Population Genetics - PLPTH 768. We track data for two groups of students separately depending on whether the students entered the program before or after the new core curriculum was implemented (Fall, 2004). As a second direct assessment measure for this SLO, we track the grades received for the student seminars mentioned for SLO (c.). Students are expected to prepare and present a seminar on genetic research outside their own research area, and these seminars are a good indicator that the student has understood key genetic processes. Faculty, post-docs and students from the home department attend the seminar and fill out a questionnaire assessing scientific content and presentation style. A final grade is assigned from the results of the questionnaire. An example of such a questionnaire is included as Appendix F. We determine if students who had completed the core courses receive higher scores on their student seminars than students who had not. Additionally, we track overall grade point averages.

For SLO (b) above, we are tracking direct indicators (Thesis research, Preliminary exam passed, and Thesis defense) for each student. Since particular emphasis will be given to assessment by the student's Thesis Research Committee, we developed a rubric for Committee members to use in reporting on the student's performance in the thesis defense (Appendix G).

For SLO (c) above, we are tracking information on three independent direct indicators: student seminars at K-State, manuscripts published, and presentations at scientific meetings.

C. Describe the results of the assessments.

The new Genetics core curriculum in the fall of 2004 has had a major impact on our students understanding of basic genetic processes in microbial, eukaryotic and population genetics. Only 21% of students who joined the program prior to implementation have taken all three courses. We currently have only 4 students who joined the program before fall, 2004, and none of these students have taken all three core courses. Current students who are required to take all three courses are making good progress on completing them. The grades achieved are 40% A, 55% B and 5% C. We assessed student seminar grades as an independent measure of their genetic skills. All students presenting seminars in the 2007-2008 reporting period received a grade of "A". We checked on whether the seminar grades differed for students who had not taken the core courses compared to those who had. Although students presenting seminars after taking the core courses tended to have higher seminar grades than students who had not taken the core courses (88% of grades are A after core courses compared to 67% A before), there are currently too few students who have not taken them to be significant. These data would be more meaningful if we included data for past students before core implementation in addition to the current data. However, these data are not currently available to us. As mentioned, we expanded our tracking to include the cumulative GPA for the Genetics students. For our MS students, the average GPA is 3.74, with the range from 3.32 to 4.00. For our PhD students the average GPA is 3.74, with the range from 3.33 to 4.00.

For SLO (b), we are tracking data on student performance in thesis research, preliminary exams and thesis defense. The first goal was to assemble a detailed record for each student currently in the genetics program. Regarding preliminary exams, 60% of the PhD students have successfully completed their preliminary exam. Of course, this number included students who are relatively new to the program and would not be expected to have passed their exams. Of all students in the program for 2 years or more, 70% have completed their preliminary exams. We determined average time between program entry and completion of the preliminary exam. For the Genetics students who have passed their exams, the average time between entry into the program and passing the exam is 2.8 years. This is regarded as satisfactory progress. During this period, we gathered input from the major advisor and the student's committee members on both the preliminary exam and the final thesis defense using the questionnaire in Appendix G. So far, most responses have been that the student is highly capable in the areas assessed, with rare assessments as capable.

For SLO (c) above, we have assembled information on three direct indicators, student seminars at KSU, manuscripts published, and presentations at national scientific meetings. Genetics M.S. students who have been in the program for more than 2 years have at least one publication (Except for a student specializing in plant breeding). For Ph.D. students, we are

considering first author publications separately from other publications, since first authorship is an indication that the individual made the major contribution to this research. For students with over 2 years in the program, the number of publications range from 0 to 5, with the best case being 4 first author publications plus one other. The publications are in well-respected journals in the various fields. As expected, publications, and especially first author publications, tend to come late in a graduate student's career. Poster presentations range from 0 for newer students to 11 for a more senior student. Senior students have given 2 or 3 invited talks at national meetings. Publications and presentations are a good indicator for some research areas, but may not be as good for others. These data must be assessed on a one-by-one basis in addition to strict number counting. Discussions on this topic are ongoing.

D. Describe the process by which faculty reviewed the results and decided on the actions and/or revisions that were indicated by them.

The faculty reviewed a copy of the assessment report received by email and then discussed the report at a faculty meeting on August 29. Two thirds of the faculty were able to attend the meeting. Others returned comments by email.

E. Describe the actions and/or revisions that were implemented in response to the assessment results.

The faculty were satisfied with the indicators being assessed and with the productivity of the students. They are satisfied with the program changes that were implemented after the external review. Only minor changes will be made in the process by which information is gathered on the student publications and presentations. We decided also to track student awards as an indicator of learning and achievement. We decided that all Genetics students will be required to prepare a professional C.V. immediately on entering the Genetics Program and that they update it and send it to the Genetics Chair annually. The information on publications, presentations and awards will be available in these C.V.s as well as in records tabulated by the Genetics Chair.

F. Describe the effects on student learning of the actions and/or revisions.

Not applicable

Graduate Program Review Report

Appendix A: Current Positions of Past Graduates from the Genetics Program					
Name	**Gender**	**Graduation**	**Employer**	**Department/Location**	**Title**
(Breuer) Kelo, Lisha	F	MS in 2004	Eli Lilly & Com., Indianapolis	(diabetes and obesity research)	Associate Biologist
Brown-Guedira, Gina	F	PhD in 1995	USDA/ARS and North Carolina State University	USDA Plant Science Research Unit and Dept. of Crop Science	Research Geneticist and Associate Professor
Faris, Justin D.	M	PhD in 1999	USDA/ARS	Northern Crop Science Laboratory, Fargo, ND	Research Geneticist (Plants)
Kam-Morgan, Lauren	F	PhD in 1987	LabCorp	Raleigh NC	Associate Director
Gill, Kulvinder	M	PhD in 1990	Washington State University	Crop and Soil Sciences	Professor, Vogel Endowed Chair, Wheat Breeding and Genetics
He, Ping	M	PhD in 2003	Texas A & M University (after post-doc at Harvard)	Norman Borlag Institute for International Ag.	Assistant Professor
Jiang, Jiming	M	PhD in 1993	University of Wisconsin, Madison	Horticulture (Plant Genetics and Breeding)	Professor
Lapitan, Nora	F	MS in 1984, PhD in 1986	Colorado State University	Soil and Crop Sciences	Professor
Lee, Grace	F	MS in 1987	Lumina Corporation, California		Analyst
Monosi, Busisiwe	F	MS in 2004	South Africa Breweries	Alrode, South Africa	Scientist

Nasuda, Shuhei	M	PhD in 1999	Kyoto University, Japan	Applied Biosciences, Plant Genetics	Assistant Professor
Pennill, Lourdes	F	MS in 2004	University of Maryland University College, Europe	Heidelberg, Germany	Adjunct Instructor, Biology
Shan, Libo	F	PhD in 2003	Texas A & M University (after post-doc at Harvard)	Plant Pathology	Assistant Professor
Song, Jason	M	PhD, date not available	University of Wisconsin, Madison	School of Pharmacy	Senior Researcher
Xiao, Fangming	M	PhD in 2002	University of Idaho	Microbiology, Molecular Biology, and Biochemistry	Assistant Professor
Xu, Jin-Rong	M	PhD in 1994	Purdue University	Botany and Plant Pathology	Professor
Yang, Jun	M	PhD in 2002	KSU	Vet Med	Microbiologist
Zhang, Peng	F	PhD in 2002	University of Sydney	Plant Breeding Institute	Senior Scientist
Zhu, Hongyan	M	MS in 1997, PhD at Texas A&M, 2001	University of Kentucky	Plant and Soil Sciences	Assistant Professor

Appendix B: Placement of Recent Graduates from the Genetics Program
(January 2005 to the present)

Degree	Name	Gender	Graduation Date	Employer	Job Title	
PhD	Xiao, Yanmei	F	Dec-05	University of CA, Davis, Dept. of Plant Breeding	Post-Doctoral Fellow	
PhD	Smith, Shavannor	F	2005	University of Georgia, Dept. of Plant Pathology	Assistant Professor	
M.S.	Wang, Suzhi	F	Dec-06	Washington Univ., St. Louis, MO	Bioinformaticist	
M.S.	Cooper Clark, Shanna Ann	F	May-07	Home with children, plans to teach		
Ph.D.	Vijayalakshmi, Kolluru	F	May-07	Home with children, but plans to return to a genetics related field		
Ph.D.	Kuraparthy, Vasu	M	May-07	Cotton Genetics and Breeding, North Carolina State U.	Assistant Professor	
Ph.D.	Yu, Jianbin	M	May-07	Oregon State University	Research Geneticist	
Ph.D.	Guo, Zhigang	M	Aug-07	Syngenta Seeds, Clinton, IL	Data-mining Scientist	
Ph.D.	Kankanala, Prasanna	F	Dec-07	Edenspace Systems Corp. Manhattan, KS	Research Geneticist	
M.S.	Smith, Lauren M.	F	May 2008	Bayer CropScience, 103 Erskine, Lubbock, TX	Quality Control Technician	

APPENDIX C. Numbers of Graduate Students in Genetics (Over 5 years)

	Genetics Program				
	M.S.		Ph.D.		
Semester	**Male**	**Female**	**Male**	**Female**	**Total**
Spring 2007	0	3	8	4	15
Fall 2006	0	1	8	4	13
Spring 2006	0	2	7	4	13
Fall 2005	0	3	7	5	15
Spring 2005	0	4	9	5	18
Fall 2004	0	5	7	5	17
Spring 2004	0	6	5	5	16
Fall 2003	0	6	2	7	15
Spring 2003	1	5	4	9	19
Fall 2002	1	4	6	9	20

Appendix D: Awards and Honors for Graduate Students in Genetics, Kansas State University (Past 5 years)

1. **Xin Deng**. 2008. $10,000 Competitive Grant. Received from the NCR-SARE (North Central Region-Sustainable Agriculture Research and Education) Graduate Student Grant Program.
2. **Shilpa Sood**. Certificate of achievement for participation in the 5th Annual Capitol Graduate Research Summit at Topeka, Kansas in 2008
3. **Lauren Smith**. American Society of Agronomy Frank D. Keim Graduate Fellowship *(Competition at national society level)*
4. **Prasanna Kankanala**. 2007. American Society of Microbiology Best Poster Award, Fungal Genetics Conference, Asilomar, CA *(Competition at an international meeting)*.
5. **Prasanna Kankanala**. 2007. Kansas State University. Don C. Warren Genetic Scholarship
6. **Shilpa Sood**. 2007. Kansas State University. Don C. Warren Genetic Scholarship.
7. **Prasanna Kankanala**. 2006. Kansas State University. Sarachek Scientific Award for Academic Excellence
8. **Vasu Kuraparthy**. 2006. Kansas State University. Sarachek Scientific Travel Award
9. **Prasanna Kankanala**. 2005. Kansas State University. Sarachek Scientific Travel Award
10. **Vasu Kuraparthy**. 2006. Kansas State University. Don C. Warren Genetic Scholarship.
11. **Prasanna Kankanala**. 2005. Kansas State University. Art in Phytopathology, American Society of Phytopathology *(Competition at national society level)*.
12. **Satya Chintamanani**. 2004. Kansas State University. College of Agriculture Tuition Waiver
13. **Satya Chintamanani**. 2003. Kansas State University. College of Agriculture Tuition Waiver
14. **Peng Zhang**. 2002. Kansas State University. Don C. Warren Genetic Scholarship.

APPENDIX E

Genetics Graduate Student Learning Outcomes

1. **For MS**: Understand the basic processes of genetics in prokaryotic and eukaryotic systems, including gene transmission, mutation, expression and regulation. ***For PhD****: Understand the basic processes of classical, molecular, developmental, population and evolutionary genetics and cytogenetics in prokaryotic and eukaryotic systems, including gene transmission, mutation, expression and regulation*.

2. Be familiar with the intersection of genetic and genomic sciences and be able to apply genetic/genomic resources in their research.

3. Be familiar with the principal experimental and theoretical methods used by geneticists and molecular biologists in their studies, and recognize the advantages and limitations of these approaches.

4. Be able to formulate genetic hypotheses, design experiments and test predictions made by these hypotheses with observed data.

5. **For MS**: Perform genetic research in an area of specialization. Demonstrate ability to follow instructions; plan and execute experiments; collect information in an organized and timely manner; analyze the data, and draw conclusions regarding the hypothesis being tested. ***For PhD****: Become expert in an area of specialization, conceive and perform original genetic research in this area, and prepare results of the research for publication in a scientific journal*.

6. Demonstrate the ability to acquire new knowledge through critical evaluation of the scientific literature in the area of specific expertise.

7. **For MS**: Develop oral and written communication skills that include the ability to publish research and to communicate the importance and excitement of genetic research to others outside the field, including those with a limited scientific background. ***For PhD****: Develop oral and written communication skills that include the ability to publish original research in a scientific journal and to communicate the importance and excitement of genetic research to others outside the field, including those with a limited scientific background*.

8. Understand the historical, social and ethical context in which genetics and genomics have developed and are continuing to develop, and implications that these fields have for society as a whole.

9. Demonstrate that they can work effectively as part of a team consisting of supervisors, team members, and/or clients with diverse background, ethnicity, skills and interests.

Appendix F: Audience Seminar Evaluation Form (Plant Pathology)

Speaker's Name

Faculty ☐ **S**taff ☐ **S**tudent ☐ **P**ost-doc/visiting scientist ☐ **V**isitor ☐

Student Seminar in Plant Pathology, Kansas State University.

Please circle one number in each line and add comments at the end or on back.
(Circling two adjacent numbers, e.g. 4 and 5, will assign the average score, e.g. 4.5)
[Note that items 4 (volume) and 15 (length) have a different scale.]

1. Pre-seminar abstract.....	Excellent	**5**	**4**	**3**	**2**	**1**	Poor
2. Introduction	Excellent	**5**	**4**	**3**	**2**	**1**	Poor
3. Spoke to the audience	Always	**5**	**4**	**3**	**2**	**1**	Never
4. Speaking volume	Too loud	**1**	**3**	**5**	**3**	**1**	Too soft
5. Speaking clarity	Clear	**5**	**4**	**3**	**2**	**1**	Unclear
6. Mannerisms	Enhancing	**5**	**4**	**3**	**2**	**1**	Detracting
7. Reliance on notes.....	None	**5**	**4**	**3**	**2**	**1**	Too much
8. Knew the topic.....	Yes	**5**	**4**	**3**	**2**	**1**	No
9. Made topic interesting	Very	**5**	**4**	**3**	**2**	**1**	Not at all
10. Visual aids	Excellent	**5**	**4**	**3**	**2**	**1**	Poor
11. Data.....	Clear	**5**	**4**	**3**	**2**	**1**	Unclear
12. Thought progression	Logical	**5**	**4**	**3**	**2**	**1**	Poor
13. Level of analysis/synthesis	High	**5**	**4**	**3**	**2**	**1**	Low
14. Conclusions	Excellent	**5**	**4**	**3**	**2**	**1**	Poor
15. Overall presentation.....	Clear	**5**	**4**	**3**	**2**	**1**	Unclear
16. Length of presentation	Too short	**1**	**3**	**5**	**3**	**1**	Too long

17. Responses to questions	Excellent	**5**	**4**	**3**	**2**	**1** Poor
18. "I understood the seminar".....	Yes	**5**	**4**	**3**	**2**	**1** No

(See reverse side for characteristics we look for in a good seminar)
Comments on any aspect of this seminar, especially on any low scores, below and on the back:

Appendix G. Exam Assessment Questionaire

Interdepartmental Genetics Program
Graduate Student Learning Outcomes – Examination Assessment Questionaire

Date: _____

Graduate Student: _____

Degree (circle one): PhD MS

Examination (circle one): Final Oral Exam PhD Preliminary Exam

Examination Outcome (circle one): Pass Fail Other _____

Based on performance on this exam, rate this student's capabilities in the following areas:

For M.S.: Understand the basic processes of genetics in prokaryotic and eukaryotic systems, including gene transmission, mutation, expression and regulation.

For Ph.D.: Understand the basic processes of classical, molecular, developmental, population and evolutionary genetics and cytogenetics in prokaryotic and eukaryotic systems, including gene transmission, mutation, expression and regulation.

5	4	3	2	1
(highly capable)	(capable)	(average)	(weak)	(unacceptable)

For M.S.: Perform genetic research in an area of specialization. Demonstrate ability to follow instructions; plan and execute experiments; collect information in an organized and timely manner; analyze the data and draw conclusions regarding the hypothesis to be tested.

For Ph.D.: Become expert in an area of specialization, conceive and perform original genetic research in this area, and prepare results of the research for publication in a scientific journal.

5	4	3	2	1
(highly capable)	(capable)	(average)	(weak)	(unacceptable)

Develop oral and written communication skills that include the ability to publish research and to communicate the importance and excitement of genetic research to others outside the field, including those with a limited scientific background.

5	4	3	2	1
(highly capable)	(capable)	(average)	(weak)	(unacceptable)

Comments: