Skeletal Biology and Regeneration Program Details

Overview

The Skeletal Biology and Regeneration area of concentration (SBR AoC) provides students with a thorough understanding of the current scientific basis of biomedical sciences related to the skeleton and oral biology, including tissue engineering, and stem cell biology. Students gain experience in the scientific method and its application to basic laboratory research and/or to clinically based research using human subjects. Our program teaches students how new knowledge is generated and disseminated through publications, presentations and grants. Students will be well-prepared to pursue careers as scientists and scholars in biological and biomedical science in a wide variety of settings including academia, education, the private sector and government service. To achieve this goal the academic environment fosters creative thinking and supports excellence in scholarship, research and teaching. The program is dedicated to quality education tailored to the needs of the individual student.

Research in the SBR program is multidisciplinary. The SBR program has particular strengths in the following research areas, and the faculty associate with each area is listed on the SBR webpage:
http://health.uconn.edu/graduate-school/academics/programs/ph-d-biomedical-science/skeletal-biology-and-regeneration/

- Biomaterial Synthesis and Scaffold Design
- Biomechanical and Material Composition of Bone
- Biomedical Engineering
- Bone and Cartilage Development and Disease

- Craniofacial and Oral Biology
- Cancer Biology
- Drug and Cell Delivery
- Genetic Disorders of the Skeleton
- Stem Cells, Development and Aging
- Skeletal Repair and Regenerative Engineering

Faculty in the SBR program are from several basic science and clinical departments, as well as institutes across the School of Medicine and School of Dental Medicine and Biomedical Engineering. New faculty members join SBR based on the criteria described under Faculty Guidelines.

A PhD in SBR can be combined with DMD or MD training leading to DMD/PhD and MD/PhD degrees. A PhD in SBR and also be combined with Dental Clinical Specialty Training. For more information about these dual degree programs visit the following web pages:
DMD/PhD: https://dentalmedicine.uconn.edu/programs-and-admissions/advanced-education/
MD/PhD: http://medicine.uconn.edu/curriculum/md-phd-program/
Dental Clinical Specialty/PhD: http://grad.uchc.edu/prospective/programs/dcs_phd/index.html

Any questions not addressed by this web page should be directed to the GDB AoC Director or pursued via the UConn Health Graduate School Registrar's Office, or the Associate Dean of the Graduate School.

Key Contacts

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Requirements and Milestones of the SBR Graduate Program

The SBR program follows the guidelines, requirements and milestones set by the Graduate School. The program also has a few requirements that are specific to the SBR AoC. The program recognizes that students from different backgrounds enter our program. Therefore, while following specific guidelines, the program also has incorporated a degree of flexibility.

Students are strongly encouraged to become familiar with the Biomedical Sciences expectations and milestones set by the Graduate School. Useful web pages are:
http://health.uconn.edu/graduate-school/current/
http://health.uconn.edu/graduate-school/current/biomedical-science-ph-d-program-milestones-made-easy/

Note all forms required for each step of the PhD should first be submitted to UConn Health Registrar's Office, MC1826, Room AM016, where forms will be checked for compliance and accuracy before the UCHC Registrar submits the forms to the Graduate School at Storrs.

Things to know for Year 1:

Credit Requirements: First year students holding graduate research assistantships must take at least 6 credits/semester. Students not on graduate assistantships must take at

least 9 credits/semester. Typically, students take 8-9 credits/semester in year 1. Suggested and required courses are listed below under "SBR Program Curriculum".

Lab Rotations: First year students will select three 3 Laboratory rotations.

End of Year 1/Start of Year 2 – Selection of major (thesis) advisor: Students must select a Major Advisor for their research by the end of their 1st year of study. The Program Director is to be notified when a student has made this decision, since the choice of Major Advisor must be approved by the Program Director. Students must complete and submit a "Change to Graduate Major Advisor(s)" form, which can be found at: https://registrar.uconn.edu/wp-content/uploads/sites/1604/2017/08/Change-of-Major-Advisor.pdf
Major advisors must be able to provide research resources and financial support as well as intellectual guidance for the term of the thesis research.

Things to know for Year 2:

Organize a Thesis Advisory Committee: The thesis committee is comprised of the student's major advisor, plus at least 2 other Biomedical Science graduate faculty, one of whom must be an SBR AoC program member. This committee will monitor your progress, help organize the Plan of Study (i.e., select courses for remaining years) and serve in a general advisory capacity.

Note: A Variation of the Thesis Advisory Committee is a 5 member-Committee with a member of another AoC or an external associate advisor with expertise in the area of the student's dissertation from the faculty at Storrs or another university. The student's major advisor must write a letter to the Graduate School requesting the external advisor and submit the individual's curriculum vitae.)

Fill out a "Plan of Study" Form: By the end of January of year 2, and prior to taking General Exam, please submit your Plan of Study (coursework for remaining years). The plan of study form can be found at: (https://registrar.uconn.edu/wp-content/uploads/sites/1604/2019/02/Plan-of-Study-Doctor-Philosophy.pdf) Suggested and required SBR courses are listed below under "Course Work" and other courses may be found in the Graduate School catalog: http://graduatecatalog.uconn.edu. General information for the plan of study is at: http://grad.uconn.edu/enrollment-services/doctoral-degree-program/

Note: all students must fulfill the Graduate School's minimum credit requirement for doctoral students, which includes *a minimum of 30 credits of coursework and 15 credits of doctoral research and complete SBR required courses*. In order *to remain in good standing, students must maintain an overall GPA of 3.0* per the guidelines of the UConn Graduate School.

Take the "General Exam": The oral exam must be completed by May 31st of second year for PhD students, or G1 year for dual degree students. The General Exam Committee will include at least 5 faculty. This includes the major advisor, all members of the advisory committee, and one member of the AoC leadership team (Director or Associate Director of SBR). For more details on exam, see section below. After

successful completion of the General Exam, a report on the General Exam form must be signed by the General Exam Committee and submitted to UCHC Registrar's Office: https://registrar.uconn.edu/wp-content/uploads/sites/1604/2018/02/Report-on-General-Exam-Doctoral.pdf

Attend yearly student – mentors meeting: The program directors will schedule an annual meeting. This meeting must be attended by all graduate students and their mentors to review the program guidelines. The program directors will schedule this meeting in late August/early September.

Continue to Attend SBR Journal Club: As a commitment to broadening your knowledge within the field of skeletal biology and regeneration as well as the continued honing of oral communication skills, we require that you continue to attend the SBR journal club.

Things to know for Year 3 and beyond:

Registering Lab Research Credits: For student research register for one of the required research courses (GRAD 6950, 6960 6930) or Continuous Registration.

Continue to Attend SBR Journal Club: As a commitment to broadening your knowledge within the field of skeletal biology and regeneration as well as the continued honing of oral communication skills, we require that you continue to attend the SBR journal club. Our policy is that exemptions from SBR journal club are limited only to the term in which a scheduled defense has been set.

Student Progress Seminars: Once a year, a student must present a seminar describing their thesis research to the SBR program. The student's advisory committee should attend the seminar.

Schedule Regular Meetings with your Thesis Advisory Committee: The Thesis Advisory Committee is required to meet at least once per year (twice per year is recommended). Meetings will discuss progress, as well as other matters arising. Presentations in research groups are not a substitute, unless followed by a committee meeting to discuss progress towards PhD).

Prepare your Doctoral Dissertation Proposal: By the beginning of Year 3, students must submit **Doctoral Dissertation Proposal (Prospectus)** The Dissertation Proposal should describe the detailed expected research plans for completion of the PhD. (<10 pages, excluding title page and references).

https://registrar.uconn.edu/wp-content/uploads/sites/1604/2018/02/Dissertation-Proposal-for-Doctoral-Degree.pdf

Continue to attend the yearly student – mentors meeting.

Things to know in order to graduate:

Preparation of Dissertation, Private and Public Defense. See section on Dissertation and Oral Defense below.

Check List and Necessary Forms:

Dissertation Submission Checklist
(https://registrar.uconn.edu/wp-content/uploads/sites/1604/2019/02/Dissertation-Submission-Checklist.pdf)

The Report on the Final Examination
(https://registrar.uconn.edu/wp-content/uploads/sites/1604/2017/08/Report-on-Final-Exam-Doctoral.pdf)

Time Limits to Obtain your PhD: PhD must be awarded within 8 years of starting PhD. (If student has Masters then 7 years). Extensions may be requested from the Graduate School.

Commencement Deadlines: Students must submit the application for graduation online through their PeopleSoft account by December 18 for fall graduation, by August 24 for summer graduation, or 13 days prior to commencement for spring graduation.

Exit Interview: Students are required to make an appointment with Human Resources (HR) to schedule an Exit Interview and complete any paperwork required by HR. You can make an appointment by calling HR at 860-679-2115.

Thesis Advisory Committee

The Thesis Advisory Committee monitors the progress of students from their second year until completion. The committee is comprised of the student's Major Advisor as well as at least two other graduate faculty, one of whom must be an SBR graduate program member. All students are required to meet with their thesis advisory committee at least once per year to discuss the progress of their research as well as other matters arising. This meeting typically takes place immediately following their Research-in-Progress seminar, and if this is not possible due to scheduling conflicts, it should take place at the next earliest possible date.

SBR Curriculum and Course Work

Courses are chosen to provide a broad background in Skeletal Biology and Regeneration, and to provide a background necessary for the student's specific research interests. In the first year, courses are selected in consultation with first year faculty advisors. At the

beginning of the second year, when students have chosen a laboratory for their thesis research, courses are selected in consultation with the student's Major (Thesis) Advisor.

In general, students take formal course work only during the first two years. However, all students are required to register for the Skeletal Biology and Regeneration Journal Club every semester, with a final-semester exemption for a student writing his/her dissertation. Additional course descriptions can be found in the graduate Course Catalog.

DMD/PhD and MD/PhD Students: The Skeletal Biology and Regeneration Graduate Program recognizes the extensive course work taken in phase 1 of the M.D./Ph.D. and D.M.D./Ph.D. Programs (the Basic Biomedical Science curriculum in the first two years of Dental and Medical school). These students receive 15 credits for the course work during the phase 1 of their training and require 30 additional credits of course work towards Ph.D. degree requirements.

Students who pursue their thesis work in the Skeletal Biology and Regeneration AoC must take:

- **MEDS 6445.** Skeletal Biology, 2 credits – spring course

  AND*/OR

- **MEDS 5415.** Craniofacial and Oral Biology, 2 credits – fall course (offered in alternate years to MEDS 6445).

  **Students on T90 training grant are required to take both MEDS 6445 and MEDS 5415*

- **MEDS 6497-43**. Skeletal Biology and Regeneration Journal Club, 1 credit/semester. All students in the program are required to participate in the journal club multiple semesters (see course description below)

Courses Required of all Biomedical Science Students

These courses are required for graduation, and must be listed on the Plan of Study:

- **MEDS 6503.** First Year Exploration, 3 credits
- **MEDS 6448.** Foundations of Biomedical Science I, 4 credits

  M.D./Ph.D. trainees are not required to take this course. However, D.M.D./Ph.D. are required to take this course. It is an excellent introduction to contemporary topics in modern biology, and allows to the D.M.D./Ph.D. student to become integrated in the Graduate School.

- **MEDS 5310.** Responsible Conduct in Research – spring of the first year, 1 credit
- **MEDS 6501.** Communications for Biomedical Scientists – fall of the second year, 1 credit
- **MEDS 6502.** Experimental Design, Rigor and Biostatistics -fall of the second year, 1 credit

A suggested timeline summary for first-year students interested in SBR is as follows:

Year 1 - Fall Semester
• **Craniofacial and Oral Biology (MEDS 5415, 2 credits)**
• **Foundations of Biomedical Science I (MEDS 6448, 4 credits)** • **MEDS 6503 First Year Exploration (3 credit)**

Year 1 - Spring Semester
• **Responsible Conduct of Research (MEDS 5310, 1 credit)**
• **Foundations of Biomedical Science II (MEDS 6449, 4 credits)** • **Skeletal Biology and Regeneration Journal Club (MEDS 6497-43, 1 credit)**
• **Skeletal Biology (MEDS 6445, 2 credits)**
Additional relevant course (1-2 credits) appropriate for the research interests of the student. Course descriptions found in the graduate Course Catalog.

MEDS 6497-43. Skeletal Biology and Regeneration Journal Club, 1 credit: SBR Journal Club, which meets each Friday from noon – 1pm during the school year, is a major focal point of the SBR AoC. Students are required to participate for the duration of their graduate career. Participants include students, post-doctoral fellows, and faculty. Presenters select a current research article that they find noteworthy, make the reference available to the SBR community, and then present appropriate background, the article itself, and their critique of the work. The diversity of topics selected by presenters, together with input from attendees, makes this an important learning opportunity for all participants. A goal for each presentation is to allow researchers with diverse interests and backgrounds to appreciate the subject matter of the paper selected. Students are encouraged to consult with their faculty advisors as well as other students and faculty for help in selecting an article. More advanced graduate students present their thesis research work.

Evaluation: At each presentation, students will be evaluated for their participation and attendance by the SBR faculty.

MEDS 5415. Craniofacial and Oral Biology, 2 credits: A combination lecture and literature discussion course with a focus on the underlying biochemical, molecular and genetic mechanisms involved in the pathogenesis of craniofacial and oral disorders, the identification of unsolved questions, and consideration of possible approaches to investigate these questions. The course will meet twice per week. The format is a one-hour lecture on Tuesdays, and a one-hour discussion of an assigned paper relevant to that lecture on Thursdays. Evaluation is on written assignments and class participation.

MEDS 6445. Skeletal Biology, 2 credits: A combination lecture and literature discussion course with a focus on the appendicular skeleton in development, homeostasis, disease

and repair. Topics include limb skeletal patterning, endochondral ossification, genetic disorders of bone and cartilage, molecular and hormonal control of bone remodeling, mechanical stress and fracture, osteo-immunology, osteoarthritis, and bone and cartilage tissue engineering. The course will meet twice per week. The format is a one-hour lecture on Tuesdays, and a one-hour discussion of an assigned paper relevant to that lecture on Thursdays. Evaluation is on written assignments and class participation.

Other Relevant Elective Courses
Additional courses should be selected as appropriate for the research interests of the student. Courses frequently taken by SBR students include:

- **MEDS 5329**. Immunobiology, 4 credits
- **MEDS 5313**. Biomaterials and Tissue Engineering, 3 credits
- **MEDS 5322**. Developmental Biology, 2 credits
- **MEDS 5418.** Stem Cells & Regenerative Biology, 3 credits
- **MEDS 5369**. Advanced Genetics and Molecular Biology, 3 credits
- **MEDS 5382**. Practical Microscopy and Modeling for Cell Biologists, 2 credits
- **MEDS 5380**. Cell Biology, 4 credits
- **MEDS 6413**. Cancer Biology, 2 credits
- **MEDS 6450**. Optical Microscopy and Bioimaging, 3 credits
- **MEDS 5309**. Molecular Basis of Disease, 2 credits
- **MEDS 5420.** Molecular Genomics Practicum, 3 credits
- **MEDS 5351**. Biochemistry II (Biophysical Methods), 3 credits

Honor Code: Academic Misconduct such as cheating, plagiarism, or the aiding or abetting of another individual in such acts will not be tolerated. The consequence of committing such actions will result in the failure in the course. Failure in a course necessitates recommendation by the advisory committee as to whether or not the student shall be permitted to continue graduate study.

Plan of Study

With guidance from the Major Advisor and Thesis Advisory Committee, the student will develop a Plan of Study that consists of a list and sequence of courses that the student plans to complete as part of their PhD degree. The Plan of Study form must be reviewed, approved and signed by the Thesis Advisory Committee. The form should be submitted to the Graduate School before the end of January of the second year of graduate study for approval. This Plan of Study must be approved by the Graduate School prior to taking the General Examination.

Student Research Progress Seminars

Student seminars offer valuable experience with the preparation and delivery of a formal seminar in the environment of familiar colleagues. In addition, these presentations acquaint program members with on-going student research projects and foster exchange of information and expertise. Once a year, students must give a formal seminar based on their thesis research project. **Yearly seminars are mandatory for PhD students in their 3rd year and G2 for dual degree students. Progress seminar will be given each year until a reasonable number of months from their scheduled thesis defense.** Student progress seminars will be open to all SBR program members (students, faculty), as well as postdocs and research staff. Seminars will occur during Wednesday Research in Progress Seminars, typically scheduled from September to June. Students should prepare a 40-45 minute presentation to allow ample time for questions. The student must notify the Director of their scheduled presentation, and must be documented in annual progress reports. Student seminars should be held in person. Substantially prior to the scheduled presentation, students should invite all members of their Thesis Advisory Committee.

General Examination

The General Examination is a qualifying examination given to all students in all PhD Programs at the University of Connecticut. Successful completion of the General Exam admits the student to doctoral candidacy and marks the transition from courses to independent research. All Ph.D. and dual degree students are required to pass the General Examination. A student is examined in the several facets of their field of study, not merely in the particular area of concentration.

Timing of the General Examination:

1. The oral exam must be completed no later than May 31st of the second year for PhD students or G1 year for dual degree students. AOCs may enact earlier deadlines for students to ensure sufficient time for scheduling conflicts or remediation, if necessary.

2. Remediation can occur if the initial exam attempt is deemed unsuccessful. This will involve one, and only one, additional attempt to revise all or part of the written exam and/or repeat the oral defense.

3. Any necessary remediation must be completed by August 15th of the second year for PhD students or G1 year for dual degree students1.

4. Deadlines stipulated by the student's General Exam committee must be complied with. A missed deadline will count as an unsuccessful exam attempt and initiate the remediation process.

General Exam Committee

- At least 5 faculty must participate in the exam. This includes the major advisor and all members of the advisory committee.

- The General Exam Committee must also include one member of the AOC leadership team, either the Director or Associate Director. The program director or associate director should ensure that all the exams are administered fairly and in a uniform fashion, and guide/advise other members of the committee who may not be familiar with general exam guidelines, or are new to the AoC.

-Additional faculty from UConn Health, or external as appropriate. External members must be approved by the Graduate School.

- In the case of combined DMD/PhD or MD/PhD candidates, the director of the dual degree program or their designee should be a member of the examination committee.

- One member shall serve as the chair of the General Exam Committee. It is their responsibility to ensure that the exam process fulfils the requirements of the Graduate School, the Biomedical Science program and the AOC.

- The major advisor should advise the student concerning the overall suitability of the topic, but does not formulate the aims and approach. The major advisor must attend the exam and participate in the preliminary discussions and post-exam evaluation. However, they must remain silent during the actual direct examination of the student, unless directly called upon by the chair of the General Exam Committee to clarify a point of confusion or provide necessary context.

- AOC Directors are responsible for ensuring that all General Exam requirements of the University of Connecticut Graduate School, the Biomedical Science Program and the AOC are fulfilled. They are also responsible for ensuring that all students in that AOC are compliant with all policies and deadlines pertaining to the General Exam.

Goals of the General Examination:

1) To determine if the student demonstrates readiness to begin independent PhD. thesis research.

2) To test the student's ability to formulate a testable hypothesis for an original research proposal and formulate specific aims and an experimental approach towards the hypothesis.

3) To become familiar with writing and the requirements of a NIH style grant application.

4) To identify gaps in the educational knowledge of the student, which can be addressed for their future development.

The Proposal

The General Examination will focus on a research proposal that is prepared and defended by the student. The research proposal should be distinct from the student's thesis research, but can be closely related. *It is important that your proposal is distinct from your thesis research because we do not want your general exam to become a referendum on your thesis advisor's research aims and approaches. We want this research proposal to be entirely thought of and designed by the student*. While it is not meant to be a comprehensive exam covering all previous course work, students are expected to draw upon this information in drafting and defending their proposal.

Written Exam Format:

The proposal should follow NIH guidelines for R-type grant application, suitable for a three year research project. Students should follow some (not all) of the guidelines and instruction of the Public Health Service grant application (PHS 398) including:

- Use an Arial, Helvetica, or Palatino, a black font color, and a font size of 11 points or larger. A symbol font may be used to insert Greek letters or special characters; the font size requirement still applies.
- Use standard size (8 ½" x 11") page layout.
- Use at least one-half inch margins (top, bottom, left, and right) for all pages
- The application must be single-sided and single-spaced.

Adhere to the page limits and sections listed below.

- **Title Page**: Proposal Title, Student's Name, and Major Advisor (one page).
- **Abstract**: (one page).
- **Specific Aims** (one page). The aims should list the objectives of the research and state the hypothesis to be tested.
- **Research Strategy** (<u>maximum ten pages</u>) should include:
    - <u>Background/Prior data/ Preliminary results</u>: original preliminary data are not required, but may be included if available. Supporting data/figures from the literature can be included, and must be properly cited. It should be noted that while preliminary data from the student's own experiments are not a prerequisite for the examination, such data can be useful in establishing the rationale and demonstrating feasibility.
    - <u>Significance</u>: a critical evaluation of existing knowledge and identify the gaps that the project is intended to fill.
    - <u>Innovation</u>: Briefly explain how the research challenges and seeks to shift current research or clinical practice paradigms. Describe any novel theoretical concepts, approaches or methodologies, instrumentation or intervention(s) to be developed or used, and any

advantage over existing methodologies, instrumentation or intervention(s).

- Approach (Research Design and Methods): describe conceptual and experimental strategies to be taken, methodology, and analyses to accomplish the specific aims of the project. Discuss how the data will be collected, analyzed, and interpreted. Include expected outcomes. Discuss potential problems, and alternative strategies for each aim. Standard methods need not be described in detail, but should have literature citations, and the student should be prepared to discuss the underlying fundamentals and details during the oral general examination.

- **Bibliography and References Cited** - Each reference must include names of all authors, the article and journal title, book title, volume number, page numbers, and year of publication. Be concise - select literature references most pertinent to the proposed research. This section is not included in the page limit.

- **Animal Care Considerations (if applicable)**. All NIH grants require justification of the animal numbers to be used in the experiments proposed. Give brief explanation of the numbers of animals proposed in the experiments in this section. This is based on a power analysis to calculate the number estimated to give statistical significance. Consideration of sex as a determinant. The thesis advisor or other committee members can help with this section. This section is not counted in the total page allotment.

The student may consult any faculty member, or any other source, for information on experimental methods and approaches in preparing the research proposal. Students may seek help regarding the general principles of grant writing, English grammar, identifying references in the literature and information regarding specific technical issues related to methodology. However, **the student is solely responsible for the development of the final written proposal submitted to the General Exam Committee**. The student is not to receive any scientific feedback on the written proposal prior to the oral examination.

Timetable for submission of the General Exam Proposal:

Step 1: Establish a general exam committee consisting of a minimum of 5 faculty members.

Step 2: Create a research topic and prepare a three page mini-proposal.

The topic of the exam should be related (but not identical) to the student's thesis topic. The topic of the exam should not be identical to the specific aims of the advisor's grants/proposals, as this exam should test the student's ability to formulate a hypothesis, specific aims and experiments. This document should include some brief background information, identified gap(s) in knowledge that will be addressed, specific aims,

experimental design and selected references. The student should email the 3 page mini-proposal to the exam committee members at least one week prior to the first meeting. Page limit does not include the Reference section.

Step 3: Meet with your general exam committee.

At the first general exam committee meeting 3 things will happen:

1. The committee will review the Plan of Study and grades. The committee should ensure that the student has and will continue to take appropriate courses that are required by the Graduate School and the AoC (a total of 45 credits are required for the PhD student, 30 credits for DMD/PhD students. Students who hold Masters degree should consult with the Graduate office to confirm number of credits that can be counted towards their PhD degree in BioMedical Science. The Committee (without the student) should discuss the student's overall record, the student's strength and weaknesses. Any deficiencies that might need special attention for this exam should be identified. The Plan of Study must be signed by the members of the student's thesis advisory committee and sent to the Graduate School. The Plan of Study must be approved by the Graduate School prior to the General Examination.

2. The committee will appoint a general exam committee chair who will be the primary person responsible for communication with the student and for organization of the exam. This chair will relay information to the rest of the committee, and will provide detailed feedback from other committee members to the student, as an aid to improve your research plan.

3. Your mini-proposal will be discussed. The specific aims and approaches of the proposal will be discussed. Prepare a short powerpoint presentation to aid the discussion. Any questions about procedures associated with exam will be addressed. The research plan must first be approved by his/her general exam committee prior to writing the full grant proposal.

The general exam committee may ask the student to revise and/or make modifications to his/her specific aims. If revisions are necessary, the committee will submit their suggestions in writing to the student and the student will be given 2 weeks to submit a revised document to the examination committee. By email, the committee can then provide feedback on whether the revised proposal is adequate to move forward or needs further revision. In some cases, the assigned chair of the committee may provide guidance to the student in these revisions.

Once the specific aims page has been approved by the General Examination Committee, the major advisor may not be consulted for specific feedback on the proposal.

Step 4: Complete and submit the written proposal.

Once the aims have been approved by the committee, the student will be given 4 weeks to complete and submit the written proposal. You can ask questions of your committee chair, faculty members, or other students related to very specific details (buffer concentrations, model parameters, data set size, etc) but should not discuss more general scientific questions your work will address. The student will email a copy of the proposal to each member of the committee 2 weeks before the oral examination is held.

The student is not to receive any specific feedback on the written proposal prior to the oral examination. The thesis advisor does not receive a copy of the written proposal until the day before the oral examination is held.

Late submissions of the written proposal will result in a fail.

Step 5: Oral Exam and procedures.

The oral exam should be scheduled within 2 weeks of submitting the written proposal. The student is responsible for scheduling the exam, including finding a room and a time for their exam. It is suggested that this be coordinated well in advance. If necessary, the SBR administrator can assist with finding a room for the examination. Examinations are typically 2-3 hours.

The student should **prepare a powerpoint presentation.** This presentation will review the overall subject area, hypothesis to be tested, specific aims and general experimental approach. The candidate may also briefly present any important corrections or changes to the written proposal.

On the day of the exam:

At the beginning of the Oral Examination, the chair will ask the student to leave the room briefly. The committee will discuss the quality of the written proposal. If generally acceptable, the oral exam will proceed - any specific deficiencies in the written proposal should be identified and subject to further discussion during the Oral Examination. If the quality is unacceptable, the student may be asked to revise the application based on the feedback from the committee, and reschedule the oral exam. Revision of the written proposal will be considered as the single (only) remediation attempt. In this case, students will have two weeks to submit the revised proposal. If the quality is so poor as to be unacceptable, the student can be given a “fail” at this point.

Committee members should decide if the student should do the oral presentation uninterrupted with questions at the end; or interrupt with questions during the presentation. The major advisor should be present during the oral examination, but only in the capacity of an observer.

After this discussion, the student is invited to return to the room. The chair should explain the ground rules to the student, and ask the student to begin their presentation.

Exam questions should be designed to probe the student's depth of knowledge on the chosen subject of the proposal, both theoretical and technical. In addition, exam questions should determine the student's general knowledge of skeletal biology and regeneration gained through lecture, seminar courses and lab rotations. The Oral Examination will focus on the hypothesis; the methods used to address the problem, the interpretation of potential results, alternative approaches to the experimental problem, and related literature.

Examiners are expected to explore the ability of the candidate to relate basic science knowledge and principles to problem solving and scientific thinking. This discussion of the proposal is expected to focus on principles and lines of thinking, and not become overly concerned with technical details.

Each member of the Examination Committee will have an opportunity to ask questions and discuss the presentation. The chair of the examining committee has the responsibility of maintaining a collegial, fair and unbiased environment during the examination and the duty to rephrase or ask for rephrasing of questions, if necessary.

When the chair feels that the student has been examined sufficiently, they will ask the committee to start their evaluation.

Evaluation and possible outcomes: After the oral presentation, the student is asked to leave the room and the Examination Committee evaluates the student's performance in: 1) quality of the written proposal, 2) quality of the oral presentation, 3) defense of the proposal, 4) general knowledge and 5) the student's overall performance in the Graduate Program (course work, rotations, work ethic, etc.). The student's Major Advisor will be asked to comment on the intellectual and technical development of the student during the time in the laboratory prior to the examination. The Examination Committee and PI will vote on the outcome. The decision requires consensus. Grading will be on a pass-fail basis. Separate entries for the written and oral sections are made into the records.

Once a decision is reached, the student will be asked to re-enter the room and the Chair of the Examination Committee will communicate the outcome to the candidate.

Defined outcomes:
Pass: This is the outcome expected for most students. It can represent a range from absolutely stellar performance to a good, generally solid one.

Conditional Pass: This is used when a particular aspect of the exam showed clear deficiencies or when the overall performance was marginal. **Remediation will involve one, and only one, additional attempt to revise all or part of the written exam and/or repeat the oral defense.** The committee must suggest to the Program Director is required for remediation – 1) rewrite the proposal, 2) redo the oral exam, or 3) revise written and redo oral exam. If the student is expected to consult with the committee members individually, this should be stated, and a time frame for completing the written

and/or oral examination should be established. It is important for the committee chair to put this in writing during the meeting so that there is no ambiguity about what is being asked of the student. When the committee communicates the outcome of the exam to the student, advisors should discuss the conditions of a conditional pass with the student. A passing grade on the exam will not be communicated to the Graduate School until the conditions set forth have been satisfactorily fulfilled. A failure to do so will delay advancement to Ph.D. candidacy.

Failure: This is the outcome when the written proposal and/or performance on the oral exam are unacceptable. A student who fails will automatically get one chance to rewrite the proposal and/or defend it at another oral examination. The amount of time available for completion of the repeat exam must be specified at this time. A student who fails either the written or oral exam twice must leave the program.

Documentation:

The **Report on the General Exam form** must be signed by each member of the General Exam Committee.

https://registrar.uconn.edu/wp-content/uploads/sites/1604/2018/02/Report-on-General-Exam-Doctoral.pdf

Students should submit the Report on the General Exam form as soon as possible upon completion of the exam process, and no later than August 15th of the exam year[1].

[1]Extensions are possible only under extraordinary circumstances and require the approval of the Associate Dean of the Graduate School or MD/PhD or DMD/PhD Program Director.

The Dissertation and Oral Defense/Final Exam

Formats for the dissertation and the public defense of the thesis are governed by rules of the Graduate School. Forms and directions are found in the Graduate Catalogue Academic Regulations page in the section titled: Candidacy, Dissertation Preparation and Final Oral Defense:

https://gradcatalog.uconn.edu/grad-school-info/academic-regulations/

In preparation for the thesis defense, students in the SBR AoC meets with their thesis advisory committee to review the progress in their research. At this time all members of the thesis advisory committee will evaluate the quality of the thesis research in detail, make recommendations for additional experiments, reanalysis of data if necessary. Approval to write the dissertation must be obtained from the Thesis Advisory Committee. The SBR program director should be notified that approval to write the thesis has been given.

With approval from the Thesis Advisory Committee, the student writes the Dissertation, in consultation with the Major Advisor. The written document should include an Abstract, a broad Introduction, Specific Aims, Materials and Methods, chapters presenting findings (results, figures/tables), and discussion of the findings. The SBR students with the approval of their Major Advisor can use the manuscripts (published, in press or in preparations) generated from their thesis research for chapters presenting findings. The written thesis should also include a final chapter that highlights the findings, implications and limitations of these findings within the context of available literature and explores future directions of study.

Since the thesis research is a significant contribution to the candidate's field and worthy of publication, it is expected that the candidate will have one or preferably more than one first-author manuscript published or submitted for publication by a peer-reviewed journal prior to scheduling the final defense.

The student must send the dissertation via email to all members of the Thesis Adivsory Committee and the Major Advisor **at least 2 weeks before the private defense is scheduled**.

Once the dissertation has been distributed to members of the Thesis Advisory Committee, the **private defense is scheduled with the committee**. In addition to discussing the data, the committee will examine the student's knowledge of the literature and broader issues related to the thesis topic. Students should be prepared to discuss the background and history of the problem addressed in the thesis work, details of methodologies and techniques used, implications of their findings and future research directions. The thesis advisory committee votes to 1) tentatively approve, pending outcome of the public defense, 2) conditionally approve pending modifications, or 3) reject the thesis. The decision of the Advisory Committee vote must reach consensus.

Students must inform the SBR Program Director of the Public Thesis Defense date at least two weeks prior to the defense. The Program Director should inform the faculty and students of the SBR AoC. The faculty and students in the SBR program are expected to attend these events.

Upon approval of the dissertation by the Advisory committee, the student can schedule the **Public Thesis defense**. The Final Examination/Thesis Defense date must be listed on the UCONN Events Calendar at least two weeks prior to the defense. The Public defense is the formal opportunity for the student to present and defend their thesis research to members of the SBR program and academic community at large, all of whom are strongly encouraged to attend. This final oral examination entails a formal seminar presented by the student to an audience that must include at least 5 members of the faculty, including all members of the candidate's advisory committee.

The oral defense of the dissertation must be announced publicly by means of the University's online Events Calendar and posted flyers **at least two weeks prior to the**

date of the public defense. The Program Director will inform the faculty and students of the SBR AoC, who are expected to attend these events.

At the end of the public defense, the Thesis Advisory Committee will meet with the student and provide the student with any revisions for the dissertation. The Thesis Advisory Committee will have a final vote to accept or reject the dissertation; the vote of the Advisory Committee must be unanimous.

Following the dissertation defense, the major advisor communicates the results to the student and verifies that the official report has been completed and signed for submission to the Office of the Registrar (or to the UConn Health Center, if appropriate).

The abstract and dissertation must be dated as of the calendar year in which all requirements for the degree are completed, including submission of the dissertation. All members of the student's advisory committee must approve the final version of the dissertation. The Graduate School requires the electronic submission of the dissertation through Submittable, a University repository for public access. The final copy must meet all specifications outlined on the Office of the Registrar's website. No restrictions that limit or delay the accessibility, use, or distribution of the results of a doctoral student's research are acceptable if such delays are inconsistent with an embargo period requested by the student or if they interfere with the timely completion of a student's academic program.

Conferral of Degrees

Conferral

Degree conferral requires that all requirements for the degree have been completed satisfactorily by the deadline specified in the Academic Calendar. Degrees are conferred three times each year: August, December, and May. However, graduate commencement ceremonies are only held once per year (in May). Students who qualify for degree conferral receive their diplomas by mail, normally within three months following conferral.

Application for the Degree

Formal application for a degree to be conferred must be filed online by the degree candidate using the Student Administration System within the first four weeks of the student's final semester. This application may be withdrawn at any time by the applicant. Information and instructions can be found on the Office of the Registrar's website under the section titled Graduation. If all required paperwork and submissions needed for conferral are not received by the Office of the Registrar by the deadlines published in the Academic Calendar, conferral is delayed to the next conferral period, even though all other degree requirements may have been completed on time.

Commencement

Graduate commencement ceremonies are held once each year at the end of the spring semester. Academic regalia appropriate for the University of Connecticut degree being conferred is strictly required for all who participate in the ceremonies. Information

concerning the commencement ceremony, including academic regalia and guest tickets, is made available by the mid-spring semester and can be found on The Graduate School website.

Information for Faculty Membership

Program Administration

Director and Associate Director of the Program

The Director of the SBR Program serves a 2-year term following their term as Associate Director. The term begins June 1 and ends May 31. Eligible candidates must have held prior service on a SBR sub-committee, served as a course director, OR trained a graduate student.

The Director performs a number of programmatic functions, including: 1) acting as the voting program representative and voice on the Graduate Programs Committee (GPC), which sets the policies of the Biomedical Science PhD Program; 2) chairing the monthly SBR Program Executive Committee meetings, which involves setting the agenda and facilitating the discussion, delivering reports from the monthly GPC meetings, and receiving reports from various subcommittees; 3) attending the General Examination Committees, and providing consistency between examinations; 4) coordinating generation of student progress reports (from the SBR data base and SBR administrator) and sharing these progress reports at biannual Student Progress Review sessions within the Executive Committee; 5) overseeing program activities and presence during recruitment events.

The Associate Director is elected by a majority vote of the SBR program faculty from nominations made by the SBR Executive Committee and faculty. The functions of the Associate Director include: 1) assuming the position of Program Director after 2 years; 2) attending the General Examination Committees, and providing consistency between examinations; 3) assisting in preparation and review of student progress reports at the Student Progress Review sessions of the Executive Committee; 4) substituting for the Director as needed at Program activities and during monthly meetings of the GPC. While the Associate Director is invited to attend monthly GPC meetings, he/she carries no vote or voice at the meetings when the Director is present. However, the Associate Director acts in the full capacity of the Director in the Director's absence.

Director and Co-Director of the Courses

The Directors of the courses administered by the SBR AoC serve 2-year terms from January 1 to December 31 of the second year. The Directors are selected by nominations from the Executive Committee and SBR faculty and are approved by the Curriculum Committee. Course Directors perform a number of important functions, including ensuring the appropriate delivery of the materials and grading. The Associate Course Director helps the Director, acts in the full capacity of the Director in the Director's absence, and replaces the Director after 2 years.

Executive Committee

The Executive Committee consists of the Director, the Associate Director, the most recent past Director, and one member of the Curriculum committee, and the Director and Associate Director of the T90/R90 training grant. A student representative will also be chosen by student vote from among the SBR students who will be invited to the Executive Committee meetings on an ad-hoc basis.

The Executive Committee meets monthly to discuss relevant program business, review program policy, and discuss program activities and functions. The frequency of the meetings can be increased if needed. The Executive Committee also monitors progress of the students from the time they enter the program until they have completed their dissertation. This monitoring occurs via biannual Student Progress Review Sessions within the Executive Committee (see below).

Student Progress Review Sessions

The progress of each student from the time they declare SBR as their AoC to their graduation is monitored by the SBR program. This occurs via data collection and input into the SBR student database by the SBR administrator assigned by the School of Dental Medicine. Twice a year (after the Fall and Spring semesters), a report on the progress of each student is generated by the administrator and presented by the SBR Director for review and discussion by the rest of the Executive Committee. Any concerns are discussed with the student's thesis advisor.

Curriculum Committee

The Curriculum Committee maintains a teaching curriculum that serves the needs of the graduate students, with an emphasis toward those interested in the field of Skeletal and Craniofacial Biology. This committee consists of a Chair and directors of existing courses (Skeletal Biology; Craniofacial and Oral Biology; and Skeletal Biology and Regeneration Journal Club) and one additional SBR faculty member appointed by the Executive Committee representing the other areas of research in the program not represented by the course directors.

The Curriculum Committee meets once a year and develops guidelines for courses, reviews existing courses and student evaluations, and reviews proposals for new courses. The Curriculum Committee submits their suggestions to the Executive Committee and when necessary to the entire SBR faculty. Final decisions on new courses are made by the Executive Committee based on the recommendation SBR Executive Committee and must be approved by the GPC and the Graduate School. The Curriculum Committee also ensures that courses are posted in the Health Center Graduate School course offerings prior to each semester *(http://gradcatalog.uconn.edu/)* and that each course is represented at the Course Fair preceding registration. The curriculum committee chair chooses an active member of the committee to assist with activities as needed and to take over when they complete their 2 year term.

Recruitment Committee

The Recruitment Committee organizes events for recruitment of students to SBR and social events for SBR students and faculty during the year. The Committee consists of volunteer faculty members from SBR and they elect their own Director to officiate for 2 years. The expenses for these activities are shouldered by the entire SBR faculty. The Recruitment Committee Chair chooses an active member of their committee to assist with activities and to take over when they complete their term.

Seminar Committee

The Seminar Committee organizes at least two seminars/year to be given by scientists outside of UCHC whose research is of interest SBR students and faculty. After the seminar, SBR students have a session (often lunch) with the speaker to interact more personally with the guest lecturer. More than two seminars/year can be planned, and seminars shared by SBR and other Centers or Departments at UConn Health are also scheduled. The Committee consists of volunteer faculty members from SBR and they elect their own Director to officiate for 2 years. The Committee Chair chooses an active member of their committee to assist with activities and to take over when they complete their term.

Elections

Every 2 years nominations for new members of SBR committees are sought from Program faculty and the Executive Committee. The list of the candidates for each position will be circulated by e-mail to Program faculty by the Director for voting. Candidates receiving a majority of the votes cast will be elected.

Faculty Meeting

There will be a SBR faculty meeting at least twice a year (end of the fall and spring semesters). During these meetings the Program Director will update the faculty on the overall progress of students, policies that need to be evaluated and updated and other discussion on issues related to graduate studies in Biomedical Sciences at the UConn Health and to the SBR program. Additional meetings will be scheduled as needed.

Guidelines for Graduate Faculty in the SBR PhD Program

Definition: Graduate Faculty of the Skeletal Biology and Regeneration (SBR) Program in Biomedical Sciences maintain active research programs in areas related to the general field of Skeletal, Craniofacial, Oral Biology and/or participate in the activities listed under "Active Participation" below. The policies of the SBR Program are set by the Graduate Faculty of the Program in accordance with University Graduate School guidelines.

Qualifications: To be eligible for membership in the SBR Graduate Faculty, individuals shall have a faculty appointment within the School of Medicine or Dental Medicine, and a PhD, MD, DMD, DDS or equivalent degree.

Selection: Any individual interested in membership must apply. A qualified individual who desires admission to the SBR Graduate Faculty will submit a written request to the director of the program and will include a current CV, a description of their research interests and an indication of how they envision participating. This request shall be considered by the Faculty. Election to the SBR Graduate Faculty is made by a majority vote of the SBR Graduate Faculty. The applicant must submit a formal application to the Graduate School. The new faculty member gives a seminar to the program soon after admission to the program.

Active Participation: Graduate School practice requires that members maintain active participation in their Graduate School program. Accordingly, SBR faculty should attend faculty meetings and actively participate in the educational mission of the program as recently evidenced by any of the following:

- Advising students as a major thesis advisor, associate advisor, or member of an advisory committee
- Participating on student preliminary examination committees
- Interviewing and evaluating potential students
- Teaching a SBR graduate course
- Accepting SBR students for laboratory rotations
- Actively participating in the SBR Journal Club
- Serving on SBR graduate program committees

Ex-Officio Faculty: Faculty serving as Directors of Dental Clinical Specialty Programs comprising the combined PhD/Certificate Program shall be ex-officio members. Ex-officio faculty shall serve as members of thesis advisory committees of their combined program students.

Emeritus Faculty: Interested, qualified emeritus faculty are encouraged to continue their membership in the SBR Graduate Program and should submit a written request to the director of the program, indicating how they envision participating. Emeritus faculty may participate in all of the activities listed above except hosting laboratory rotations and serving as a thesis major advisor. This request shall be considered by the SBR Graduate Faculty, with election made by a majority vote.

Maintaining Active Participation and Membership: At least once a year the Program Director will report to the SBR Graduate Faculty on the needs and opportunities to participate in the various activities listed above. Faculties are encouraged to participate as needed and as fits their academic goals. Faculty not actively participating over a three-year period should re-evaluate their membership in the SBR Graduate Faculty.