



UNIVERSITY  
OF  
ALBERTA

DEPARTMENT OF BIOCHEMISTRY  
GRADUATE PROGRAM MANUAL

4-74 Medical Sciences Building – Faculty of Medicine and Dentistry –  
Edmonton, Alberta – T6G 2H7 – 780-492-7834

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## Section 1 How to Apply for Graduate Admission

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### **Ensure you meet the minimum requirements**

- A four-year baccalaureate degree or its equivalent from an academic institution recognized by the University of Alberta.
- A Grade Point Average (GPA) of 3.3 on a 4.0 scale. The GPA calculation will be determined from the most recent 2 years (or 60 credits) of course work.
- A B.Sc degree in Biochemistry or a closely related discipline is normally required for admission, but outstanding applicants from related disciplines are encouraged to apply.
- Please ensure you meet the **minimum requirements from other countries** as set by the Faculty of Graduate Studies and Research (FGSR) before applying  
<https://www.ualberta.ca/graduate-studies/prospective-students/international-admissions-protocol/international-academic-requirements/minimum-academic-requirements-by-country>
- If an applicant is from an institution which is not well known, a Graduate Record Exam (GRE) may be required. A good performance is generally considered to be a score of 2000 or higher on the General Examination and 80% or higher on the Subject Area Examination. If necessary, these requirements will be requested by the Graduate Coordinator. The minimum scores for international applicants are 500 (verbal reasoning), 650 (quantitative reasoning), 4.5 (analytical writing).

Applicants with degrees and qualifications in a language other than English may need to demonstrate English Language Proficiency. Proficiency can be demonstrated by a satisfactory score on one of the following approved English language examinations;

- **TOEFL:** Minimum score of 600 (paper-based), or 100 (internet-based) with at least 20 on each of the individual skill areas
- **IETLS:** Minimum overall band score of 6.5 with at least 5 on each band
- **MELAB:** Minimum score of 85
- **CAEL:** overall minimum score of 60, with at least 60 on each subtest
- **PTE:** Overall minimum score of 59

Some applicants with qualifications from certain countries and international universities are exempt from the English language requirements. See the [exemptions list](#):

<https://www.ualberta.ca/graduate-studies/prospective-students/international-admissions-protocol/english-language-proficiency/exemptions>

### **Complete the online application form**

- Applications for graduate admission must be submitted online.  
<http://www.gradstudies.ualberta.ca/apply/onlineapplication.aspx>

The online application enables you to follow the documents that are submitted and added to the file.

### **Pay the application fee**

- A non-refundable application fee of \$100 CAD is required to apply.

### **Please upload the following documents:**

- A current curriculum vitae/resume.
  - Statement of Interest - one or two pages summarizing your background in Biochemistry, an explanation of why you wish to pursue graduate studies, and your future career goals.
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- **Official** transcripts from all colleges or universities attended (with the institution seal, date and appropriate signature).
- **Official** translation of foreign transcripts with the original transcript in English and the original language.
- If original transcripts cannot be obtained, applicants should supply certified true copies of original transcripts and certified statements confirming degrees awarded and academic standing achieved. Certification of transcripts and degrees must be effected by imprinting them with the official seal of the institution or by endorsing them by hand with the original signature of the responsible university officer (eg, Registrar, Admissions Officer, or President).
- Original document of proof of English proficiency (if the undergraduate degree is from a non-English university).
- **Three references** from persons (preferably professors) who are knowledgeable about the applicants academic and research potential and capabilities. The letter submitted must be on letterhead and signed by the referee.
- A list and description of all biochemistry courses taken (if not from the University of Alberta).
- If applicable, copies of research papers or publications

**Incomplete applications will not be reviewed**

**Ensure you meet the application deadlines**

- **Canadian Applicants**

Applications for graduate admission from Canadian applicants can be accepted at any time however, students should allow a minimum of two months for processing of their application.

- **International Applicants**

Students applying from outside Canada are advised to allow at least 4-6 months for processing of their application.

International students who have been accepted for admission are advised to contact the nearest Canadian Consulate as soon as possible.

- The deadline for a September admission is July 1.
- The deadline for a January admission is November 1.

Detailed information for international students is available from the [University of Alberta International Centre](https://www.ualberta.ca/international-student-services) <https://www.ualberta.ca/international-student-services>

- **International Applicants from China and Nigeria**

Applicants from China or Nigeria typically need additional time to obtain a student visa.

We advise these applicants to meet the following deadlines to ensure starting their program on time.

- The deadline for a September admission is May 1.
- The deadline for a January admission is September 1.

**Evaluation of Applicants**

Applicants are evaluated by the department's Graduate Coordinating Committee (GCC) for admission and funding. Several considerations guide the evaluation:

- Academic merit
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- Ability of potential supervisor to fund the project; and
- Availability of space in a particular research lab

### **Graduate Coordinating Committee**

The role of the Graduate Coordinating Committee (GCC) is to set policies and procedures regarding the graduate program.

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## **Section 2 Registration Procedures**

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### **Course Selection and Registration**

Students are responsible for ensuring that their programs are planned in accordance with degree specifications, and for the completeness and accuracy of their registration. Students are required to register themselves each year. If assistance or Departmental approval is required, please contact the Graduate Program Advisor in writing. Registration will not be automatically done for you.

### **Full-Time Registration Policy**

Students who are admitted to any thesis-based degree program (excluding cost-recovery programs) and who **initially register as full-time students** in these programs **must register full-time for the remainder of their program.**

Students registered in a total of nine or more units of course weight in the Fall and Winter Term are considered full-time. Students typically register in THES 906 to maintain full-time registration during the Spring and Summer terms.

### **Thesis Registration**

Registration in THES is restricted to those students in thesis-based graduate degree programs.

Thesis sections are scheduled according to units of course weight equivalents for registration status and fee purposes. Students should consult with the Graduate Program Advisor to determine which of the thesis sections is appropriate. The selection will depend on the amount of time that the student will devote to work on the program. By registering in the appropriate Thesis designation (along with any other courses), the registration status of the student is calculated automatically.

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## **Section 3 Graduate Courses**

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### **BIOCH 510: Signal Transduction - second term**

Principles of the biochemistry of cell communication and signal transduction through receptor activation, the generation of second messengers, and the control of protein modifications. The course will emphasize the mechanisms responsible for the regulation of cell migration, division and death.  
**Prerequisites:** BIOCH 310, 320 and 330, or BIOCH 203 and 205, all with a minimum grade of B-, or consent of the Department.

#### **Notes:**

- (1) Lectures are the same as for BIOCH 410, but with additional assignments and evaluation appropriate to graduate studies.
  - (2) This course may not be taken for credit if credit has already been obtained in BIOCH 410.
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**BIOCH 520: Protein Chemistry, Structure, and Function - second term**

Protein chemistry and purification. The intra- and intermolecular forces that determine protein structure. Principles of protein folding and dynamics. Enzyme mechanisms and ligand binding interactions.

**Prerequisites:** BIOCH 320, or BIOCH 203 and 205, all with a minimum grade of B- or consent of Department.

**Notes:**

- (1) Lectures are the same as for BIOCH 420, but with additional assignments and evaluation appropriate to graduate studies.
- (2) This course may not be taken for credit if credit has already been obtained in BIOCH 420.

**BIOCH 530: Biochemistry of Eukaryotic Gene Expression - first term**

The organization and expression at the molecular level of information encoded in the nucleic acids of eukaryotic cells. The focus will be on genome structure and the regulation of gene expression at the levels of transcription, post-transcriptional processing, translation, post-translational modification and protein sorting. Recombinant DNA technologies and genetic engineering will be discussed as methods for studying the cellular processing of genetic information.

**Prerequisites:** BIOCH 320 and 330, or BIOCH 203 and 205, all with a minimum grade of B- or consent of Department.

**Notes:**

- (1) Lectures are the same as for BIOCH 430, but with additional assignments and evaluation appropriate to graduate studies.
- (2) This course may not be taken for credit if credit has already been obtained in BIOCH 430.

**BIOCH 541: Structure and Function of Biological Membranes - first term**

Survey of the structure and function of biological membranes. Topics include the structure, properties and composition of biomembranes, characterization and structural principles of membrane lipids and proteins, lateral and transverse asymmetry, dynamics, lipid-protein interactions, membrane enzymology, permeability, and biogenesis.

**Prerequisites:** BIOCH 320, or BIOCH 203 and 205, all with a minimum grade of B- or consent of Department.

**Notes:**

- (1) Lectures are the same as for BIOCH 441, but with additional assignments and evaluation appropriate to graduate studies.
- (2) This course may not be taken for credit if credit has already been obtained in BIOCH 441.

**BIOCH 550: The Molecular Biology of Mammalian Viruses - first term**

This course will focus on virus structure, replication, and interaction with host cells at the molecular level. Lytic viruses with single- or double-stranded DNA or RNA genomes will be discussed, as will the mechanisms of viral oncogenesis.

**Prerequisites:** BIOCH 320 and 330, or BIOCH 203 and 205, all with a minimum grade of B- or consent of Department.

**Notes:**

- (1) Lectures are the same as for BIOCH 450, but with additional assignments and evaluation appropriate to graduate studies.
  - (2) This course may not be taken for credit if credit has already been obtained in BIOCH 450.
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### **BIOCH 555: Biochemistry of Lipids and Lipoproteins - second term**

Advanced course focusing on specific aspects of the regulation of lipid and lipoprotein metabolism. Topics include the transcriptional and post-translational mechanisms governing the synthesis and degradation of important enzymes, lipids, and lipid transport molecules; the role of lipid mediators in signaling pathways and protein modification; the assembly and dynamics of lipoproteins and biological membranes; genetic disruptions of lipid regulatory proteins such as cell surface receptors leading to human disease.

**Prerequisites:** BIOCH 310, 320, and 330, or BIOCH 203 and 205, all with a minimum grade of B- or consent of Department.

**Notes:**

(1) Lectures are the same as for BIOCH 455, but with additional assignments and evaluation appropriate to graduate studies.

(2) This course may not be taken for credit if credit has already been obtained in BIOCH 455.

### **BIOCH 565: Methods in Molecular Biophysics**

Survey of biophysical methods used in the characterization and structural determination of biological macromolecules, from ensemble measurements to single-molecule detection. Topics include mass spectrometry, optical spectroscopy, light microscopy, X-ray and neutron diffraction, electron microscopy, molecular dynamics and nuclear magnetic resonance. Emphasis is on using techniques in evaluating structure-function relationships through the discussion of representative macromolecular systems.

**Prerequisites:** BIOCH 320 with a minimum grade of B- or consent of the Department. This course cannot be taken for credit if credit has already been obtained in BIOCH 460.

**Coordinator:** Dr. H. Young

### **BIOCH 609: Macromolecular Structure Analysis - second term**

Principles of X-ray crystallography as applied to the study of protein and nucleic acid structure. Practical aspects of diffraction and structure solution are demonstrated by a collaborative study of a suitable small molecule of biological interest. Designed for senior honors and graduate students.

**Prerequisite:** consent of Instructor.

**Notes:**

(1) Maximum enrolment of 10 students. Offered in alternate years.

### **BIOCH 620: Selected Topics in Protein Structure, Function, and Regulation - second term**

Directed reading and seminar course, based on papers taken from recent literature of protein research. Students critically discuss the papers and give oral presentations to the class. Designed for graduate students.

**Prerequisite:** BIOCH 420 or equivalent, or consent of Department.

### **BIOCH 623: A Special Topics in Research on Polynucleotides - two term**

This course is a journal club and discussion group in which current research topics on nucleic acids are discussed. Specific talks range from biochemistry, genetics and microbiology to nuclear biology and clinical aspects.

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**BIOCH 623B: Special Topics in Research on Polynucleotides - two term**

This course is a journal club and discussion group in which current research topics on nucleic acids are discussed. Specific talks range from biochemistry, genetics and microbiology to nuclear biology and clinical aspects.

**BIOCH 626A: Special Topics in Protein Research - two term**

Seminar course for advanced students. Detailed consideration is given to recent advances in research on protein structure and function and mechanism of enzyme action.

**Prerequisite:** BIOCH 420 or consent of Department.

**BIOCH 626B: Special Topics in Protein Research - two term**

Seminar course for advanced students. Detailed consideration is given to recent advances in research on protein structure and function and mechanism of enzyme action.

**Prerequisite:** BIOCH 420 or consent of Department.

**BIOCH 630: Selected Topics in Modern Molecular Biology - second term**

Directed reading and seminar course, based on papers taken from the recent literature of molecular biology. Students critically discuss the papers and give oral presentations.

**Prerequisite:** BIOCH 530 and consent of the Department.

**Note:** designed for graduate students; offered yearly.

**BIOCH 640A: Special Topics in Research on Biomembranes - two term**

Seminar course for advanced students covering selected topics from the current literature in the field of membrane structure and function.

**Prerequisite:** BIOCH 441 or consent of Department.

**BIOCH 640B: Special Topics in Research on Biomembranes - two term**

Seminar course for advanced students covering selected topics from the current literature in the field of membrane structure and function.

**Prerequisite:** BIOCH 441 or consent of Department.

**BIOCH 641: Selected Topics on the Structure and Function of Biological Membranes - first term**

Directed reading and seminar course on the structure and function of biological membranes. Topics include membrane biogenesis, bioenergetics, transport and structural aspects of membrane lipids and proteins.

**Prerequisite:** BIOCH 441 or consent of the Department.

**BIOCH 650A: Signal Transduction - two term**

A journal club and discussion group addressing topics in the general area of signalling mechanisms that control cell activation, growth, apoptosis and vesicle trafficking. Specific talks range from biochemistry, genetics and microbiology to molecular biology and clinical aspects.

**Prerequisite:** BIOCH 410/510 or consent of Department.

**BIOCH 650B: Signal Transduction - two term**

A journal club and discussion group addressing topics in the general area of signalling mechanisms that control cell activation, growth, apoptosis and vesicle trafficking. Specific talks range from biochemistry, genetics and microbiology to molecular biology and clinical aspects.

**Prerequisite:** BIOCH 410/510 or consent of Department.

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**BIOCH 651A: Special Topics in Lipid and Lipoprotein Research - two term**

Seminar for advanced students covering selected topics from the current literature in the field of lipid and lipoprotein research.

**Prerequisite:** BIOCH 555 or consent of Department.

**BIOCH 651B: Special Topics in Lipid and Lipoprotein Research - two term**

Seminar for advanced students covering selected topics from the current literature in the field of lipid and lipoprotein research.

**Prerequisite:** BIOCH 555 or consent of Department.

**BIOCH 655: Advances in Lipid and Lipoprotein Research - first term**

Recent developments and use of the current literature are emphasized. Topics include regulation of lipid metabolism, intracellular lipid trafficking, regulation of lipoprotein secretion, lipid transfer among lipoproteins, reverse cholesterol transport, and atherosclerosis.

**Prerequisite:** BIOCH 455, or 555, or consent of Department.

**Note:** Offered in alternate years.

**BIOCH 670A: Recent Advances in Biochemistry - two term**

A seminar course on topics of current interest in biochemistry. Students will contribute to a presentation based on recent developments published in first rate journals. Attendance at all seminars is expected.

**Note:** Open only to graduate students in Biochemistry.

**BIOCH 670B: Recent Advances in Biochemistry - two term**

A seminar course on topics of current interest in biochemistry. Students will contribute to a presentation based on recent developments published in first rate journals. Attendance at all seminars is expected.

**Note:** Open only to graduate students in Biochemistry.

**BIOCH 671A: Recent Advances in Biochemistry - two term**

A seminar course on topics of current interest in biochemistry. Students will contribute a presentation on their research project that includes original data. Attendance at all seminars is expected. Prerequisite: BIOCH 670 or consent of the Department.

**Note:** Open only to graduate students in Biochemistry.

**BIOCH 671B: Recent Advances in Biochemistry - two term**

A seminar course on topics of current interest in biochemistry. Students will contribute a presentation on their research project that includes original data. Attendance at all seminars is expected.

Prerequisite: BIOCH 670 or consent of the Department.

**Note:** Open only to graduate students in Biochemistry.

**BIOCH 675: Magnetic Resonance in Biology and Medicine II - second term**

Designed for advanced honors and graduate students interested in the application of nuclear magnetic resonance spectroscopy to biological systems. Topics include quantum mechanical basis of NMR, multinuclear multidimensional NMR experiments, NMR relaxation theory, new NMR applications.

**Prerequisite:** consent of Instructor.

**Note:** Offered in alternate years.

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## Section 4 Degree Program Requirements

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### The Master's Degree

MSc students are required to have a cumulative GPA of not less than 3.0 in non-seminar courses taken during the graduate program. Failure (a grade of C+ or lower) in two one-term courses or in a single two-term course will normally result in an automatic recommendation to terminate a student's program unless the student's cumulative GPA at that time is 3.0 or higher.

All candidates for the MSc degree must prepare an acceptable thesis describing the results of their research activities, and be examined orally on the thesis by a committee formed according to the Faculty of Graduate Studies and Research (FGSR) regulations.

Students who are initially MSc candidates can have their status changed to the PhD stream on the recommendation of their supervisory committee and approval of the Graduate Coordinating Committee (GCC) following one or two years of satisfactory performance in course work and research.

The Department of Biochemistry does not require knowledge of any language other than English for the MSc degree.

### The Doctoral Degree

To be eligible for a PhD degree, students are required to have a cumulative GPA of not less than 3.3 in non-seminar courses taken during the graduate program. Failure (a grade of C+ or lower) in two one-term courses or in a single two-term course will normally result in an automatic recommendation to terminate a student's program unless the student's cumulative GPA at that time is 3.0 or higher.

Each PhD graduate must have given at least three presentations to a journal club, of which at least two must be given before the student may take the candidacy examination. Abstracts and seminar notices must be submitted to the Graduate Program Advisor.

PhD candidates are required to pass an oral candidacy examination. The examination is based on a research proposal written by the student and evaluated by the candidacy examination committee. **The candidacy exam must be completed within the first three years of the program.** The exam is conducted by a committee comprising the student's supervisory committee and at least two additional members of the academic staff who have not been involved in the student's research project. One member must be from a department other than Biochemistry. A student who fails the examination will normally be required to withdraw from the program.

All candidates for the PhD degree must prepare an acceptable thesis describing the results of their research activities, and be examined orally on the thesis by a committee formed according to the Faculty of Graduate Studies and Research (FGSR) regulations.

The Department of Biochemistry does not require knowledge of any language other than English for the PhD degree.

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### **Course Requirements**

All candidates for the MSc or PhD degrees must include some course work in their program, normally equivalent to at least two and one-half full-year (or five single-term) courses (16 course weights): BIOCH 670 (4 credits); BIOCH 671 (4 credits); BIOCH 6xx journal club (2 credits); one of BIOCH 620, 630, 641 or 655 (3 credits); BIOCH 5xx or 6xx (3 credits).

Students entering their graduate programs without the appropriate advanced level undergraduate courses in the major areas of biochemistry will be required to take additional course work. In particular, students who have not taken any advanced biochemistry courses will be required to enroll in at least two 500-level courses in addition to the minimum course requirement.

All graduate students are required to take at least 2 additional courses. One of these must be a 600-level Biochemistry course. The current list of courses that satisfy this requirement included BIOCH 620, 630, 641, and 655. These courses are directed reading courses in which graduate students are challenged to analyze and critique current research papers on selected topics.

The other required course is a graduate level course in Biochemistry (500 or 600 level) or an approved graduate course in another department. These requirements are the minimum and students who wish to take additional courses to enhance their background to or development expertise in additional research areas are encouraged to do so.

### **Seminar Courses and Journal Clubs**

All graduate students are required to enroll in the seminar courses BIOCH 670 and BIOCH 671.

- BIOCH 670 will be taken for credit in the first year of the program. Students will present one literature-based seminar on 1-2 peer reviewed scientific publications, usually in Winter Term for new students starting in Fall Term.
  - Third year graduate students will register in BIOCH 671. Students will present a seminar on their research in the fall term of their third year. The BIOCH 671 seminar will normally be combined with the candidacy examination.
    - The decision to transfer from the M.Sc. program to the Ph.D program or to remain in the M.Sc. program should normally occur before the end of the second year, prior to September 1<sup>st</sup> of the third year. When a transfer to the Ph.D. program is recommended, BIOCH 671 will be linked to the candidacy examination for all Ph.D. students.
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- Transfer from the M.Sc. to the Ph.D. program after September 1<sup>st</sup> of the third year will only be considered if significant changes in the student's research have occurred after this time.
- For a PhD student, the BIOCH 671 presentation will normally be followed by a candidacy examination the next day.

Students are graded independently for BIOCH 670 and 671 and are required to attend these seminar series regularly during all years of their program.

All graduate students must enroll once for credit in a relevant specialized journal club course, such as BIOCH 623, 626, 640 or 650. The BIOCH 670, BIOCH 671 and journal club courses fulfill 10 course weights of the minimum course requirements. Abstracts and seminar notices must be submitted to the Graduate Program Advisor.

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**Department of Biochemistry  
Graduate Program Course Requirement Checklist**

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Name: \_\_\_\_\_ Program: \_\_\_\_\_

Admit Date: \_\_\_\_\_ Supervisor: \_\_\_\_\_

All candidates must include course work in their program, equivalent to at least two and one-half full-year (or **five** single-term) courses or 16 course weights. BIOCH 670, BIOCH 670 are required. One Journal Club is required. One didactic 600 level course is required (not a journal club). At least one more course, didactic 600 or 500 level (not a journal club) is required.

**Required Seminars:**    BIOCH 670 (\*4) [ ]    670 and 671 are mandatory for all students.  
  BIOCH 671 (\*4) [ ]

**One Journal Club:**    BIOCH 626 (\*2) [ ]    Students should participate in the appropriate  
  BIOCH 640 (\*2) [ ]    Journal Club each year but register for credit  
  BIOCH 650 (\*2) [ ]    one time during the graduate program.  
  BIOCH 651 (\*2) [ ]  
  BIOCH 623 (\*2) [ ]

**Didactic 600 level:**    BIOCH 609 (\*3) [ ]    All students require one or more of the didactic  
  BIOCH 620 (\*3) [ ]    600 level courses.  
  BIOCH 630 (\*3) [ ]  
  BIOCH 641 (\*3) [ ]  
  BIOCH 655 (\*3) [ ]  
  BIOCH 675 (\*3) [ ]

**500 level course:**    BIOCH 510 (\*3) [ ]    Students may take 500 level courses to complete  
  BIOCH 520 (\*3) [ ]    the requirement for 16 course weights.  
  BIOCH 525 (\*3) [ ]  
  BIOCH 530 (\*3) [ ]  
  BIOCH 541 (\*3) [ ]  
  BIOCH 550 (\*3) [ ]  
  BIOCH 555 (\*3) [ ]  
  BIOCH 565 (\*3) [ ]

Students are permitted to take graduate level courses outside the department to meet their requirements if the supervisor and Graduate Program Coordinator approve the courses.

### **Lectures in Biochemistry**

Each year the department hosts a “Lectures in Biochemistry” seminar series in which invited scientists give research seminars on a broad range of subjects. Graduate students are required to attend these seminars, as they are an important part of a graduate student’s education.

### **Academic Integrity and Ethics Training Requirement**

Graduate degree requirements include a mandatory component that provides training in the areas of academic integrity and ethics.

The normal requirements of this training component will include participation in activities such as workshops, presentations, discussion groups and course work related to each of the following areas:

- **The Annual Ethics and Scientific Integrity Days. (5 hours of training).**
- **Introduction to Ethics, Integrity, and Responsibility in the Laboratory for First Year Graduate Students. (1 hour of training).**
- **GET Program (Graduate Ethics Training) a WebCT course organized by the FGSR. (5 hours of training).**
- The Care and Use of Animals in Research, Teaching and Testing (includes proper care and handling of animals). (1.5 hours of training).
- The Radiation Safety Course. Completed in accordance with the Nuclear Safety and Control Act and Regulations of Canada to ensure safe and responsible laboratory conduct.

**The Department of Biochemistry requires the first three activities be completed within the first two years of the MSc and PhD programs.** These **mandatory** activities will provide approximately 11 hours of training. Participation will be monitored and verified to the FGSR.

Please be aware you will not be able to submit your thesis nor graduate without the ethics requirement.

### **Teaching Duties**

All students must contribute to teaching responsibilities in BIOCH 200 or BIOCH 401. Every effort will be made to ensure equal distribution of responsibilities.

### **Academic Standing**

Students are required to have a cumulative Grade Point Average (GPA) of not less than 3.3 (for the PhD program) and 3.0 (for the MSc program). In calculating the GPA, seminar courses are not included.

Failure (a grade of 2.0 or lower) in two one-term courses, or in a single two-term course, would normally result in the automatic termination of the program, unless the cumulative GPA is 3.0 or higher.

### **Annual Report**

Each year graduate students are required to complete an annual report. This report updates the Graduate Coordinator on student progress and also ensures degree requirements are being met on schedule.

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## Section 5 Responsibilities Related to Graduate Programs

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### **Graduate Student Responsibilities and Expectations**

Admission into our graduate program is a first step in what may be a long and productive career in science. To take full advantage of the opportunities graduate studies offers, both now and in the future, you should understand the responsibilities and expectations. Once your supervisor has been determined, you and your supervisor will be required to complete a Conversation Checklist for a New Graduate student along with a Memorandum of Understanding. Please ensure you understand what was discussed. If you need clarification please communicate this to your supervisor, or contact the Graduate Coordinator for assistance.

Graduate students are ultimately responsible for their own programs. They are expected to read the Calendar and any other relevant documents to become familiar with all regulations and deadlines relating to their programs.

The students' fundamental responsibilities include ensuring that their registration is accurate and does not lapse, submitting appropriate forms to the department for signature and processing, and paying all fees required by the deadline dates set out in the Calendar.

### **Graduate students should:**

- make themselves aware of the contents of the graduate portions of the Calendar and take responsibility for their own programs in that the Calendar sets out the requirements for the various programs;
- maintain open communication with their supervisor and Graduate Coordinator concerning any problem either real or perceived;
- inform the supervisor regularly about progress, and provide the supervisor with an annual report for distribution to the supervisory committee;
- make research results accessible (beyond their appearance in a thesis) to an appropriate audience;
- be aware of deadlines for possible scholarship applications, and seek advice and assistance from the department in making applications, etc.

### **Research Expectations**

All graduate students are expected to have a supervisory committee formed within 12 months of admittance, and to meet with their committee at least once per year. It is important to involve the members of your committee early and often. You will be expected to submit a progress report which will be signed by your supervisory committee, and then submitted to the Graduate Coordinator. The purpose of your supervisory committee is to ensure your graduate education experience is the best it can be.

1. Your research is expected to make a significant contribution to the body of knowledge in the area of the thesis and generate original data suitable for publication in peer-reviewed journals. Publication of research results is one standard by which you will be judged by your peers.

The following are suggested guidelines:

- Aim to publish in top-tier journals in your area of research.
  - Produce 1-2 peer-reviewed publications from an MSc thesis.
  - Produce 3-5 peer-reviewed publications from a PhD thesis.
  - Present your findings at suitable regional, national, and international meetings.
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2. Departmental activities should be a high priority for graduate students because they expose students to a broader spectrum of scientific knowledge than can be offered by any single laboratory. They also provide an opportunity to develop presentation skills and offer possibilities for networking. All graduate students are expected to participate in Departmental activities including:
  - Department of Biochemistry Seminars.
  - Recruitment Candidate Seminars.
  - Thesis Defense Seminars.
3. All graduate students are expected to devote their full-time efforts to research, teaching and courses. **Stipend support is provided to allow full attention to these responsibilities** and the Department expects a high level of commitment to them. Any additional commitments that impair a student's ability to meet these responsibilities may not be undertaken without permission of your research supervisor. The stipend is not a wage, but support to allow you to pursue a graduate degree. You are entitled to three weeks' vacation per year. Vacations or leaves should be arranged in consultation with the supervisor to minimize the negative impact on research in the laboratory.
4. Graduate students are expected to work in a group or team environment. Regular communication with the supervisor is essential for a healthy and productive relationship. Students should respect the work and equipment of others and be aware that facilities or resources are often shared. The workplace must be safe, tidy and health for all. Students should be thoughtful and economical in using lab resources. Students must maintain good records of their work.
5. All original research materials (notebooks, tapes, computer hard drives, and disks, etc) must remain with the supervisor upon completion of the degree. These items belong to the University of Alberta. You are entitled to retain a copy of all materials.
6. Graduate students are expected to uphold the high standards of research and the integrity. Students should familiarize themselves with the Intellectual Property Guidelines of the University of Alberta. [Intellectual Property Guidelines](#)

**Program Expectations:**

1. Students must maintain a GPA of 3.3 to remain in the PhD Program.
  2. Students must maintain a GPA of 3.0 to remain in the MSc Program.
  3. All students, regardless of the source of their stipend, must participate in undergraduate teaching associated with Biochemistry 401. You will need to communicate with the course coordinator to understand your responsibilities.
  4. **A maximum** of 3 or 5 years between entering the graduate program and completing all requirements for the MSc and PhD is permitted, respectively.
  5. All candidates for graduate degrees must include at least five (5) single-term courses (16 course weights) in their program.
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## **General Expectations**

### **Graduate students:**

- Are creative and broad-minded.
- Set clear research and career goals.
- Integrate ideas, methods, skills, and knowledge to fulfill research and career goals.
- Must take the initiative and responsibility for their graduate programs.
- Are productive and demonstrate their talents through high quality peer-reviewed publications.
- Are goal-oriented rather than time oriented. Research is not a job, but a career and a passion.
- Are aware that a degree is awarded for scholarship, not for marks, hours in the lab, or data collection.
- A PhD is awarded for independent and innovative thinking.
- Develop excellent communication skills.
- Regularly read the literature.
- Recognize that enthusiasm, optimism, and dedication are the best path to success.
- Are available to others. Research is usually a team activity.
- View graduate school as professional development; science and research offer life-long opportunities for professional growth and development.
- Are 'junior colleagues in research' and not employees or technicians.

### **Responsibility of the Supervisor**

The supervisor is directly responsible for the supervision of the student's program. In this capacity, the supervisor assists the student in planning a program, ensures that the student is aware of all program requirements, degree regulations, and general regulations of the department and the Faculty of Graduate Studies and Research (FGSR), provides counsel on all aspects of the program, and stays informed about the student's research activities and progress.

The supervisor is also charged with ensuring that students conduct their research in a manner that is as effective, safe, and productive as is possible.

The supervisor must prepare a program of studies for the student, arrange for and attend all supervisory committee meetings and examinations, ensuring that these are scheduled and held in accordance with FGSR regulations, and must review the thesis both in draft and in final form.

The supervisor with the support of the home department should:

- provide an environment for the student that is conducive to research and in which the student can grow intellectually;
  - provide appropriate guidance to the student on the nature of research and the standard expected, and be accessible to give advice and constructive feedback; at the beginning of the supervisory relationship, the student should be made aware of the normal expectations held by the supervisor and the department;
  - with the student establish a realistic timetable for completion of various phases of the program;
  - consider a graduate student as a "junior colleague in research";
  - ensure that there are sufficient material and supervisory resources for each graduate student under supervision;
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- work with the student to establish the supervisory committee as soon as possible after the start of the program and ensure that it maintains contact and formally meets at least once a year with the student;
- when going on leave or an extended period of absence, ensure that the student is adequately supervised by the provision of an acting supervisor (who should be a member of the supervisory committee);
- ensure that the student is aware of his/her guidelines and, when necessary, assist the student in meeting these;
- set up committee meetings and examinations after consultation and with full knowledge of the student.

### **Responsibility of the Department of Biochemistry**

The term "Department" applies both to a department and to a non-departmentalized faculty (eg, Law, Nursing, Pharmacy and Pharmaceutical Sciences); or to an extra-departmental graduate program (ie; PhD in Medical Sciences, Neuroscience). The term "Department" also refers to the Chair, Graduate Coordinator, Director, or any other individual officially designated as being responsible for graduate programs.

- The department oversees the supervision of all graduate students enrolled in its programs and serves as the chief liaison with the FGSR. It is responsible for ensuring that the student receives proper supervision and that the regulations and requirements of the FGSR are met.
  - The department is responsible for recommending and keeping the FGSR informed of any development in or changes relating to the student's program, including the appointment of the supervisor and supervisory committee members (where applicable) and changes to that membership, course and program changes, scheduling of examination dates, and so on.
  - The department's Graduate Coordinator is the official representative of the department to its graduate students.
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## Timeline for Students

### Year One (1 to 12 months)

- Register for courses and thesis.
- Attend 1 hour **MANDATORY** Ethics Training Session.
- Supervisory Committee must be in place.
- Hold first Supervisory Committee Meeting to assess progress (progress report to be provided by student).
- Register in Biochemistry 670.
- Submit Graduate Student Annual Report.

### Year Two (12-24 months)

- Register for courses and thesis.
- Attend the Annual Ethics & Scientific Integrity Days Ethics Sessions. Finish department ethics requirements.
- Hold 2<sup>nd</sup> Supervisory Committee Meeting to assess progress (progress report to be provided by the student).
- Inform the Graduate Program Advisor if a transfer from the MSc to PhD program is applicable (must be supported by the Supervisor and Supervisory Committee). This must be completed before year 3 of the program. Transfers can only be processed at the beginning of a term.
- Prepare for Master's Final Oral Exam (if applicable).
- Submit Graduate Student Annual Report.

### Year Three (24-36 months)

- Register for courses (if applicable) and thesis.
- Hold 3<sup>rd</sup> Supervisory Committee meeting to assess progress (progress report to be provided by the student).
- Arrange meeting with Supervisory Committee to approval PhD thesis proposal.
- Register in Biochemistry 671.
- Candidacy examination
- Submit Graduate Student Annual Report.

### Year Four (36-48 months)

- Register for thesis.
  - Hold 4<sup>th</sup> Supervisory Committee meeting to assess progress (progress report to be provided by the student).
  - Complete thesis research.
  - Prepare for thesis examination.
  - Prepare and present final thesis seminar.
  - Submit Graduate Student Annual Report.
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### **Code of Student Behavior**

The University is defined by tradition as a community of people dedicated to the pursuit of truth and advancement of knowledge, and as a place where there is freedom to teach, freedom to engage in research, freedom to create, freedom to learn, freedom to study, freedom to speak, freedom to associate, freedom to write and to publish. There is a concomitant obligation upon all members of the University community to respect these freedoms when they are exercised by others.

For these freedoms to exist, it is essential to maintain an atmosphere in which the safety, the security, and the inherent dignity of each member of the community are recognized. Please review the code carefully. <https://www.ualberta.ca/governance/resources/policies-standards-and-codes-of-conduct/code-of-student-behaviour>

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## **Section 6 Supervisor and Supervisory Committee Members**

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### **Choosing a Supervisor**

The responsibility for finding a supervisor rests with the student. Choosing a faculty member is one of the most critical decisions a graduate student will make. Several years will be spent working with the faculty member of choice and that choice will significantly affect the direction of the student's career. Choosing a supervisor is not a decision to be taken lightly. A student should seek a supervisor who is academically competent in a particular area and is always willing to act as an advocate for the student when necessary.

The student should be able to work and communicate effectively with the supervisor and not feel intimidated in the relationship. The graduate student: supervisor relationship is beneficial to both parties. *Each student requires the guidance of someone who will stimulate thought and creativity and who will challenge the student to achieve his or her potential in research.*

Choosing a new faculty member as a supervisor has advantages and disadvantages. In the research group of a new faculty member, graduate students often have a wider choice of projects and can expect extensive interactions with the supervisor. In the groups of more established faculty members, new students may have a more limited choice of projects and may not have daily access to the supervisor. In a new lab, equipment must be purchased and set up and new techniques must be established; these activities require time and effort, but that time and effort will contribute to a deeper understanding of the research and to your independence. In more established labs, equipment and trained personnel are already present, offering opportunities to make rapid progress in research. Choose the environment that best matches your expectations and research style. *Make an informed decision and do not let others make the decision for you.*

### **Selection of a Supervisor**

- The selection of a supervisor is made by mutual agreement between the student and faculty member.
  - The supervisor can be any faculty member with a primary appointment in Biochemistry or a cross-appointed faculty who is permitted to supervise Biochemistry graduate students.
  - No faculty member is obligated to accept a student into their laboratory.
  - A student must have a supervisor to remain in the program.
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### How to get started in choosing a supervisor:

Find and read information about potential supervisors on the department website. Download and read recent publications authored by potential supervisors.

- Attend a seminar or class given by a potential supervisor.
- Introduce yourself to graduate students currently working with a potential supervisory. They are an invaluable source of information.
- Make an appointment to meet with potential supervisors.
- Consider joint or co-supervision if it seems appropriate.

### Questions to ask a potential supervisor:

- How many graduate students have you supervised? How many do you currently have?
- How many hours of work per week do you expect from a graduate student? How much time do you expect students to take to complete their theses?
- Specifically, what research projects do you have available for me? How long have you been interested in these areas?
- Are funds available for a stipend and for conducting the research project?
- What level of independence do you expect of graduate students?
- Will I have the opportunity to attend conferences?
- What are your expectations in terms of productivity and research publications? Who will write the manuscripts?
- How often do you meet with your students? Do you have group meetings or meet individually with your students? Do you wish to communicate in person or by email? Do your students have regular supervisory committee meetings?
- How often do you travel? Are you planning a sabbatical soon?
- What qualities are you looking for in a graduate student?
- Do you have any other expectations of your students?

### Questions you should be prepared to answer from a potential supervisor:

- What do you expect from a supervisor?
- Are there any plans that may interfere with your completing your degree? Are you considering a doctoral degree?
- Do you have any disabilities or other concerns that may need to be accommodated?
- Why do you find this area of research interesting and promising?

### **Supervisor and Graduate Student Relationships**

Poor graduate student/supervisor relationships can lead to negative consequences for the student, the supervisor, and the department. These consequences may be no more than aggravation, but they can also extend to damaged career prospects, damaged reputations and

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lawsuits. The biggest source of trouble is the clash of expectations between the student and the supervisor.

**Some suggestions for healthy student and supervisor relationships are:**

- Avoid entering into an unhealthy relationship. An academic relationship does **not** entail that you are drinking buddies or close personal friends. Avoid any relationships that create a conflict of interest. Choose your relationships carefully by making informed choices based on research and interviews.
- Clearly communicate your expectations and listen carefully to the other person's expectations before committing. Once established, lay out milestones in your program and revise them **together** as needed.
- Good relationships require good management. This relationship is too important to be anything but *scrupulously professional and respectful*. A supervisor should be academically supportive but should not become a part of the student's emotional support group. The university has a wide variety of student services available, and a supervisor should refer students to the appropriate university resource for assistance.
- Keep track of all discussions and decisions. Retain all emails and notes. After meetings one party should be responsible for sending an email summary of the discussion to the other person.
- When problems do arise, deal with them early. Try to resolve the problem through direct communication. Present rational arguments, not emotional ones.
- When necessary, seek advice or assistance from colleagues, the Graduate Coordinator, the Chair, the Graduate Ombudsperson, or the Associate Dean of the Faculty of Graduate Studies and Research (FGSR).
- Assessments of performance are part of every student/supervisor relationship. Feedback should be given calmly and productively.
- Don't say something you wouldn't say in front of an appeal board (something you can back up with facts). Provide written feedback whenever possible.
- Consider co-supervision to preserve or enhance a difficult relationship.
- Respect confidentiality. Only share information on a 'need to know' basis.
- Not all students will complete their programs. Termination of a program is a last resort after all options have been exhausted. A supervisor should consult appropriately, make the decision in consultation with the supervisory committee, document the reasons and allow the appeal process to take its course if it is invoked.

**Supervisory Committee Members**

After a new student chooses a supervisor, a supervisory committee should be appointed within three months. If the supervisor is an adjunct appointment to the department, another biochemistry faculty must serve on the committee.

As minimum criteria, supervisors and committee members must:

- normally be full-time faculty
  - be active in the general area of the student's research
  - have a tenured (or tenure track) faculty appointment (including soft tenure track faculty appointments such as University Research Fellows and Heritage Scholars) in a department relevant to the field
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- hold a degree equivalent to or higher than that for which the student is a candidate. (This would always be the case for newly appointed faculty, but certain recognized and well-established exceptions should be respected.)
- demonstrate continuing scholarly or creative activity of an original nature

Because of diverse interpretations of the term "scholarly or creative activity", the Faculty will always find it necessary to rely on sound and informed judgment of chairs and graduate coordinators to ensure adherence to minimum faculty criteria.

The determination of "scholarly or creative activity" assumes a continuing peer review process that, at least indirectly, is included annually at the appropriate Faculty Salaries and Promotions Committee. The following list summarizes criteria used by various faculties to describe scholarly or creative activity:

- publication of research papers in refereed journals
- publication of research papers in journals acceptable to the discipline
- publication of books and/or monographs
- publication of research findings in conference proceedings
- publication and/or performance of new compositions or plays
- exhibition of new artistic works
- peer recognition of outstanding professional practice
- invitations to speak at conferences or at other institutions
- editorial or refereeing responsibilities for journals
- invitations to serve as external examiner for the PhD
- presentations at professional society meetings or workshops
- invitations to review grant proposals or manuscripts
- invitations to referee requests for promotions to full professor in recognized institutions
- additional criteria approved by the Dean, FGSR may be added by individual departments, and should be included in departmental graduate handbooks.

### **"Grey" Areas— Individual Categories Eligible for Supervisors and Committee Members**

There are several potentially "grey" areas relating to eligibility for graduate supervision and committee membership, including such categories as retired professors, professors from departments not offering a graduate program, clinical appointees, adjunct professors from outside the University, sessionals, faculty service officers (FSOs), postdoctoral fellows (PDFs), research associates, and experts from outside the University.

For approval of the following categories the department shall formally apply to the Dean, FGSR:

- retired professors or professors emeriti
- professors from departments not offering a graduate program
- clinical appointees
- adjunct professors who do not hold academic appointments at the University of Alberta

The request for supervision or committee membership approval should include a memo indicating the reasons for, and the benefits of, having such a colleague as co-supervisor or on the proposed supervisory or examining committee, and the proposed individual's current CV.

If approved, the colleague will remain eligible for appointment to new committees for three years.

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Appointments will only be made of those individuals expected to be able to remain on the committee until completion of the student's degree program. Should there be a change in the relationship between the home department and the approved appointee, the department should assess the implications and inform the Dean, FGSR.

In all cases colleagues from the following groups should be active in a scholarly or creative way as demonstrated by satisfying an appropriate set of criteria from among those listed previously.

Retired Professors or Professors Emeriti may serve as co-supervisor or as a supervisory committee member after the initial decanal approval outlined above.

The other co-supervisor should be from the student's home department. They may serve as examining committee members in the same manner as continuing academic staff. The Dean may waive the approval mechanism where circumstances warrant.

Request for supervisors who have taken early retirement will be dealt with by the Associate Dean, FGSR on a case-by-case basis. The guiding principle will be that faculty who take early retirement can continue to supervise the graduate students they already have, as long as the chair of the department approves.

Professors from Departments not offering a graduate program may serve as co-supervisors or as members of supervisory or examining committees after initial decanal approval.

Clinical Appointees may serve as co-supervisors or as members of supervisory or examining committees after initial decanal approval. They may sit on examining committees as fully enfranchised members but additional to the normal complement of University examiners.

It is imperative that clinical appointees serving as co-supervisors or on supervisory committees be readily accessible to the student for the duration of the program. They may be "internal-externals" only if they come from units with doctoral programs.

Adjunct Professors who do not hold academic appointments at the University of Alberta may serve as co-supervisors or as members of supervisory or examining committees after initial decanal approval. They may serve on candidacy or final examining committees as fully enfranchised members but additional to the normal complement of University examiners. They may not serve as the "internal/external" committee member.

**Additional categories:**

Experts from outside the University may, if approved by the Associate Dean on an ad hoc basis, serve on examining committees as fully enfranchised members but additional to the normal complement of University examiners.

The FGSR interpretation is that this category includes First Nations' Elders where appropriate, given the academic and cultural context of the student's research program. Departments must indicate why this individual is considered an Elder and justify his/her inclusion on the committee as an Elder.

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For off-campus experts, there should be an indication of the means by which meaningful interaction can be maintained.

Adjunct Professors from inside the University may serve as supervisors, co-supervisors or as members of supervisory or examining committees in the department where they hold the adjunct appointment, but they are not to serve as the "internal-external" committee member. They are not required to be extra to the committee. Initial decanal approval is not required.

Sessionals, Research Associates, FSO's, and PDF's are not eligible to serve on committees, unless recommended by a Chair and approved by the Dean on an ad hoc basis.

### **Supervisory Committee Meetings**

Supervisory Committee Meetings must be held at least once per year. This meeting is arranged by the Supervisor.

Students must provide a brief written report (no more than 10 double-spaced pages) outlining their research activities. The report must be sent to the Supervisory Committee at least 5 business days in advance of the committee meeting.

The Supervisor will complete a Report of Supervisory Committee Meeting form which outlines the student's progress and outlines specific recommendations. The report is signed by the student and the supervisor and held in the student's permanent file.

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## **Section 7 Program Transfer from MSc to PhD Programs**

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A Master's student can request to be transferred to the PhD program. To be considered for promotion, the following guidelines must be adhered to:

- A minimum Grade Point Average (GPA) of 3.3 in all non-seminar courses should normally have been attained.
  - The decision to transfer should normally occur before the end of the second year, prior to September 1, of the third year.
  - The student has demonstrated that they are capable of significant original research work.
  - The student commands an adequate, growing and critical knowledge of the discipline and of the subject matter relevant to the thesis.
  - The student is developing originality and creativity relevant to the thesis.
  - The student displays the enthusiasm, drive and commitment expected of a doctoral student.
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## **Section 8 Doctoral Candidacy Examination**

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### **The Doctoral Candidacy Document**

The Candidacy document is a written research proposal that should take the form of a grant application to a funding agency such as the Canadian Institute for Health Research (CIHR). This document is to be a research proposal and as such the primary focus should be placed upon experiments and research that the PhD candidate proposes to do rather than on data that has already been collected. Normally the Candidacy document will be a proposal for research that the PhD candidate is proposing to perform to complete their PhD thesis.

### **How to Write a Great Candidacy Proposal**

The objective of these guidelines is to assist you in preparing an effective candidacy proposal that is clear, focused and a pleasure to read. Good writing doesn't save bad ideas, but bad writing kills good ones.

### **The examining committee:**

The doctoral Candidacy examining committee is composed of 5 University of Alberta Faculty members. This will typically consist of the students supervisor, two supervisory committee members and two "arms-length examiners" An arms-length examiner is an individual that is: not a member of the supervisory committee; not connected with the thesis research in a significant way; not associated with the student outside of usual contact in courses or other non-thesis activities; and not a close collaborator of the supervisor. An arms-length examiner may be from the same or another department and may serve as an arms-length examiner for both the candidacy and Doctoral final examination.

### **Long before D-day:**

- Consider the time frame you have to work in. The Candidacy proposal must be submitted to your examining committee **two weeks before the date of the exam.** Failure to submit the document on time may lead to postponing the exam.
- Ask your fellow graduate students for past examples of successful candidacy proposals. Reading good proposals will give you ideas on layouts and styles that could work for you.
- Start thinking of interesting projects and experiments many months before D-day. Try to find an appropriate balance between the "sure" (experiments that have a high likelihood of success but still provide new information), and the innovative or risky (experiments that may not succeed but have potential to provide significant new insight). Avoid being too cautious and doing 'more of the same'. Design experiments to provide new and important information even if the results don't support your hypothesis. Try to incorporate alternative approaches when possible.
- Show the reader that you are aware the initial approach may not be successful and that you have a back-up plan.
- Discuss your ideas with colleagues. Explaining your ideas will help to clarify and focus them and to identify problems.
- **The candidacy document must be your own creation**, although you should avail yourself of expertise to discuss ideas and obtain specific information.

- **The supervisor must not edit or revise the document, nor should the document be based on your supervisor's grant proposals.**

### **General Considerations**

- Everybody is busy, so make your proposal easy to read, with a pleasant and attractive presentation. A sloppy application is often equated with sloppy science. Examiners that have to struggle with your proposal are likely to be more critical.
- Use appropriate type 12 pt, font: Times, Times New Roman or Helvetica, use 1 1/2 line spacing and margins 1 inch top, bottom and each side. Do not exceed the maximum number of pages allowed. The main body of the document is limited to 15 pages (12 point font; 1 1/2 spacing), not including references and figures. Append as many figures and tables as necessary but do not include superfluous material. Remember you are accountable to defend anything you include in this document. Figures not made by you should be attributed appropriately. Figure legends should be sufficiently explanatory for the reader to understand what the figure shows. The purpose of the legend is to define parts of the figure, not to extend the text page limit. Keep each legend to a maximum of 5 lines. Make figures large enough to see all the details sufficiently to evaluate.
- Organize your proposal with appropriate headings and sub-headings. Use a simple and obvious numerical classification. For example, Specific Aim 1 may be followed by experimental approaches 1.1 and 1.2.
- Each paragraph should begin with a strong lead sentence that is interesting and defines the rest of the paragraph. You should be able to get the sense of a proposal by reading only the lead sentences. The remainder of the paragraph elaborates on the lead sentence. A good lead sentence is more effective than a strong concluding sentence.
- Examiners often do their reading in bits-and-pieces. Organize your proposal with this in mind. It can be rather depressing to see 15 pages of dense text without any visual breaks.
- Use the first person (I will measure the activity ...) and an active voice. Rather than "The enzyme is being inhibited by ATP." use "ATP inhibits the enzyme."
- Be ruthless when editing your document. Eliminate statements that do not convey anything important. Scientific proposals are not literature; don't use flowery language and rambling sentences.
- Do not be solely dependent on your computer's spell checker. "If you can't get the spelling right, how are you expected to get the research right?" Have at least one other person read your proposal for spelling, grammar and logic. When editing your own work, there is a tendency to see what you intended to say, rather than what you actually said.
- Avoid the excessive use of abbreviations, acronyms and jargon, especially ones that the non-expert may not understand. If you do use them, define them upon first use. If your proposal contains many abbreviated terms or acronyms, consider adding a table containing the terms and their definitions
- Assume that you are writing for an examiner in a somewhat related field, rather than for an expert directly in your area. Make it easy to read.

- Avoid preparing a fragmented and disjointed proposal. Link all the sections to each other.

### **Specific Considerations**

- Effective proposals are often divided into the following sections:
  - HYPOTHESIS AND LONG-TERM OBJECTIVES
  - SPECIFIC AIMS
  - BACKGROUND AND SIGNIFICANCE
  - RESEARCH DESIGN AND METHODS
  - TIMETABLE
- The TITLE of your project is important and sets the first impression. Make it descriptive, specific and reflect the importance of your proposal. A table of contents page can be an effective way to help organize your proposal and to orient an examiner.
- BACKGROUND AND SIGNIFICANCE: This section should include the big picture, what is known, what is not known, and why is it essential to find out. Provide a brief outline of the highlights in the background review, including your own contributions, if applicable. Don't drown them in details! You should ask yourself whether each bit of background information is needed.

Critically evaluate the relevant literature: this should not be an exhaustive or uncritical list. When a controversy or disagreement exists, discuss fairly all sides. Identify the gaps and contradictions that you will address. Link these into the rationale for your proposal. Emphasize how your proposal bridges the background review and your hypotheses and objectives. State clearly what is novel, and what is merely confirmatory. This section should not exceed half the allotted pages.

- HYPOTHESIS AND LONG-TERM OBJECTIVES: A hypothesis-driven proposal is usually better received than a primarily descriptive one. Begin with your stated hypothesis and link it to your long-term objectives. Make these concise and specific. Ask yourself what the proposed research is intended to accomplish and what its significance and relevance are?
- SPECIFIC AIMS: Distinguish these from your hypothesis and objectives. These are the specific projects or studies you will undertake as part of your long-term objectives. Put your specific aims in a logical and sequential order. Indicate the priority you assign to each one.

- RESEARCH DESIGN AND METHODS: The Specific Aims have stated what you propose. Now, you must describe how you propose to achieve them. Consider a brief opening paragraph describing the relationship of the Specific Aim to the Objectives and a one-sentence rationale. Follow this with an outline of the design and methods. Explain why the proposed approach was chosen. Don't repeat descriptions of identical procedures that apply to more than one Specific Aim. Reference, but don't describe well-known or standard procedures. Do describe procedures that are new or unlikely to be known to one or more of the examiners. For a new method, explain why it is better than a more traditional one. Discuss relevant control experiments; this is too often lacking. Explain your data collection and analysis, the expected outcomes and your interpretation. What conclusions do you expect to be able to draw? Be sure to briefly discuss potential difficulties and limitations of the proposed procedures and to provide alternative approaches. This may pre-empt serious criticisms.
- TIMETABLE: Provide a brief tentative sequence and timetable for the project. Although not essential for a candidacy proposal, thinking about timelines can alert you to issues pertaining to feasibility. Your proposal should be feasible by yourself and a laboratory technician in three to five years. Many candidacy proposals include a lifetime of work and are unrealistically ambitious.

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## **Section 9 Master's Final Examination**

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### **Thesis Seminar**

All students are required to present a seminar on their theses prior to defending. Anyone is welcome to attend the seminar. Seminars are scheduled for one hour and will precede the defense on the same day.

### **Examining Committee Composition**

Before nominating the supervisor or examining committee, ensure that eligibility criteria, conflict of interest, and teleconferencing guidelines have been met.

Minimum three faculty member examiners:

- At least one from outside the department (see "Internal/External Examiners").
- Roles of the three faculty members can be in almost any combination. Examples: co-supervisors; a co-supervisor who is also the internal-external; supervisor from outside the department.
- Must be chaired by a faculty member from inside the department
- All members must attend the examination, which includes members participating through teleconferencing (see "Attendance at Examinations").

It is the responsibility of the supervisor to ensure that:

- proper arrangements are made for the candidate's examination
- the exam is scheduled and held in accordance with FGSR regulations
- the candidate is not required to make these arrangements

In the absence of the supervisor, these responsibilities shall be carried out by the graduate coordinator or designate. It is the responsibility of the department to keep committee members informed of meetings of the committee and details of examinations.

### **Time Lines and Approval of the Final Oral Examining Committee**

At least three weeks prior to the final oral examination, it is the responsibility of the department to:

- recommend names of all members of the final oral examining committee and forward them to the FGSR for approval on a Notice and Approval of a Master's Final Oral Examining Committee form.
- notify the examiners of the examination date
- supply examiners with a copy of the thesis so that they may have adequate time to appraise the thesis

### **Changing a Final Examining Committee**

The department recommends revisions to the final examining committee by completing a Notice and Approval of a Master's Final Oral Examining Committee form and submitting it to the FGSR.

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### **Master's Examination**

The committee will review the thesis and conduct an oral examination designed to test the candidate's knowledge of the thesis subject and of related fields. The language used to conduct the final oral examination shall be English. However, the committee may petition the Dean, FGSR, and on receiving written approval, may conduct the examination in a language other than English.

### **Attendance at a Master's examination**

Except for the Dean, FGSR (or Associate Dean or pro dean), who may participate fully in the examination, persons other than the examiners may attend only with the approval of the Dean, FGSR, or the chair of the committee. Visitors may not participate in the committee's discussion concerning its decision on the student's performance and must withdraw before such discussion commences.

### **Decision of the Master's Final Examination Committee**

The decision of the examining committee will be based both on the content of the thesis and on the candidate's ability to defend it.

Normally, if all but one member of the committee agree on a decision, the decision shall be that of the majority. The dissenting committee member does not have to sign the thesis.

If two or more dissenting votes are recorded, the department will refer the matter to the Associate Dean, FGSR, who will determine an appropriate course of action.

One of the following outcomes of the final oral examination is appropriate:

- Pass
- Pass subject to revisions
- Adjourned
- Fail

**There is no provision for a final oral examination to be "passed subject to major revisions".**

**Pass:** If the student passes the examination, the department shall complete a Report of Completion of Final Oral Examination form and submit it to the FGSR.

**Pass subject to revisions:** The student has satisfactorily defended the thesis but the revisions to the thesis are sufficiently minor that it will not require a reconvening of the examining committee.

The department shall complete a Report of Completion of Final Oral Examination form and submit it to the FGSR indicating "pass subject to revisions".

It is expected that the student will make the changes in time to submit the thesis to the FGSR on or before the deadline for the next convocation.

These changes should be checked and approved by the committee chair or supervisor, who does not sign the thesis until the required changes are satisfactorily completed. Other committee

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members may also wish to withhold their signature until they can verify that their required revisions have been made to their satisfaction.

**Adjourned:** The final oral examination should be adjourned in the following situations:

- The revisions to the thesis are sufficiently substantial (if further research or experimentation or major reworking of sections are required, or if the committee is not satisfied with the general presentation of the thesis) that it will require a reconvening of the examining committee. The committee should not propose that the candidate has passed rather the committee shall adjourn the examination.
- The committee is dissatisfied with the candidate's oral presentation and defence of the thesis, even if the thesis itself is acceptable with or without minor revisions.
- Compelling, extraordinary circumstances such as a sudden medical emergency during the examination.

If the examination is adjourned, the committee should:

- Specify in writing to the student, with as much precision as possible, the nature of the deficiencies and, in the case of revisions to the thesis, the extent of the revisions required. Where the oral defence is unsatisfactory, it may be necessary to arrange some discussion periods with the candidate prior to reconvening the examination.
- Decide upon a date to reconvene. If the date of the reconvened oral examination depends upon the completion of a research task or a series of discussions, it should be made clear which committee members will decide on the appropriate date to reconvene. The final date set for reconvening shall be no later than six months from the date of the examination.
- A final decision of the examining committee must be made within six months of the initial examination.
- Make it clear to the student what will be required by way of approval before the examination is reconvened (eg, approval of the committee chair or supervisor, approval of the entire committee, or of select members of the committee).
- Specify the supervision and assistance the student may expect from the committee members in meeting the necessary revisions.
- Advise the FGSR in writing of the adjournment and the conditions.
- When the date is set for the adjourned final oral examination, the department will notify the FGSR. Normally the Dean, Associate Dean or Pro Dean attends the examination.

**Fail:** If the final examination committee agrees that the student has failed, the committee chair shall provide the reasons for this recommendation and the department's recommendation for the student's program in writing to the Associate Dean, FGSR and to the student.

The Associate Dean, FGSR will arrange to meet with the candidate and with department representatives before acting upon any department recommendation. A decision of the FGSR which affects a student's academic standing (ie, required to withdraw) is appealable.

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### **Signatures on the Master's Thesis**

Many departments adhere to the following guidelines in having members of the examining committee sign the thesis signature page:

**Pass:** Thesis is approved as is. Examining committee members sign the signature page immediately. (If one of the examiners fails the student but the student passes, that examiner does not have to sign the thesis.)

**Pass subject to revisions:** Members wishing to do so may sign immediately. The committee chair or supervisor withholds signature until the thesis is amended satisfactorily and all other committee members have signed. If problems arise in the amendment process, the chair or supervisor may wish to solicit opinions from the other committee members.

**Adjourned:** No member of the committee signs the signature page.

**Fail:** No member of the committee signs the signature page.

In cases where the Chair is not a member of the examining committee, the Chair's name does not appear on the thesis signature page, nor does the Chair sign it.

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## **Section 10 Final Doctoral Examination**

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### **Preliminary Acceptance of the Thesis**

Before the thesis is forwarded to the external examiner, PhD supervisory committee members shall declare in writing to the supervisor either that the thesis is of adequate substance (and quality) to warrant that the student proceed to the final examination or that the thesis is unsatisfactory and the student should not be allowed to proceed to the final oral examination.

The purpose of this process is to ensure the thesis is vetted by the supervisor and all supervisory committee members and to verify that it is of sufficient substance and quality to proceed to the defence.

This process is critical to protect and uphold the reputation of the department and the University of Alberta for excellence in graduate programs. It is also critical to ensure that External Examiners and other additional members of the examining committee are not asked to invest time reading a thesis that is substandard.

Departments should obtain these declarations before the date of the final examination is set and the external examiner invited. Departments may choose to prepare a "Preliminary Acceptance of Thesis" signature sheet for their own records.

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### **Inviting the External Examiner or Reader**

It is the responsibility of the Graduate Chair to nominate an external examiner or reader and to submit the name to the Faculty of Medicine and Dentistry (FoMD) for approval. This should be done on a Request to Invite External Reader or Examiner for the Final Doctoral Oral Examination form prepared by the department normally **at least two months** in advance of the examination date.

The submission must include a brief CV of the external examiner and a short statement regarding the external's qualifications. The FGSR is particularly interested in the external examiner's current scholarly publications and research activities and experience with graduate student education.

The external shall be a recognized authority in the special field of research of the candidate's thesis, and will be an experienced supervisor of doctoral students. The proposed external examiner must be in a position to review the thesis objectively and to provide a critical analysis of the work and the presentation. It is therefore essential that the external examiner not have a current or previous association with the student, the supervisor, or the department that would hinder this type of objective analysis. For example, a proposed examiner who has recently been associated with the student as a research collaborator or co-author would not be eligible. Also, a proposed external examiner must not have had recent association with the doctoral candidate's supervisor (as a former student, supervisor, or close collaborator, for instance). Supervisors who are in doubt about the eligibility of a potential external examiner should call the Associate Dean, Research (FoMD), to review the case before approaching the external.

Under normal circumstances the same person will not be used as an external examiner at the University of Alberta if that examiner has served in the same capacity at this University within the preceding two years.

The FGSR interprets this to mean the same external examiner cannot be used in the same department within two years; this does not preclude an examiner serving in another department.

Once the external has been approved by the FoMD, the Associate Dean will officially invite the external, with a copy of the letter of invitation to the department.

**The external shall receive the thesis at least four weeks before the final oral examination.**

The external should not be contacting the supervisor directly regarding the thesis or making arrangements related to the examination.

### **FGSR Travel Funds for External Examiners**

The Dean, FGSR, has limited funding available for external examiners if graduate coordinators provide a compelling rationale why it would be particularly important to have an external examiner in attendance.

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### **Final Doctoral Examining Committee Composition**

Before nominating the final doctoral examining committee, ensure that eligibility criteria, conflict of interest, and teleconferencing guidelines have been met.

Minimum five faculty member examiners:

- The supervisory committee and (normally) the addition of at least two other faculty members
- At least one University of Alberta member must be from outside the department (see “Internal/External Examiners”).
- One member must be an external examiner/reader from outside the University
- In addition to the external, the committee must have a minimum of one additional arm's length member who comes new to the examination (but may have served on the candidacy examining committee). The FGSR encourages departments to nominate for this function a University staff member who comes to the finished thesis having read none of its earlier drafts. In this way the student benefits from an outside perspective without any of the possible biases of the supervisor and supervisory committee members.
- Must be chaired by a faculty member who is not the supervisor (or co-supervisor) but is a member of the student's home department. If this chair is not a member of the examining committee (FGSR encourages this arrangement), the chair does not vote.
- Must have a minimum of five members in attendance at the examination, which includes members participating through teleconferencing (see “Attendance at Examinations”). If an external reader is used, there still needs to be five members in attendance at the examination.
- Roles of members (except the chair) can be in almost any combination. Examples: co-supervisors; a co-supervisor from outside the department; supervisor from outside the department; arm's length member from inside or outside the department, etc.

### **Approval of the Final Doctoral Examining Committee**

The department will recommend names of all members of the final oral examining committee and forward them to the FGSR for approval on a Notice and Approval of Doctoral Final Oral Examining Committee form. This form must be submitted to the FGSR at least three weeks before the date of the final oral examination.

**Changing a Doctoral Final Oral Examining Committee** The department recommends revisions to the final examining committee by completing a Notice and Approval of Doctoral Final Oral Examining Committee form and submitting it to the FGSR.

### **Report of the External Reader**

In the letter of invitation sent to the external reader by the FGSR, the external reader is requested to provide to the graduate coordinator in the department and the FGSR, at least one week in advance of the examination, a written evaluation of the thesis, including the following items:

- a statement that the thesis is acceptable for the doctoral degree,
  - either a brief, written commentary on the scope, structure, methodology, and findings of the thesis, which can be read to the candidate for response, or
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- a list of clear, direct, contextualized questions (preferably no more than five) for the candidate to address during the examination,
- a list of minor corrections (if any).

The chair of the examining committee will present the external's report and questions to the student for the first time during the examination and the committee will evaluate the student's answers as part of the examination.

### **When an External Examiner Attends the Oral**

If the department and supervisor have the resources to bring an external to the campus for the examination, the FGSR encourages them to do so. In these cases, departments should indicate on the Request to Invite External Reader or Examiner for the Final Doctoral Oral Examination form that the external will be in attendance. Once the external examiner is approved by the Associate Dean, FGSR, a letter of invitation will be mailed to the external asking that the thesis be temporarily placed in one of the following categories:

- the thesis is acceptable with minor or no revisions;
- the external wishes to reserve judgment until after the examination; or
- the thesis is unacceptable without major revisions. If the thesis is judged by the external to fall into the last category, the external is asked to contact the Associate Dean, FGSR immediately, since the final examination may have to be postponed.

The external examiner will also be asked to make travel arrangements in consultation with the department. All travel expenses involved are the responsibility of the department.

### **Report of the External Examiner**

In the letter of invitation sent to the attending external examiner by the FGSR, the external is requested to prepare and send to the graduate coordinator, at least one week in advance of the examination, a brief written commentary (approximately two to three pages) on the structure, methodology, quality, significance and findings of the thesis for the reference of both the candidate and supervisor. The commentary should not be given to the student prior to the examination.

### **Establishing Doctoral Examination Procedures**

Each department offering a doctoral degree is required to establish detailed examination procedures for final oral examinations. These procedures should be made available to faculty members and students in the department and to the Dean, FGSR.

The examining committee shall conduct a final oral examination, based largely on the thesis.

It is the responsibility of the supervisor to ensure that:

- proper arrangements are made for the candidate's examination
- the examination is scheduled and held in accordance with FGSR regulations
- the candidate is not required to make these arrangements

In the absence of the supervisor, these responsibilities shall be borne by the departmental graduate coordinator or designate.

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The department must notify the examining committee members of the examination date and should supply them with a copy of the thesis at least three weeks in advance (four weeks for the external), so that they may have adequate time to appraise the thesis.

The language used to conduct the examination shall be English. However, the committee may petition the Dean, FGSR, and on receiving written approval, may conduct the examination in a language other than English.

The following recommendations/guidelines may be useful for departments in establishing such procedures.

- Ensure that the examination is held in an appropriate venue. Several times observers have remarked that an examination room was too small or uncomfortable.
- It is customary for the candidate to leave the room while procedures are determined and explained (ie, the order of questioning, the length of time allocated per question, the number of rounds, etc). It has been found that a CV provided by the candidate is often helpful (for example, to help an external examiner write a subsequent letter of reference); a quick review of the student's progress through the program is also useful.
- Ensure that the chair, student and all examiners have a final draft of the thesis at the examination.
- The candidate should make a brief presentation about the thesis, usually from five to 20 minutes long. This functions to calm the candidate's nerves and to remind the examiners about important aspects of the thesis. Candidates should never play host or hostess, serving tea, etc.
- It is generally agreed that the most time should be allotted to the internal/external member and the external examiner (if present) and the least to the supervisor. In this way new and challenging questions are asked in place of reiteration of questioning already utilized to develop the candidate and enhance the research. Examiners should avoid arguing among themselves and excluding the candidate. They should not lecture but should ask detailed questions about the thesis and occasional broad, disciplinary questions, testing for evidence of education, not just training. Typographical and stylistic errors should not take up examination time.
- At the close of the examination, before the student is asked to withdraw, it is often beneficial to ask the candidate if there are any final comments. When a positive conclusion is obvious, sometime should be spent on discussing the future of the thesis and the research area.
- For the adjudication, no final verdict should be rendered without each examiner having given an opinion. It is customary for two opinions to be sought: (1) on the acceptability of the thesis; and (2) on the acceptability of the defence.
- In announcing the decision, some observers feel that the best result is achieved if the announcement is made in front of all the examiners, not outside the room by the chair.

### **Responsibilities of the Chair**

The final oral examination shall be chaired by a faculty member who is not the supervisor but is a member of the student's home department. Each department shall establish a mechanism by which individuals are assigned this responsibility. The chair is responsible for moderating the discussion and directing questions and may participate in the questioning. If the chair is not a

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member of the committee, the chair does not vote or sign the thesis. It is the chair's responsibility to ensure that departmental and FGSR regulations relating to the final oral examination are followed.

### **Attendance at Doctoral Examinations**

Faculty members of the student's major department as well as members of FGSR Council (or their alternates) have the right to attend doctoral examinations but should notify the chair of the examining committee. Other persons may attend the defence only with special permission of the Dean, FGSR, or the chair of the examining committee. Except for the Dean, FGSR, (or Associate Dean or pro dean) who may participate fully in the examination, persons who are not members of the examining committee: (a) may participate in the questioning only by permission of the chair of the committee; (b) are not permitted to participate in the discussion of the student's performance and must withdraw before such discussion commences (see "Attendance at Examinations" and "Attendance of Pro Dean at Examinations").

### **Decision of the Final Doctoral Examining Committee**

The decision of the examining committee will be based both on the content of the thesis and on the candidate's ability to defend it. Normally, if all but one member of the committee agrees on a decision, the decision shall be that of the majority, except when the one dissenting vote is that of the external examiner. If this happens, it must be reported to the Associate Dean, FGSR, who will determine an appropriate course of action. If two or more dissenting votes are recorded, the department will refer the matter to the Associate Dean, FGSR, who will determine an appropriate course of action.

One of the following outcomes of the final oral examination is appropriate:

- Pass
- Pass subject to revisions
- Adjourned
- Fail

There is no provision for a final oral examination to be "passed subject to major revisions".

Pass: If the student passes the examination, the department shall complete a Report of Completion of Final Oral Examination form and submit it to the FGSR.

Pass subject to revisions: The student has satisfactorily defended the thesis but the revisions to the thesis are sufficiently minor that it will not require a reconvening of the examining committee. The department shall complete a Report of Completion of Final Oral Examination form and submit it to the FGSR indicating "pass subject to revisions".

It is expected that the student will make the changes in time to submit the thesis to the FGSR on or before the deadline for the next convocation.

These changes should be checked and approved by the committee chair or supervisor, who does not sign the thesis until the required changes are satisfactorily completed. Other committee

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members may also wish to withhold their signature until they can verify that their required revisions have been made to their satisfaction.

Adjourned: The final oral examination should be adjourned in the following situations:

- The revisions to the thesis are sufficiently substantial (if further research or experimentation or major reworking of sections are required, or if the committee is not satisfied with the general presentation of the thesis) that it will require a reconvening of the examining committee. The committee should not propose that the candidate has passed, rather the committee shall adjourn the examination.
- The committee is dissatisfied with the candidate's oral presentation and defence of the thesis, even if the thesis itself is acceptable with or without minor revisions.
- Compelling, extraordinary circumstances such as a sudden medical emergency during the examination.

If the examination is adjourned, the committee should:

- Specify in writing to the student, with as much precision as possible, the nature of the deficiencies and, in the case of revisions to the thesis, the extent of the revisions required. Where the oral defence is unsatisfactory, it may be necessary to arrange some discussion periods with the candidate prior to reconvening the examination.
- Decide upon a date to reconvene.  
If the date of the reconvened oral examination depends upon the completion of a research task or a series of discussions, it should be made clear which committee members will decide on the appropriate date to reconvene. The final date set for reconvening shall be no later than six months from the date of the examination. A final decision of the examining committee must be made within six months of the initial examination.
- Make it clear to the student what will be required by way of approval before the examination is reconvened (eg, approval of the committee chair or supervisor, approval of the entire committee, or of select members of the committee).
- Specify the supervision and assistance the student may expect from the committee members in meeting the necessary revisions.
- Advise the FGSR in writing of the adjournment and the conditions (in the points above).

When the date is set for the adjourned final oral examination, the department will notify the FGSR. Normally the Dean, Associate Dean or Pro Dean attends the examination.

Fail: If the final examination committee agrees that the student has failed, the committee chair shall provide the reasons for this recommendation and the department's decision for the student's program in writing to the Associate Dean, FGSR and to the student.

For failed examinations, the Associate Dean, FGSR, will arrange to meet with the candidate and with department representatives before acting upon any department recommendation. A decision of the FGSR which affects the student's academic standing (ie, required to withdraw or transfer to a master's program) is appealable.

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### **Signatures on the Doctoral Thesis**

Many departments adhere to the following guidelines in having members of the examining committee sign the thesis signature page.

Pass: Thesis is approved as is. Examining committee members sign the signature page immediately. (If one of the examiners fails the student but the student passes, that examiner does not have to sign the thesis.)

The following guidelines may be followed for external readers, under the assumption that the external reader has indicated general acceptance of the thesis:

- When the external does not attend the final oral examination, and the student has passed the final oral examination (with the assent of the external), the external examiner's name and institution will be typed on the signature page, and the chair of the examining committee will initial the external's signature line. All other examining committee members will sign the signature page.
- When the external examiner attends the final oral examination, the external shall sign the thesis along with the other committee members.

Pass subject to revisions: Members who wish to do so sign immediately. The committee chair or supervisor withholds the signature until the thesis is amended satisfactorily and all other committee members have signed. If problems arise in the amendment process, the chair or supervisor may wish to solicit opinions from the other committee members.

Adjourned: No member of the committee signs the signature page.

Fail: No member of the committee signs the signature page.

### **Time Limit for Submission of Doctoral Theses to FGSR**

Following completion of the final oral examination at which the thesis is passed or passed subject to revisions, the candidate shall make the appropriate revisions where necessary and submit the approved thesis to the FGSR within six months of the date of the final oral examination. Departments may impose earlier deadlines for submitting revisions.

**If the thesis is not submitted to the FGSR within the six-month time limit, the candidate will be considered to have withdrawn from the program. After this time, the candidate must apply and be re-admitted to the FGSR and register again before the thesis can be accepted.**

If the final oral examination is adjourned, the six-month time limit will take effect from the date of completion of the examination where the thesis was passed with or without revisions.

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## **Section 11 Completing Your Program**

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Once you have successfully defended your thesis, follow the checklist provided by FGSR to complete your program: format and upload your thesis and apply for graduation. <https://www.ualberta.ca/graduate-studies/current-students/academic-requirements/thesis-requirement-and-preparation>

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