Responsibility and Implementation Process

Responsibility for all graduate programs in the College of Pharmacy is based on a balance between the autonomy of individual faculty members in supervising their graduate students and the responsibility of the entire College graduate faculty for ensuring the quality of our graduate programs. There is a single Ph.D. degree in pharmacy, with sub-specialties in each of the areas represented by the current Division structure of the College:

- Medicinal Chemistry
- Pharmaceutics
- Pharmacology & Toxicology
- Pharmacotherapy
- Pharmacy Administration
- Pharmacy Practice

Oversight responsibility for the Ph.D. programs rests globally with the Associate Dean for Research and Graduate Studies, who reports directly to the Dean of the College. The Associate Dean works directly with the Graduate Coordinator for daily management of the programs. Within each Division, Graduate Advisors assist students with coursework and progression toward the anticipated degree. Division Heads manage each of the programs cited above, and the Administrative Sub-Committee (Division Graduate Advisors, chaired by the Associate Dean) provides governance and quality assurance (e.g., candidacy approval). The Graduate Faculty rely on each Division to ensure that its graduate students have the requisite academic background for the discipline and demonstrate mastery through a rigorous candidacy examination. The Graduate Faculty also rely on the dissertation committee members to ensure quality in graduate research, dissertation formulation, and dissertation defense.

Program Educational Objectives (PEOs)

The program educational objectives for the Ph.D. programs in pharmacy are designed to prepare graduates to enter research-oriented careers, where they will be prepared to demonstrate:

- Forefront knowledge of their discipline and sub-discipline (including comprehensive understanding of the current state of the discipline, modern experimental techniques characteristic of the discipline, and research challenges in the area).
- An ability to conduct independent research in the discipline (formulation of the research problem/hypothesis, experimental design and execution, data analysis, and interpretation).
- The ability to discriminate quality scholarship in the discipline and the ability to communicate their scholarship (both written and oral communication of results).
- An understanding of appropriate sources of funding for the discipline.
- The ability to communicate with colleagues in related disciplines, and to initiate interdisciplinary research through those contacts.
- A high level of professional ethics in their disciplinary community and a strong desire to improve the health and welfare of society through their research contributions.
- Ability to provide a leadership role for careers in industry, government, and/or academics.
- An ethic for life-long learning in their discipline.

The following table relates the program outcomes and assessment methods:

<table>
<thead>
<tr>
<th>Assessment Method</th>
<th>Program Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Disciplinary Expertise</td>
</tr>
<tr>
<td>Pre-Candidacy Qualifying Examination</td>
<td>X</td>
</tr>
<tr>
<td>Completion of Core Curriculum</td>
<td>X</td>
</tr>
<tr>
<td>Advancement to Candidacy</td>
<td>X</td>
</tr>
<tr>
<td>Dissertation Proposal</td>
<td></td>
</tr>
<tr>
<td>Dissertation Proposal Defense</td>
<td></td>
</tr>
<tr>
<td>Dissertation</td>
<td></td>
</tr>
<tr>
<td>Dissertation Final Defense</td>
<td></td>
</tr>
<tr>
<td>Publications</td>
<td></td>
</tr>
</tbody>
</table>


**Program Outcome: Disciplinary Expertise**

Ph.D. graduates in Pharmacy will demonstrate knowledge and expertise in their discipline (generally) and sub-discipline (specifically) in terms of underlying scientific principles and research methods.

**Method: Pre-Candidacy Qualifying Examination**

All students must pass a formal examination prior to advancing to candidacy. The Divisions may have slight variations in the format (written versus written/oral, with or without formalized research proposal, etc), but the exam is designed to ensure that the candidate has acquired forefront knowledge of their discipline and sub-discipline, including comprehensive understanding of the current state of the discipline, modern experimental techniques characteristic of the discipline, and research challenges in the area. For this particular outcome, the criteria being evaluated are associated with oral communication skills during oral qualifying exams. The Division of Pharmacy Administration only requires a written qualifying exam, so their students are not included in these results.

Performance on the pre-candidacy qualifying examination for this program outcome will be measured using a general analytic rubric including the following criteria:

- content knowledge
- creativity
- independent thinking

We expect at least 60% of students to pass the examination. (Students who do not pass will have the opportunity to retake the exam once or transfer to a terminal Master’s degree. We expect at least 60% of students to pass the re-examination.)

**Result: Results of Pre-Candidacy Qualifying Examination - 2010:**

To date in 2010, 100% of students (4 of 4) either met or exceeded expectations during his/her pre-candidacy qualifying examinations on each of the following criteria:

- content knowledge
- creativity
- independent thinking

In addition, all four students achieved a passing score on the rubric overall and successfully passed the examination.
**Method: Completion of Core Curriculum**

Each Division has identified a specific core curriculum for all graduate students in that Division, as well as additional required coursework based on the student's sub-discipline.

Performance on the core curriculum will be measured using an average of scores on in-class exams in required coursework. The in-class exams in these courses test students' knowledge, skills, and abilities on topics related to their sub-discipline. The composite list of these required courses is as follows:

- CH386J Advanced Organic Chemistry
- CH395G Biochemistry
- CH395J Molecular Biology
- PHR396M Medicinal Chemistry: General Principles, Pharmacological Classification, and Mechanism of Action
- PHR 380F Biomedical Pharmacology I
- PHR 380N Biomedical Pharmacology II
- PHR 390N Biochemical & Molecular Toxicology
- PHR 384K Fundamental Toxicology
- NEU 382T Principles of Neuroscience I
- PHR 383D Neuropharmacology
- PHR 383Q Statistics
- PHR 390K Research Methodology
- EDP 482K Research Design and Inferential Statistics
- EDP 382K Correlations
- EDP 382K Multivariate
- PHR w390J Data Analysis

We expect at least 90% of students to earn an average grade of B or better on the in-class exams in their required coursework.

**Result: Results of Completion of Core Curriculum - 2010:**

The following table presents the percentage of students who earned a grade of B or better on in-class exams for each of the required courses offered to date in 2010:

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Semester</th>
<th>% of Students Earning ≥B on Exams</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 395J</td>
<td>Molecular Biology</td>
<td>Spring</td>
<td>82</td>
</tr>
<tr>
<td>PHR 380N</td>
<td>Biomedical Pharmacology II</td>
<td>Spring</td>
<td>100</td>
</tr>
</tbody>
</table>
Method: Advancement to Candidacy

All graduate students progress to Ph.D. candidacy based upon meeting Division coursework and qualifying examination requirements.

We expect at least 80% of students to have advanced to candidacy by the end of their third year in the doctoral program.

Result: Results of Advancement to Candidacy – Spring, 2010:

To date in 2010, 50% of students (5 of 10) who had started their graduate studies during the Fall semester of 2007 successfully completed their required coursework and passed their qualifying examinations by the end of their third year, which is this Spring semester of 2010.

Action Summary: Action Composite:

August, 2010

Pre-Candidacy Qualifying Examination

The results for 2010 have been updated with one additional student, and the percentage of students who have met or exceeded expectations on content knowledge, creativity, and independent thinking and achieved a passing score on the rubric overall for the pre-candidacy qualifying examination exceeded our standard of performance of 60%.

Although we believe this is a positive outcome, we still have plans to consult with appropriate administrators, graduate advisers, and graduate faculty to continue refining the rubric as well as streamlining the process for collecting and submitting the data.

Completion of Core Curriculum

Data for one course offered this summer (PHR w390J) have been added to the results table for 2010.

Based on the results presented above for 2009 and so far in 2010, the percentage of students who have earned a grade of B or better on
in-class exams in required courses exceeded our standard of performance of 90% in all but six courses.

Although we believe this is a positive outcome for most of the required courses, we acknowledge that for the five courses in 2009 (CH 386J, CH 395J, PHR 396M, PHR 380F, and EDP 482K) the percentage of students who earned a grade of B or better on in-class exams did not meet our standard of performance. In 2010, the percentage of students who earned a grade of B or better on in-class exams in CH 395J also did not meet our standard of performance. At the next Division Graduate Advisers meeting in early September, we will be revisiting the performance in these courses and discuss concrete next steps to help us improve this outcome (e.g., examine each student’s performance more closely, approach course instructors, etc.).

**Advancement to Candidacy**

The results presented above for 2009 as well as the results presented for 2010 so far did not meet our standard of performance of 80%. However, because this is still a new piece of data we are collecting on graduate students, we would like to retain this method to be able to look for trends and have more information in the future to share with the Associate Dean, the Graduate Coordinator, the Division Graduate Advisers, and graduate faculty for further review. This will be another item of discussion at the next Division Graduate Advisers meeting in early September.
Program Outcome: Conducting and Reporting Independent Research

Ph.D. graduates in Pharmacy will be able to identify forefront, challenging problems for study in their discipline and conduct independent research, including statement of the problem, hypothesis formulation, experimental design, experimental execution and data collection, data analysis, and defensible conclusion.

Method: Dissertation Proposal

Each Ph.D. student is required to submit a written original, comprehensive dissertation proposal, except for those students within the Division of Medicinal Chemistry. This particular Division requires a qualifying exam and a final dissertation defense, but they do not have a separate dissertation proposal. Therefore, students from Medicinal Chemistry are not included in these results.

Performance on the dissertation proposal for this program outcome will be measured using a general analytic rubric including the following criteria:

- knowledge of key relevant peer-reviewed literature
- ability to identify and write clear, specific research aims
- ability to develop an experimental design based on research aims and within the expertise of the student
- ability to identify appropriate methodology
- ability to foresee research limitations and provide alternative aims

We expect at least 90% of students to achieve a passing score on the rubric.

Result: Results of Dissertation Proposal - 2010:

To date in 2010, 100% of students (3 of 3) either met or exceeded expectations on their dissertation proposals on each of the following criteria:

- literature review
- research questions
- experimental design
- methodology
- potential limitations

Thus, all three students achieved a passing score on the rubric.
Method: Dissertation Proposal Defense

Each Ph.D. student is required to defend the dissertation proposal in front of a Dissertation Committee, except for those students within the Division of Medicinal Chemistry. This particular Division requires a qualifying exam and a final dissertation defense, but they do not have a separate dissertation proposal. Therefore, students from Medicinal Chemistry are not included in these results.

Performance during the dissertation proposal defense for this program outcome will be measured using a general analytic rubric including the following criteria:

- content knowledge
- presentation skills
- professional composure
- creativity
- independent thinking

We expect at least 90% of students to achieve a passing score on the rubric.

Result: Results of Dissertation Proposal Defense - 2010:

To date in 2010, 100% of students (3 of 3) either met or exceeded expectations during their dissertation proposal defenses on each of the following criteria:

- content knowledge
- presentation skills
- professional composure
- creativity
- independent thinking

Thus, all three students achieved a passing score on the rubric and successfully defended their dissertation proposals.

Method: Dissertation

Each Ph.D. candidate is required to submit a written dissertation document to a Dissertation Committee.
Performance on the dissertation for this program outcome will be measured using a general analytic rubric including the following criteria:

- knowledge of key relevant peer-reviewed literature
- ability to identify and write clear, specific research aims
- ability to develop an experimental design based on research aims and within the expertise of the student
- ability to identify appropriate methodology
- ability to foresee research limitations and provide alternative aims
- ability to explain study results clearly
- ability to write a defensible conclusion

We expect at least 90% of candidates to achieve a passing score on the rubric.

**Result: Results of Dissertation - 2010:**

To date in 2010, 100% of candidates (8 of 8) either met or exceeded expectations on their dissertations on each of the following criteria:

- literature review
- research questions
- experimental design
- methodology
- limitations
- results
- conclusion

Thus, all eight candidates achieved a passing score on the rubric.

**Method: Dissertation Defense**

Each Ph.D. candidate is required to defend the dissertation in front of a Dissertation Committee (as per University requirements).

Performance during the defense for this program outcome will be measured using a general analytic rubric including the following criteria:

- content knowledge
- presentation skills
• professional composure
• creativity
• independent thinking

We expect at least 90% of candidates to surpass their performance at the pre-candidacy level on the above criteria, and we expect at least 90% of candidates to achieve a passing score on the rubric by presenting their research and answering questions posed by the Dissertation Committee.

**Result: Results of Dissertation Defense - 2010:**

To date in 2010, 100% of candidates (8 of 8) either met or exceeded expectations during their dissertation defenses on each of the following criteria:

• content knowledge
• presentation skills
• professional composure
• creativity
• independent thinking

Thus, all eight candidates achieved a passing score on the rubric and successfully defended their dissertations.

**Action Summary: Action Composite:**

August, 2010

Dissertation Proposal

The results for 2010 have been updated with two additional students, and the percentage of students who have achieved a passing score on the rubric for the dissertation proposal exceeded our standard of performance of 90%.

Although we believe this is a positive outcome, we still have plans to consult with appropriate administrators, graduate advisers, and graduate faculty to continue refining the rubric as well as streamlining the process for collecting and submitting the data.

Dissertation Proposal Defense
The results for 2010 have been updated with two additional students, and the percentage of students who have achieved a passing score on the rubric for the dissertation proposal defense exceeded our standard of performance of 90%.

Although we believe this is a positive outcome, we still have plans to consult with appropriate administrators, graduate advisers, and graduate faculty to continue refining the rubric as well as streamlining the process for collecting and submitting the data.

**Dissertation**

The results for 2010 have been updated with seven additional candidates, and the percentage of candidates who have achieved a passing score on the rubric for the dissertation exceeded our standard of performance of 90%.

Although we believe this is a positive outcome, we still have plans to consult with appropriate administrators, graduate advisers, and graduate faculty to continue refining the rubric as well as streamlining the process for collecting and submitting the data.

**Dissertation Defense**

The results for 2010 have been updated with seven additional candidates, and the percentage of candidates who have achieved a passing score on the rubric for the dissertation defense exceeded our standard of performance of 90%.

Although we believe this is a positive outcome, we still have plans to consult with appropriate administrators, graduate advisers, and graduate faculty to continue refining the rubric as well as streamlining the process for collecting and submitting the data.

**Program Outcome: Oral Communication Skills**
Ph.D. graduates in Pharmacy will be able to orally communicate their research results in an effective manner.

**Method: Pre-Candidacy Qualifying Examination**

All students must pass a formal examination prior to advancing to candidacy. The Divisions may have slight variations in the format (written versus written/oral, with or without formalized research proposal, etc), but the exam is designed to ensure that the candidate has acquired forefront knowledge of their discipline and sub-discipline, including comprehensive understanding of the current state of the discipline, modern experimental techniques characteristic of the discipline, and research challenges in the area. For this particular outcome, the criteria being evaluated are associated with oral communication skills during oral qualifying exams. The Division of Pharmacy Administration only requires a written qualifying exam, so their students are not included in these results.

Performance on the pre-candidacy qualifying examination for this program outcome will be measured using a general analytic rubric including the following criteria:

- presentation skills
- professional composure

We expect at least 60% of students to pass the examination. (Students who do not pass will have the opportunity to retake the exam once or transfer to a terminal Master’s degree. We expect at least 60% of students to pass the re-examination.)

**Result: Results of Pre-Candidacy Qualifying Examination - 2010:**

To date in 2010, 100% of students (4 of 4) either met or exceeded expectations during his/her pre-candidacy qualifying examinations on each of the following criteria:

- presentation skills
- professional composure

In addition, all four students achieved a passing score on the rubric overall and successfully passed the examination.

**Method: Dissertation Proposal Defense**

Each Ph.D. student is required to defend the Dissertation Proposal in front of a Dissertation Committee, except for those students within the Division of Medicinal Chemistry. This particular Division requires a qualifying exam and a final dissertation defense, but they do not have a separate dissertation proposal. Therefore, students from Medicinal Chemistry are not included in these results.
Performance on the Dissertation Proposal Defense for this program outcome will be measured using a general analytic rubric including the following criteria:

- presentation skills
- professional composure

We expect at least 90% of students to achieve a passing score on the rubric.

**Result: Results of Dissertation Proposal Defense - 2010:**

To date in 2010, 100% of students (3 of 3) either met or exceeded expectations during their dissertation proposal defenses on each of the following criteria:

- content knowledge
- presentation skills
- professional composure
- creativity
- independent thinking

Thus, all three students achieved a passing score on the rubric and successfully defended their dissertation proposals.

**Method: Dissertation Defense**

Each Ph.D. candidate is required to defend the dissertation in front of a Dissertation Committee (as per University requirements).

Performance during the defense for this program outcome will be measured using a general analytic rubric including the following criteria:

- presentation skills
- professional composure

We expect at least 90% of candidates to surpass their performance at the pre-candidacy level on the above criteria, and we expect at least 90% of candidates to achieve a passing score on the rubric by presenting their research and answering questions posed by the Dissertation Committee.

**Result: Results of Dissertation Defense - 2010:**

To date in 2010, 100% of candidates (8 of 8) either met or exceeded expectations during their dissertation defenses on each of the
following criteria:

- presentation skills
- professional composure

In addition, all eight candidates achieved a passing score on the rubric overall and successfully defended their dissertations.

**Action Summary: Action Composite:**

**Pre-Candidacy Qualifying Examination**

The results for 2010 have been updated with one additional student, and the percentage of students who have met or exceeded expectations on content knowledge, creativity, and independent thinking and achieved a passing score on the rubric overall for the pre-candidacy qualifying examination exceeded our standard of performance of 60%.

Although we believe this is a positive outcome, we still have plans to consult with appropriate administrators, graduate advisers, and graduate faculty to continue refining the rubric as well as streamlining the process for collecting and submitting the data.

**Dissertation Proposal Defense**

The results for 2010 have been updated with two additional students, and the percentage of students who have achieved a passing score on the rubric for the dissertation proposal defense exceeded our standard of performance of 90%.

Although we believe this is a positive outcome, we still have plans to consult with appropriate administrators, graduate advisers, and graduate faculty to continue refining the rubric as well as streamlining the process for collecting and submitting the data.

**Dissertation Defense**

The results for 2010 have been updated with seven additional candidates, and the percentage of candidates who have achieved a passing score on the rubric for the dissertation defense exceeded our standard of performance of 90%.

Although we believe this is a positive outcome, we still have plans to consult with appropriate administrators, graduate advisers, and graduate faculty to continue refining the rubric as well as streamlining the process for collecting and submitting the data.
Program Outcome: Scholarly Writing Skills

Ph.D. graduates in Pharmacy will be able to express scholarly ideas in writing.

**Method: Pre-Candidacy Qualifying Examination**

All students must pass a formal examination prior to advancing to candidacy. The Divisions may have slight variations in the format (written versus written/oral, with or without formalized research proposal, etc), but the exam is designed to ensure that the candidate has acquired forefront knowledge of their discipline and sub-discipline, including comprehensive understanding of the current state of the discipline, modern experimental techniques characteristic of the discipline, and research challenges in the area.

Performance on the pre-candidacy qualifying examination for this program outcome will be measured using a general analytic rubric including the following criteria:

- knowledge of key relevant peer-reviewed literature
- ability to identify and write clear, specific research aims
- ability to develop an experimental design based on research aims and within the expertise of the student
- ability to identify appropriate methodology
- ability to foresee research limitations and provide alternative aims

We expect at least 60% of students to pass the examination. (Students who do not pass will have the opportunity to retake the exam once or transfer to a terminal Master's degree. We expect at least 60% of students to pass the re-examination.)

**Result: Results of Pre-Candidacy Qualifying Examination - 2010:**

To date in 2010, 100% of students (5 of 5) either met or exceeded expectations during their pre-candidacy qualifying examinations on each of the following criteria:

- literature review
- research questions
- experimental design
- methodology
- potential limitations

All five students achieved a passing score on the rubric overall and successfully passed the examination.
Method: Dissertation Proposal

Each Ph.D. student is required to submit a written original, comprehensive dissertation proposal, except for those students within the Division of Medicinal Chemistry. This particular Division requires a qualifying exam and a final dissertation defense, but they do not have a separate dissertation proposal. Therefore, students from Medicinal Chemistry are not included in these results.

Performance on the dissertation proposal for this program outcome will be measured using a general analytic rubric including the following criteria:

- knowledge of key relevant peer-reviewed literature
- ability to identify and write clear, specific research aims
- ability to develop an experimental design based on research aims and within the expertise of the student
- ability to identify appropriate methodology
- ability to foresee research limitations and provide alternative aims

We expect at least 90% of students to achieve a passing score on the rubric.

Result: Results of Dissertation Proposal - 2010:

To date in 2010, 100% of students (3 of 3) either met or exceeded expectations on their dissertation proposals on each of the following criteria:

- literature review
- research questions
- experimental design
- methodology
- potential limitations

Thus, all three students achieved a passing score on the rubric.

Method: Dissertation

Each Ph.D. candidate is required to submit a written dissertation document to a Dissertation Committee.
Performance on the dissertation for this program outcome will be measured using a general analytic rubric including the following criteria:

- knowledge of key relevant peer-reviewed literature
- ability to identify and write clear, specific research aims
- ability to develop an experimental design based on research aims and within the expertise of the student
- ability to identify appropriate methodology
- ability to foresee research limitations and provide alternative aims
- ability to explain study results clearly
- ability to write a defensible conclusion

We expect at least 90% of candidates to achieve a passing score on the rubric.

**Result: Results of Dissertation - 2010:**

To date in 2010, 100% of candidates (8 of 8) either met or exceeded expectations on their dissertations on each of the following criteria:

- literature review
- research questions
- experimental design
- methodology
- limitations
- results
- conclusion

Thus, all eight candidates achieved a passing score on the rubric.

**Method: Publications**

All Ph.D. candidates will have primary authorship on at least one published or in press article in a peer-reviewed journal by the time of their dissertation defenses.

Performance will be measured by the candidates’ number of publications, either published or in press.

We expect at least 70% of candidates to have at least two articles either published or in press, and for which they are the primary author, before their dissertation defenses.
Result: Results of Publications - 2010:

To date in 2010, 25% of candidates (2 of 8) had at least two articles either published or in press, and for which they were the primary author, by the time of their dissertation defenses.

Action Summary: Action Composite:

August, 2010

Pre-Candidacy Qualifying Examination

The results for 2010 have been updated with one additional student, and the percentage of students who achieved a passing score on the rubric overall for the pre-candidacy qualifying examination exceeded our standard of performance of 60%.

Although we believe this is a positive outcome, we still have plans to consult with appropriate administrators, graduate advisers, and graduate faculty to continue refining the rubric as well as streamlining the process for collecting and submitting the data.

Dissertation Proposal

The results for 2010 have been updated with two additional students, and the percentage of students who have achieved a passing score on the rubric for the dissertation proposal exceeded our standard of performance of 90%.

Although we believe this is a positive outcome, we still have plans to consult with appropriate administrators, graduate advisers, and graduate faculty to continue refining the rubric as well as streamlining the process for collecting and submitting the data.

Dissertation

The results for 2010 have been updated with seven additional candidates, and the percentage of candidates who have achieved a passing score on the rubric for the dissertation exceeded our standard of performance of 90%.

Although we believe this is a positive outcome, we still have plans to consult with appropriate administrators, graduate advisers, and graduate faculty to continue refining the rubric as well as streamlining the process for collecting and submitting the data.

Publications

Based on the results presented above, the percentage of candidates who had at least two articles either published or in press by the time
of their dissertation defenses did not meet our standard of performance of 70%.

This will be another item of discussion at the next Division Graduate Advisers meeting in early September to determine if we should offer more opportunities for candidates to publish during the graduate program or if our standard of performance should be adjusted.

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