Pharmacy, PhD

The College of Pharmacy offers a Doctor of Philosophy degree in pharmacy with subprograms in three areas: drug discovery and experimental therapeutics, health services research, and pharmaceutics.

The drug discovery and experimental therapeutics subprogram offers a unique educational opportunity for students interested in drug discovery and the development of novel therapeutics. The changing landscape of drug discovery has created a need for scientists with interdisciplinary training to navigate the complex landscape of medicinal chemistry, biotherapeutics, pharmacogenetics/genomics, and basic pharmacology/toxicology.

The health services research subprogram provides an innovative approach to studying the challenges facing the health care system and provides evidence to support policy-based solutions. It combines ideas across several distinct scientific paradigms (sociology, economics, psychology, business, and anthropology) to better understand the factors leading to decisions in health care and the consequences of these decisions. Students gain a broad knowledge of health and pharmaceutical care, informed by theories from economics and social psychology. The subprogram teaches intellectual and practical skills to investigate research questions dealing with current issues.

The pharmaceutics subprogram provides a multidisciplinary science focus that examines the development, production, and characterization of dosage forms, as well as the disposition and action of drugs in the body. As pharmaceutical scientists have been engaged in the development of novel biomaterials for sophisticated drug delivery systems, they also have expanded into research with applications in the development of medical devices and tissue engineering.

For more information about graduate study, visit the College of Pharmacy website.

Learning Outcomes

Graduates will demonstrate the ability to:

- identify important research problems through the development of subject matter expertise and critical evaluation of the current state of knowledge in that area of expertise;
- develop testable hypotheses and/or research questions, and then utilize sound methodology to design research approaches to address them;
- conduct, analyze, and interpret independent original research that contributes new knowledge to the field of study;
- effectively communicate research results to a range of audiences in both written and oral formats;
- conduct all aspects of research and communication of results with the highest ethical standards; and
- be prepared for a diversity of career options in academia, industry, government, or other relevant fields.

Required Courses

<table>
<thead>
<tr>
<th>Course #</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHAR:5510</td>
<td>Pharmaceutical Sciences and Experimental Therapeutics Seminar</td>
<td>1-2</td>
</tr>
<tr>
<td>PHAR:5545</td>
<td>Current Medicinal Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:6515</td>
<td>Perspectives in Drug Discovery</td>
<td>2</td>
</tr>
<tr>
<td>PHAR:6820</td>
<td>Drug Discovery and Experimental Therapeutics Research</td>
<td>arr.</td>
</tr>
<tr>
<td>BIOS:4120</td>
<td>Introduction to Biostatistics</td>
<td>3</td>
</tr>
<tr>
<td>PCOL:4130</td>
<td>Drug Mechanisms and Actions (OR)</td>
<td>3</td>
</tr>
<tr>
<td>or PHAR:7101</td>
<td>Principles of Experimental Therapeutics</td>
<td></td>
</tr>
</tbody>
</table>

Interdisciplinary Electives

Students select a minimum of 10 s.h. of electives chosen from the following courses. Additional electives can be selected from biochemistry, chemistry, genetics, neuroscience, and pharmacology at the discretion of the advisor.

<table>
<thead>
<tr>
<th>Course #</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHAR:5512</td>
<td>Drug Discovery and Mechanisms</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:5537</td>
<td>Enzymatic Basis of Drug Metabolism</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:5541</td>
<td>Total Synthesis of Biologically Active Natural Products</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:5549</td>
<td>Analytical Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:6501</td>
<td>Principles and Mechanisms of Chemical Toxicology</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:6504</td>
<td>Mastering Reproducible Science</td>
<td>1</td>
</tr>
<tr>
<td>PHAR:6700</td>
<td>Advanced Pharmacokinetics and Pharmacodynamics</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:7101</td>
<td>Principles of Experimental Therapeutics</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:7102</td>
<td>Applied Clinical and Translational Science</td>
<td>3</td>
</tr>
<tr>
<td>BIOL:5512</td>
<td>Readings in Genetics</td>
<td>2</td>
</tr>
<tr>
<td>BIOS:5120/IGPI:5120/STAT:5610</td>
<td>Regression Modeling and ANOVA in the Health Sciences</td>
<td>3</td>
</tr>
</tbody>
</table>

Drug Discovery and Experimental Therapeutics

The Doctor of Philosophy in pharmacy with a subprogram in drug discovery and experimental therapeutics requires 72 s.h. of credit. The degree requires 25 s.h. of didactic coursework, including 15 s.h. of required courses and a minimum of 10 s.h. of interdisciplinary electives. The remaining hours may be fulfilled by research, seminars, additional electives, and the doctoral dissertation. The typical time to complete the degree is five years. Students must maintain a cumulative grade-point average of at least 3.00.

The curriculum provides a strong foundational base of knowledge along with options for a tailored experience for students. The program prepares scientists capable of bridging the complex landscape of medicinal chemistry, biotherapeutics, pharmacogenetics/genomics, and basic pharmacology/toxicology.

The Doctor of Philosophy in pharmacy with a subprogram in drug discovery and experimental therapeutics requires the following work.
Comprehensive Examination
Students take the comprehensive examination between the beginning and end of their third year of graduate study.

Dissertation
The dissertation is defended in a final oral examination.

Health Services Research
The Doctor of Philosophy in pharmacy with a subprogram in health services research requires 74 s.h. of credit. Students must maintain a cumulative grade-point average of at least 3.00.

In the first two years in the program, students participate in ongoing research and complete coursework. In the third year, emphasis is placed on developing a dissertation topic. The following two years are spent on research and writing of the dissertation.

The Doctor of Philosophy in pharmacy with a subprogram in health services research requires the following work.

Core Competencies
Students complete the following coursework before they take the core competency qualifying exam.

Health Services Research

<table>
<thead>
<tr>
<th>Course #</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>All of these:</td>
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<td></td>
</tr>
<tr>
<td>PHAR:6320</td>
<td>Health Services Research</td>
<td>arr.</td>
</tr>
<tr>
<td>PHAR:6330</td>
<td>Models of Patient Behavior and Choice</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:6331</td>
<td>Models of Provider Behavior and Choice</td>
<td>3</td>
</tr>
<tr>
<td>HMP:4000</td>
<td>Introduction to the U.S. Health Care System (or equivalent as approved by advisor)</td>
<td>3</td>
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</table>

Research Methods and Statistics

<table>
<thead>
<tr>
<th>Course #</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>All of these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHAR:5350</td>
<td>Introduction to Research Methods</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:5360</td>
<td>Applied Research Methods: Primary Data</td>
<td>2</td>
</tr>
<tr>
<td>PHAR:5365</td>
<td>Applied Research Methods: Secondary Data</td>
<td>2</td>
</tr>
<tr>
<td>BIOS:4120</td>
<td>Introduction to Biostatistics</td>
<td>3</td>
</tr>
<tr>
<td>BIOS:5120/IGPI:5120/STAT:5610</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Regression Modeling and ANOVA in the Health Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Additional statistics coursework (biostatistics, economics, education, psychology, mathematics, or sociobiology)</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Specialty
The specialty area requires at least 24 s.h. of coursework. With the guidance of their faculty advisor, students develop a plan of study that encompasses an area of expertise or specialty.

Additional Requirements
Students are expected to participate in specific aspects of ongoing research. These research activities are often paid graduate research assistantships; course credit is not available for paid assistantships. By the end of their third year, students are expected to present the results from one completed research project at a regional or national meeting.

<table>
<thead>
<tr>
<th>Course #</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHAR:5310</td>
<td>Health Services Research Seminar (students enroll in the seminar for 1 s.h. each semester they are on campus, excluding summer session)</td>
<td>1</td>
</tr>
<tr>
<td>BMED:7270</td>
<td>Scholarly Integrity/Responsible Conduct of Research I (taken in second year)</td>
<td>0</td>
</tr>
<tr>
<td>BMED:7271</td>
<td>Scholarly Integrity/Responsible Conduct of Research II (taken in second year)</td>
<td>0</td>
</tr>
</tbody>
</table>

Pharmaceutics
The Doctor of Philosophy in pharmacy with a subprogram in pharmaceutics requires 72 s.h. of credit. The degree requires 30 s.h. in didactic coursework, including a minimum of 15 s.h. in divisional courses and 15 s.h. of elective coursework. The remaining 42 s.h. can be fulfilled with research (PHAR:6720 Pharmaceutics Research) or electives. Students must maintain a cumulative grade-point average of at least 3.00.

Entering students who do not have basic knowledge in all subjects follow a plan of study in order to complete divisional requirements during their first and second years.

The Doctor of Philosophy in pharmacy with a subprogram in pharmaceutics requires the following work.

Divisional Courses

<table>
<thead>
<tr>
<th>Course #</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 s.h. from these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHAR:4146</td>
<td>Drug Disposition and Pharmacokinetics</td>
<td>2</td>
</tr>
<tr>
<td>PHAR:4736</td>
<td>Properties of Dosage Forms I (or equivalent)</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:4737</td>
<td>Properties of Dosage Forms II</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:4800</td>
<td>Chemical and Biophysical Properties of Drugs</td>
<td>2</td>
</tr>
<tr>
<td>PHAR:5720</td>
<td>Pharmaceutical Materials and Analysis</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:5880</td>
<td>Protein Pharmaceuticals</td>
<td>2</td>
</tr>
<tr>
<td>PHAR:6700</td>
<td>Advanced Pharmacokinetics and Pharmacodynamics</td>
<td>3</td>
</tr>
</tbody>
</table>
**Elective Courses**

Students choose appropriate electives for individual research objectives.

**Comprehensive Examination**

Students take the comprehensive examination between the beginning and end of their third year of graduate study.

**Dissertation**

The dissertation is defended in a final oral examination.

**Admission**

Applicants must meet the admission requirements of the Graduate College. They must:

- hold a bachelor’s degree from a U.S. institution or an equivalent degree from another country as determined by the University of Iowa Office of Admissions, and
- have a minimum grade-point average of at least 3.00.

Students may submit a Graduate Record Examination (GRE) General Test score, but that is optional.

Visit Graduate Degree: How to Apply on the College of Pharmacy website for a list of program requirements and application deadlines. Academic requirements for maintaining graduate registration are determined by the Graduate College and by the individual divisions in the College of Pharmacy.

**Career Advancement**

Advanced study in the pharmaceutical sciences prepares students for research, teaching, and administrative positions in the pharmaceutical industry, in colleges and universities, in government agencies, and in health-related institutions and organizations.

**Academic Plans**

**Sample Plans of Study**

Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

**Pharmacy, PhD**

- Drug Discovery and Experimental Therapeutics Subprogram [p. 3]
- Health Services Research Subprogram [p. 4]
- Pharmaceutics Subprogram [p. 5]

**DRUG DISCOVERY AND EXPERIMENTAL THERAPEUTICS SUBPROGRAM**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOS:4120</td>
<td>Introduction to Biostatistics</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:5510</td>
<td>Pharmaceutical Sciences and Experimental Therapeutics Seminar</td>
<td>1 - 2</td>
</tr>
<tr>
<td>PHAR:6515</td>
<td>Perspectives in Drug Discovery</td>
<td>2</td>
</tr>
<tr>
<td>PHAR:6820</td>
<td>Drug Discovery and Experimental Therapeutics Research</td>
<td>3</td>
</tr>
<tr>
<td>PCOL:4130</td>
<td>Drug Mechanisms and Actions</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Second Year Fall</strong></td>
<td></td>
</tr>
<tr>
<td>PHAR:6820</td>
<td>Drug Discovery and Experimental Therapeutics Research</td>
<td>3</td>
</tr>
<tr>
<td>Interdisciplinary Elective b</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Spring</strong></td>
<td></td>
</tr>
<tr>
<td>PHAR:6820</td>
<td>Drug Discovery and Experimental Therapeutics Research</td>
<td>3</td>
</tr>
<tr>
<td>PCOL:4130</td>
<td>Drug Mechanisms and Actions</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Third Year Any Semester</strong></td>
<td></td>
</tr>
<tr>
<td>PHAR:6820</td>
<td>Drug Discovery and Experimental Therapeutics Research</td>
<td>3</td>
</tr>
<tr>
<td>Interdisciplinary Elective b</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

**Academic Career**

- Doctoral Comprehensive Exam c
- Graduate Comprehensive Exam

**Hours**

| 0 | 7-8 | 8 | 9 | 0 | 6 | 2 |
### Fourth Year

#### Fall
- PHAR:6820 Drug Discovery and Experimental Therapeutics Research 6
- Interdisciplinary Elective *b* 3
- **Hours** 9

#### Spring
- PHAR:6820 Drug Discovery and Experimental Therapeutics Research 6
- **Hours** 6

#### Fifth Year

#### Fall
- PHAR:6820 Drug Discovery and Experimental Therapeutics Research 7
- **Hours** 7

#### Spring
- PHAR:6820 Drug Discovery and Experimental Therapeutics Research 7
- Exam: Doctoral Final Exam *d*
- **Hours** 7
- **Total Hours** 72-73

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### Health Services Research Subprogram

#### Academic Career

#### Any Semester
74 s.h. must be graduate level coursework; graduate transfer credits allowed upon approval. More information is included in the General Catalog and on department website.

#### First Year

#### Fall
- BIOS:4120 Introduction to Biostatistics 3
- HMP:4000 Introduction to the U.S. Health Care System *d, c* 3
- PHAR:5310 Health Services Research Seminar 1
- PHAR:5350 Introduction to Research Methods *c, e* 3
- PHAR:6320 Health Services Research 2
- **Hours** 12

#### Spring
- BIOS:5120 Regression Modeling and ANOVA in the Health Sciences 3
- PHAR:5310 Health Services Research Seminar 1
- PHAR:5360 Applied Research Methods: Primary Data 2
- PHAR:6320 Health Services Research 1
- Research Methods and Statistics Elective *c, f, g* 3
- **Hours** 12

#### Second Year

#### Fall
- BMED:7270 Scholarly Integrity/Responsible Conduct of Research I 0
- PHAR:5310 Health Services Research Seminar *d* 1
- PHAR:6320 Health Services Research 2
- PHAR:6330 Models of Patient Behavior and Choice *c, e* 3
- Research Methods and Statistics Elective *c, f, g* 3
- Specialty Area Elective *g* 3
- **Hours** 12

#### Spring
- BMED:7271 Scholarly Integrity/Responsible Conduct of Research II 0
- PHAR:5310 Health Services Research Seminar *d* 1
- PHAR:6320 Health Services Research 2
- PHAR:6331 Models of Provider Behavior and Choice *c, e* 3
- Specialty Area Elective *g* 3
- Specialty Area Elective *g* 3
- **Hours** 12

#### Third Year

#### Any Semester
Specialty Qualifying Exam *h*

#### Hours** 0

#### Fourth Year

#### Any Semester
Exam: Doctoral Comprehensive Exam *i*

#### Hours** 0

#### Fall
- PHAR:5310 Health Services Research Seminar 1
- PHAR:6320 Health Services Research 2
- Specialty Area Elective *g* 3
- Specialty Area Elective *g* 3
- Specialty Area Elective *g* 3
- **Hours** 9

#### Spring
- PHAR:5310 Health Services Research Seminar 1
- PHAR:6320 Health Services Research 2
- Specialty Area Elective *g* 3
- Specialty Area Elective *g* 3
- **Hours** 9

---

*a* Students must complete specific requirements in the University of Iowa Graduate College after program admission. Refer to the Graduate College website and the Manual of Rules and Regulations for more information.

*b* Work with faculty advisor to determine appropriate graduate coursework and sequence; see General Catalog and department website for specifics.

*c* Faculty advisor to determine when this exam will be, but typically by the end of third year.

*d* Dissertation defense.
### Fifth Year

#### Fall
- PHAR:5310 Health Services Research Seminar 1
- PHAR:6320 Health Services Research 1
  
  **Hours** 2

#### Spring
- PHAR:5310 Health Services Research Seminar 1-2
- PHAR:6320 Health Services Research 1
  
  **Hours** 2-3

#### Exam: Doctoral Final Exam

**Total Hours** 76-78

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**a** Students must complete specific requirements in the University of Iowa Graduate College after program admission. Refer to the Graduate College website and the Manual of Rules and Regulations for more information.

**b** May be waived for students who have had equivalent coursework.

**c** Must complete before taking the Core Competency Qualifying Exam.

**d** Registration required every semester; optional after fourth year.

**e** Offered every other year; work with faculty advisor to select appropriate first year classes if entering the program on a year when not taught.

**f** May be taken in biostatistics, economics, education, psychology, mathematics, or sociobiology.

**g** Work with faculty advisor to determine appropriate graduate coursework and sequence; see General Catalog and department website for specifics.

**h** Faculty advisor to determine when this exam will be, but typically by the end of third year.

**i** A required Core Competency Qualifying Exam; work with faculty advisor to determine when this exam may be completed (typically during fourth year).

**j** Dissertation defense.

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### Pharmaceutics Subprogram

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Any Semester</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>72 s.h. must be graduate level coursework; graduate transfer credits allowed upon approval. More information is included in the General Catalog and on department website.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The degree requires 30 s.h. in didactic coursework, including a minimum of 15 s.h. in divisional courses and 15 s.h. of pharmacy or elective coursework; the remaining 42 s.h. can be fulfilled with research or electives.</td>
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</tbody>
</table>

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### First Year

#### Fall
- MATH:3600 or MATH:2560 Introduction to Ordinary Differential Equations 3
  or Engineering Mathematics IV: Differential Equations
- CHEM:4431 or CHEM:4430 Chemical Thermodynamics b or Principles of Physical Chemistry 3
- PHAR:4736 Properties of Dosage Forms I b 3
- PHAR:6710 Pharmaceutics Graduate Seminar c 1
  
  **Hours** 2

#### Spring
- PHAR:4737 Properties of Dosage Forms II b 3
- PHAR:4800 Chemical and Biophysical Properties of Drugs 2
- PHAR:6706 Equilibria Processes 3
- PHAR:6710 Pharmaceutics Graduate Seminar c 1
  
  **Hours** 2

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### Second Year

#### Fall
- PHAR:4146 Drug Disposition and Pharmacokinetics 2
- BMED:7270 Scholarly Integrity/Responsible Conduct of Research I 0
- PHAR:6720 Pharmaceutics Research 2
- PHAR:6710 Pharmaceutics Graduate Seminar c 1
  
  **Hours** 11

#### Spring
- PHAR:5745 Drug Delivery: Principles and Applications I 3
- PHAR:6700 Advanced Pharmacokinetics and Pharmacodynamics 3
- BMED:7271 Scholarly Integrity/Responsible Conduct of Research II 0
- PHAR:6720 Pharmaceutics Research 2
- PHAR:6710 Pharmaceutics Graduate Seminar c 1
  
  **Hours** 11

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### Third Year

#### Any Semester
- Exam: Doctoral Comprehensive Exam e 0

#### Fall
- Elective course d 3
- Elective course d 3
- PHAR:6720 Pharmaceutics Research 3
  
  **Hours** 9

#### Spring
- Elective course d 3
- Elective course d 3
- PHAR:6720 Pharmaceutics Research 3
  
  **Hours** 9
### Summer
**Internship (optional)**

<table>
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<th>Hours</th>
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### Fourth Year
**Fall**

<table>
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<tbody>
<tr>
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**Hours** 2

### Spring

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<td>PHAR:6720</td>
<td>Pharmaceutics Research</td>
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**Hours** 2

**Summer**
**Internship (optional)**

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### Fifth Year
**Fall**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHAR:6720</td>
<td>Pharmaceutics Research</td>
<td>2</td>
</tr>
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</table>

**Hours** 2

**Spring**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHAR:6720</td>
<td>Pharmaceutics Research</td>
<td>2</td>
</tr>
<tr>
<td>Exam: Doctoral Final Exam</td>
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**Hours** 2

<table>
<thead>
<tr>
<th>Total Hours</th>
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<tbody>
<tr>
<td>72</td>
</tr>
</tbody>
</table>

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a Students must complete specific requirements in the University of Iowa Graduate College after program admission. Refer to the Graduate College website and the Manual of Rules and Regulations for more information.
b If equivalent course not taken previously; otherwise work with faculty advisor to select relevant elective in Pharmaceutics or outside the department.
c Enrollment required each semester until completion of comprehensive exam.
d Work with faculty advisor to determine appropriate graduate coursework and sequence.
e Written research proposal and oral exam; typically completed by the end of third year.
f Dissertation defense.