

**GRADUATE PROGRAM IN ARTIFICIAL ORGANS, BIOMATERIALS,
& CELLULAR TECHNOLOGY (ABC)**

I.	Governance	1
II.	Admission	2
III.	Counseling	3
IV.	Course of Study	3
V.	Student Seminars	4
VI.	Teaching	5
VII.	Research	5
VIII.	Comprehensive Examination	5
IX.	Preliminary Research Examination	6
X.	Ph.D. Thesis	7
XI.	Financial support	8
XII.	Dismissal	8
XIII.	M.S. Degree	8
XIV.	M.D.-Ph.D. Degree	8
XV.	Master of Medical Science Degree	8

GRADUATE PROGRAM IN ARTIFICIAL ORGANS, BIOMATERIALS, & CELLULAR TECHNOLOGY (ABC)

The ABC Graduate Program in the Department of Molecular Pharmacology, Physiology and Biotechnology offers advanced training appropriate for academic and research careers in fields of biology, natural sciences and medical sciences that include cellular, molecular, comparative, and drug delivery and tissue engineering. Admission is ordinarily limited to applicants for the Ph.D. Students interested in the field of biomedical engineering at Brown University may apply to the department's Program in Molecular Pharmacology and Physiology.

To fulfill Ph.D. requirements students must pass a comprehensive examination and a preliminary research examination according to established schedules, complete and publicly defend a doctoral dissertation, and participate in the undergraduate and graduate teaching programs of the Division of Biology and Medicine. Attainment of the Ph.D. degree normally requires four to five years for Ph.D. candidates and three to four years of graduate work for M.D./Ph.D. candidates.

I. Governance

The Graduate Program in Artificial Organs, Biomaterials and Cellular Technology is administered by the Program Director and a series of standing and ad hoc committees, as a component of the Graduate Program of the Division of Biology and Medicine. Standing committees are the Steering Committee and the Graduate Program Committee, described below. Ad hoc committees include a Preliminary Advisory Committee, Comprehensive Examination Committee, Thesis Advisory Committee and Thesis Committee for each graduate student. These committees, chosen at appropriate stages in the student's career, are described below.

The Steering Committee is composed of the current Graduate Program Committee and the Chair of the Department of Molecular Pharmacology, Physiology, & Biotechnology. The Program Director is a senior faculty member appointed by the Dean of Biology and Medicine or designate upon recommendation by the Steering Committee for a term of three years, renewable. The Steering Committee is responsible for establishing policy, allocating resources and designating faculty as trainers or members within the Graduate Program, as outlined below.

The Graduate Program Committee is composed of the Program Director and at least two other faculty members. The faculty members are appointed by the Program Director in consultation with the Steering Committee. The term for faculty members of the Graduate Program Committee is three years, renewable. The responsibilities of the Graduate Program Committee include admissions recommendations to the Graduate School and curriculum recommendations to the Steering Committee.

The faculty of the Graduate Program will be divided, with respect to graduate training, into two categories, members and trainers.

Members will have an active research interest in the areas encompassed by the Program. They will participate in the activities of the Program by involvement in an upper level course, or by

attending program seminars or journal clubs, or by serving on ad hoc committees. They may serve as thesis advisors for Master of Science or Master of Medical Science students.

Trainers are those faculty who may serve as thesis advisors for Ph.D. students. Trainers must conduct an active research program and must be prepared to commit the time and effort required to supervise the student's research. They are also expected to have the financial resources to support a research project by graduate students and to provide stipends to them during the summer months and year-round support once they have fulfilled their tuition requirements. Ph.D. training is most appropriate in an environment where the student can interact with other active investigators and graduate students. Trainers are expected to offer at least one upper level course every other year, either alone or as a leading instructor in a group.

Potential members and trainers are proposed to the Steering Committee by one of its members, who will provide the committee with documentation of the candidate's credentials. Designation of faculty status, as a member or trainer, is made on the basis of the credentials, subject to review every three years.

II. Admission

Entering students are expected to have strong undergraduate qualifications in mathematics, physics, and chemistry as well as in biological sciences. However, engineers are also encouraged to apply. The Graduate Program will make recommendations to the full faculty for interviews and acceptance after the applications have been made available for review by the faculty.

III. Counseling

Until the Thesis Advisory Committee is selected, counseling on academic matters and review of student progress will be carried out by the Graduate Program Committee. This committee will also put students in touch with other faculty members with related interests who may also provide useful advice.

IV. Course of Study

The University requires 24 course credits for graduation at the Ph.D. level, of which a maximum of 8 can be transferred from post-baccalaureate work. Courses must be taken for a grade rather than on a credit/no credit basis. Additionally, students in the M.D./Ph.D. program can receive 8 credits for satisfactory completion of the first two years of the Program in Medicine.

Programs of study and research are developed individually in consultation with the student's thesis advisor and advisory committees and are designed to ensure expertise in the student's principal research field. Interdisciplinary work is encouraged and may be undertaken with other graduate programs of the Division of Biology and Medicine. A student must maintain a 3.0 average by the end of the first two years to remain in good standing.

V. Student Seminars

Graduate students are expected to attend and participate in departmental weekly seminars. Each student will give at least one departmental seminar within one year of passing the Preliminary Research Exam. This may be based on the student's original research or may consist of a critical analysis of the literature.

VI. Teaching

The minimum teaching requirement may be fulfilled by teaching for two semesters. Prior teaching experience, comparable to that which would be obtained at Brown, is applicable toward fulfillment of the teaching requirement. The teaching requirement may be fulfilled only by teaching in courses in which graduate students conduct a discussion or laboratory section or present a small number of lectures.

VII. Research

Students are strongly encouraged to participate in research rotations in at least three different labs. This can take the form of the graduate course, Bio 296, Graduate Independent Study. Rotations provide the opportunity to gain exposure to different techniques and ways of thinking about scientific problems. All three rotations may be carried out during the spring semester of the first year, running 4-5 weeks each. The choice of a Ph.D. thesis advisor and research area will be made no later than by the end of the third semester. Entering students who have not identified a thesis advisor before coming to Brown are encouraged to attend seminars and talk with faculty.

VIII. Comprehensive Examination

By the end of semester 4, each student is required to pass a comprehensive examination covering a range of topics broadly related to the student's research interests. Students are expected to become familiar with the subject material covered in this examination through course work, outside reading, seminars, and working in research laboratories.

A Comprehensive Examination Committee consisting of four program faculty will construct, administer and evaluate the exam and make a decision. The committee will consist of two members of the Graduate Program Committee (who will give continuity from exam to exam), two ad hoc members appropriate to the interests of the student involved, and the thesis advisor. Members of the committee will be asked to serve by the thesis advisor after being selected jointly by the advisor and the student. The thesis advisor should send a memo to the Graduate Program Director listing the membership of the committee, for inclusion in the student's files. The thesis advisor should also schedule the meeting times of this committee, but should not chair the committee. The committee will be chaired by one of the two members of the Graduate Program Committee at the request of the Program Director.

Prior to the comprehensive examination, the student will submit to the Comprehensive Examination Committee a brief summary of his/her graduate work at Brown and research interests. On the basis of this statement, the committee will identify areas basic to the student's research interests and decide upon the specific range of topics to be covered on the exam. The committee will provide the student with a list of the general areas to be included in the exam.

The main purpose of the comprehensive exam is to assess the student's breadth and depth of knowledge, and ability to integrate this information. The exam is intended to cover broad areas of physiology, pharmacology, neuroscience, and related disciplines. While topics covered will differ

from one student to the next, parity in depth and breadth will be assured by the two continuing members of the examining committee.

The comprehensive examination will consist of two parts, a written component, lasting the equivalent of a full day, and an oral exam one to two weeks later, lasting at least two hours, in which the candidate will face the examining committee. The committee may solicit questions for the written exam from program faculty who are not on the committee. The answer to each question will be graded by the individual who contributed it, prior to the oral component. The thesis advisor may play a passive role in the oral exam, but will participate in the final decision, which should be made immediately following the oral exam. The committee chairman will communicate the final decision and summarize the committee's response to the candidate. If a student fails this exam, the committee chairman will recommend to the full faculty that the student be asked to leave the program.

IX. Preliminary Research Examination

Within one year of passing the comprehensive examination, the student will submit a written proposal for thesis research, which will form the basis of an oral, preliminary examination. The exam will consist of a brief oral presentation of the proposal by the student followed by discussion of the thesis proposal with the committee. Written notification of successful completion of the preliminary examination will be sent by the chair of the Thesis Advisory Committee to the Program Director for inclusion in the student's record.

The examining committee, designated the Thesis Advisory Committee, shall consist of the thesis advisor, three other members of the Brown Faculty, and where possible an authority in the area of the thesis research from another institution. If a committee member cannot attend the exam, his/her written critique should be available to the committee at least one week in advance. The responsibilities of the thesis advisor for selecting committee members, reporting to the Program Director, and scheduling meetings will be the same as those given above for the Comprehensive Examination Committee. The preliminary exam will be chaired by a member of the Graduate Program Committee (who may or may not be a committee member) at the request of the Program Director. Requests for delays in achieving the stated deadline should be reviewed by the Steering Committee of the Graduate Program before approval of the request by that committee.

The thesis proposal will be no more than 20 pages (double-spaced) in length. This document will be written in the style of a research grant proposal (with sections on specific aims and goals, significance, background, proposed methods and experimental approaches, interpretation of expected results, and a report on any preliminary progress). A final draft of the thesis proposal shall be provided to all Thesis Advisory Committee members at least two weeks prior to the date of the oral examination. It is strongly recommended that the student, when possible, submit the written document as a predoctoral fellowship application to a funding agency such as the NIH after completion of the Research Examination.

The thesis advisor should arrange a meeting of the Brown affiliated members of the Thesis Advisory Committee with the student at least once a year after completion of the preliminary examination. The purpose of this committee is to follow the progress of the student, to help the student with difficulties encountered in the dissertation research, and to aid with the evolution of the

project. These meetings could be scheduled for the Intersession between semesters in the academic year, a time when both faculty and students are likely to be available and free of teaching responsibilities. The student will prepare a brief (about one page) written report of progress and proposed work to be distributed to committee members prior to each annual meeting. A copy of the student's annual progress report should be sent to the Program Director for inclusion in the student's file.

X. Ph.D. Thesis

The Thesis Committee consists of the thesis advisor, three other members of the Brown faculty, and a reader external to Brown. The doctoral thesis should represent a comprehensive summation of the student's total research effort. It is expected to contribute significantly to the field of study and to be of sufficient quality to merit publication in a refereed journal. The thesis can be presented in either of two formats. The first format, which may be used by any degree candidate, should contain the following elements:

- a) Abstract - less than 350 words summarizing the thesis problem, methods used to solve the problem, the results and conclusions.
- b) Introduction - a comprehensive review of the field and reasons for performing the research.
- c) Methods and Results - a description of the research performed.
- d) Discussion - an evaluation of the contribution of the thesis research to the field of study and consideration of future directions

The second format may only be used by candidates whose thesis work forms the basis for two or more papers accepted for publication in refereed journals. In this case the published papers (or relevant portions of the manuscripts) may be substituted for the Methods and Results section of the thesis. Otherwise the format should be the same as that given above; i.e., it should contain a complete Abstract, Introduction, and Discussion.

If portions of the student's work have been done in collaboration with other investigators, the candidate should explicitly state his/her contribution to the work. **Detailed instructions on preparation and format of the Ph.D. dissertation should be obtained from the Graduate School.**

After submission of the thesis, the student will present his/her work in a seminar, following which there will be an oral examination attended by members of the Thesis Committee and other faculty members who choose to participate. The thesis advisor will schedule the thesis defense and notify the Program Director and all program faculty at least one week before the defense. Faculty members are encouraged to read each thesis submitted, attend the seminar and participate in the examination.

XI. Financial Support

Graduate students who are candidates for the Ph.D. are generally accepted into the Program of Physiology with a commitment of financial support while their research and academic studies progress satisfactorily.

Any student who has passed the Preliminary Research Examination may request up to \$400/year from the Program Director who administers the Graduate Program budget for travel funds to attend scientific meetings if the student is presenting an abstract in the meeting. Students may also request the Program Director to have the Program budget pay their final dissertation fee (approximately \$50).

XIII. Dismissal

A student may be dismissed from the Graduate Program for academic or non-academic reasons. The Graduate Program Committee will review each case and place its recommendation before the full faculty convened by the Program Director. Two thirds of the faculty will constitute a quorum and a decision to accept the recommendation of the Graduate Program Committee will require a favorable majority vote. Appeal of such decisions is to the Dean of the Graduate School.

XII. M.S. Degree

In a few cases, students will be admitted to the program as candidates for the M.S. degree only; such students are normally not eligible for financial aid. . The M.S. degree requires 8 course credits, and 1 credit can be transferred for post-baccalaureate work done elsewhere. In addition to Divisional requirements, a written thesis based on original research must be completed and accepted by a committee consisting of the research advisor plus two additional members of the Brown faculty. There is no teaching requirement for the M.S. degree.

XIII. M.D./Ph.D. Degree

Applicants to the Brown University Program in Medicine may also apply to the M.D./Ph.D. Program. M.D./Ph.D. students must complete all of the Program requirements specified for the Ph.D. degree.

XIV. Master of Medical Science Degree

Medical students who are enrolled in the Program in Medicine may apply to the Master of Medical Science Program. In addition to Divisional requirements, a written thesis must be completed and evaluated as given above for the Master's degree.