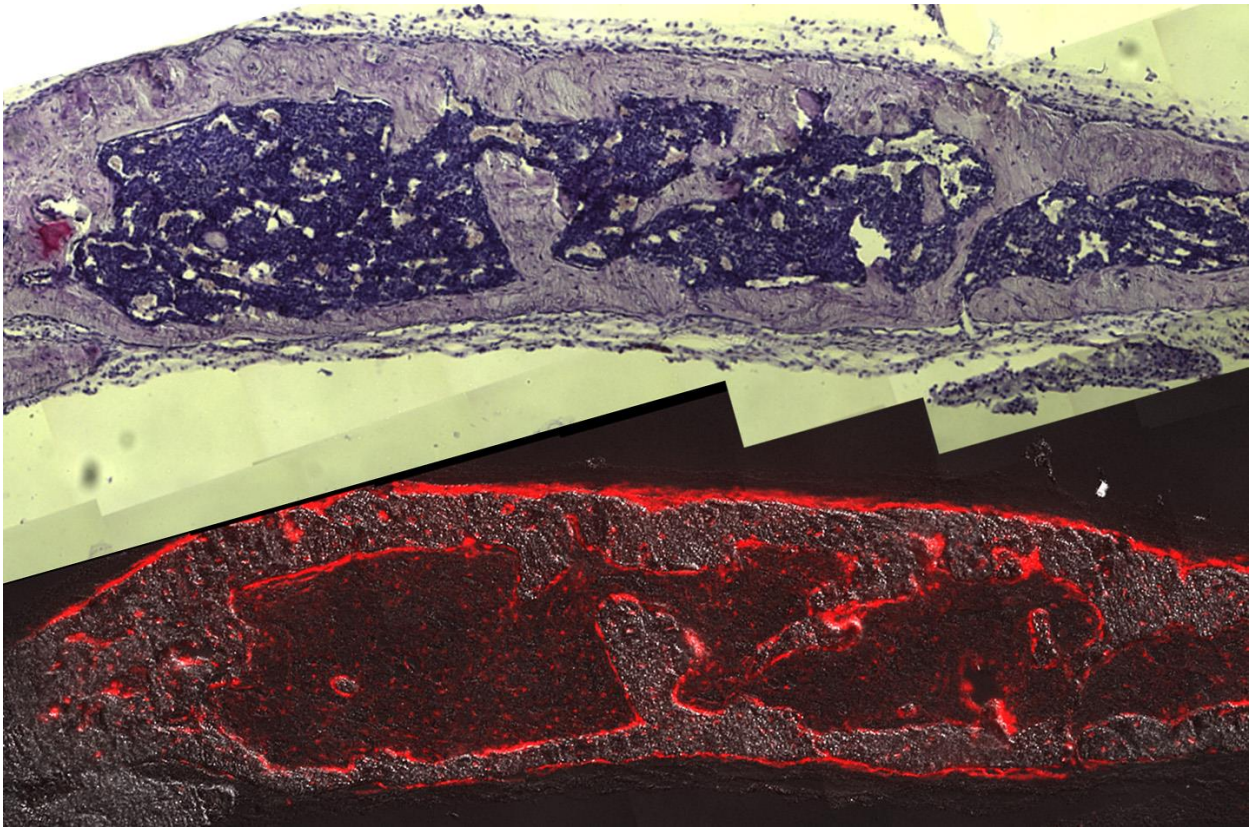
UConn Health
Skeletal Biology and Regeneration

Area of Concentration



PhD Training Program Handbook

January 7, 2020 update

http://health.uconn.edu/graduate-school/academics/programs/ph-d-biomedical-science/skeletal-biology-and-regeneration/

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PhD Training Program Handbook

This handbook describes the Skeletal Biology and Regeneration (SBR) Area of Concentration of the Biomedical Science (BMS) PhD Graduate Program at UConn Health. This booklet gives an overview of the Program requirements and expectations and details the series of milestones that students will need to accomplish to obtain the Doctor of Philosophy (PhD) degree in Biomedical Science from the University. We hope that this handbook provides adequate information about the educational philosophy, research opportunities, and financial support for the SBR Graduate Program; and that it answers most of your questions. Additional information can be found at the UConn Health Graduate School website *(http://health.uconn.edu/graduate-school/)*

Key Contacts

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1. Information for Prospective Students

Description of the Program and its Objectives

UConn Health is the health sciences campus of the University of Connecticut. UConn Health is home to the UConn John Dempsey Hospital, School of Dental Medicine, School of Medicine, and a division of the Graduate School at the University of Connecticut. It offers a wide range of educational and research opportunities and has a talented faculty pursuing exciting and innovative research on contemporary problems in biology, medicine and dental medicine.

At UConn Health, graduate education leading to the PhD degree in Biomedical Science is unified under the Biomedical Science PhD (BMS-PhD) program. This umbrella program is comprised of 134 graduate faculty and 7 thematic Areas of Concentration (AoC) (*http://health.uconn.edu/graduate-school/academics/programs/ph-d-biomedical-science/)*. The composition of the graduate faculty of each AoC is interdepartmental and include faculty from the Schools of Medicine and Dental Medicine. UConn Health faculty sponsor approximately 150 PhD students and 120 postdoctoral fellows in the Health Center's various departments and centers. Many faculty members participate in more than one AoC.

Skeletal Biology and Regeneration (SBR) is one of the seven Areas of Concentration (AoC) of the Biomedical Science PhD Program. The SBR program is multidisciplinary and its home is in the School of Dental Medicine. Faculty in the SBR program currently includes faculty of the Center for Regenerative Medicine and Skeletal Development, the Institute of Regenerative Engineering and individuals with appropriate active research programs in the Schools of Medicine and Dental Medicine. New faculty members join SBR based on the criteria described under Faculty Guidelines.

The goal of the SBR program is to provide fundamental training for the next generation of scientific scholars. Research in the SBR program is multidisciplinary. Among the topics currently investigated by faculty are: biomaterials, factors regulating bone turnover, osteoblast and osteoclast differentiation, fracture repair, cartilage and skin differentiation, craniofacial and tooth development, limb development and regeneration, osteoarthritis, stem cells for skeletal tissue regeneration and repair, pathogenesis of oral opportunistic infections in the immunocompromised host, the oral microbiome, cancer, aging, human genetic disorders of skin, cartilage and bone, inflammation biology, cytokine biology, and pathogenesis of periodontal inflammation in chronic periodontitis.

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

The specific objectives of the SBR program are:

1. To provide the student 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,
2. To provide the student with experience in the scientific method and its application to basic laboratory research and/or to clinically based research using human subjects.
3. To teach students how new knowledge is generated and disseminated through publications, presentations and grants.
4. To prepare students 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.

PhD. in Biomedical Science Program Admissions Process

Also visit the web page http://health.uconn.edu/graduate-school/admissions/apply/#biomedical

The deadline for the receipt of all application materials for the PhD. in the Biomedical Science program is DECEMBER 1.

1. You will need to complete an application form

- Application to the program is made **on-line**. The application fee must be paid with a credit card (Visa, MasterCard or Discover).

The on-line application form is used for several programs and campuses for the UConn system, so *it is important to indicate the correct enrollment information* in order to ensure that your application is routed to our program. This information is filled out on the online application on the "Enrollment Information" section of the application.

In the section labeled “Enrollment Information” please use the following information:

- In "Admission requested for" please select the **FALL** semester from the drop-down menu (Please note that this program does not have rolling admissions, and matriculates students for the **Fall semester only** following the application deadline (for example, a candidate applying by December 1, 2017 is applying for admission to the Fall 2018 semester))
- In “Field of study and degree” choose **Biomedical Science (Health Center) (PhD)** from the drop-down menu.
- In “Concentration,” choose one of the seven areas of concentration from the drop-down menu. If you are unsure which area of concentration to pick, choose the one you feel best

matches your research interests (**your choice of an area of concentration at this point is not binding**, but is for internal use). You may also select "Undecided."

- In "Campus of intended registration" choose **Farmington** from the pull-down menu (this should be the only choice available).

******Proceed to on-line application form******

2. These documents are required for application to the PhD. in Biomedical Sciences

- Official Transcripts
- Letters of Recommendation
- Personal Statement
- Residence Affidavit
- TOEFL Scores (International Applicants ONLY)
- Official GRE Scores (requested from ETS to be sent directly to the UConn Health)

DMD/PhD Program Admissions Process

Also visit the web page: http://grad.uchc.edu/prospective/programs/dmd_phd/index.html

- Applicants must satisfy the course requirements specified for admissions to the School of Dental Medicine.
- The Graduate Record Examination (GRE) is not required.
- Applicants should have research experience as the program seeks to enroll students who are deeply committed to careers as Dentist-scientists.

Interested individuals may contact:

DMD/PhD Program Director
Dr. Mina Mina
Phone: 860-679-4081
Email: Mina@nso1.uchc.edu

Clinical Specialty/PhD Program Admissions Process

Applicants to the combined clinical specialty/training program should contact the director of the desired clinical program as early as possible while in dental school. For admission to the PhD program, interested individuals should follow the Admissions Process described for PhD in Biomedical Science Program. For further details on application procedures, interested individuals may contact director of the desired clinical program and the Director of the SBR Program.

MD/PhD Program Admissions Process

Visit the web page at http://medicine.uconn.edu/curriculum/md-phd-program/

Interested individuals may contact:

MD/PhD Program Director
Dr. Carol Pilbeam, Ph.D., M.D.
Phone: 860-679-3846
Email: pilbeam@nso.uchc.edu

Research Areas/Faculty Research

The SBR program has particular strengths in the following research areas and the faculty associated with each area is listed on the SBR web page: (http://health.uconn.edu/graduate-school/academics/programs/ph-d-biomedical-science/skeletal-biology-and-regeneration/)

- Stem Cells, Development and Aging
- Bone and Cartilage Disease
- Genetic Disorders of the Skeleton
- Skeletal Repair and Regenerative Engineering
- Craniofacial and Oral Biology
- Biomaterial Synthesis and Scaffold Design
- Drug and Cell Delivery
- Biomechanical and Material Composition of Bone

Research Facilities

Faculties in the SBR Program (approximately 35 members) represent a number of schools, departments, institutes and centers. This interdisciplinary group of scientists is engaged in advancing understanding of the biology of bone, cartilage, oral tissues and skin, and exploring the potential for regeneration of these tissues lost in humans in response to trauma, disease and aging. Areas of particular research strength are listed above.

The research instruments and equipment for the research and training programs are housed in the faculty laboratories, centers, institutes and core facilities; as well as videoconference meeting rooms. Faculty and students in the SBR program have full access to these resources and facilities and other state-of-the-art information and research services at UConn Health and those at Storrs.
http://core.uconn.edu/resources

Financial Support

Students in the SBR Graduate Program may receive financial support from a variety of sources. Most students are initially supported by Research Assistantships from the Graduate Programs Committee, which currently provides student stipends for the first and second years. In subsequent years, the major advisors provide stipends.

The annual stipend for 2019-20, which is issued in bi-weekly payments, is $32,000 for all students within the Biomedical Science PhD program, irrespective of their year or Area of Concentration. The financial support package also includes full payment of tuition and associated fees, as well as health and dental insurance. There is no teaching obligation associated with this stipend.

A Training Grant from the National Institutes of Dental and Craniofacial Research (NIDCR) that is maintained by the School of Dental Medicine also supports research, education and training opportunities for qualified graduate students, students in combined degree programs (D.M.D/PhD) and postdoctoral fellows in SBR.

2. Information for Current Students

Program Requirements

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 BMS 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.

Milestones of Requirements of the SBR Graduate Program

1. **Things to know for Year 1:**

   - **First Year Advisor:** Upon entering the graduate program, you will be assigned a first-year advisor and co-advisor. You will correspond with these

two advisors primarily for help in selecting courses and lab rotations. However, if any problems arise during your first year of graduate school, please feel free to contact your first year advisors to help resolve these problems.

- **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 8-10 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 (in the fall, spring, and summer semesters). Students may petition the Chair of the Graduate Programs Committee (GPC) for permission to forego the 3rd laboratory rotation by submitting the Biomedical Science Third Rotation Waiver Form. Interested students should submit the appropriate form to the head of the GPC. The requests will be evaluated based on the student's past research experiences and academic performance.
- **End of Year 1/Start of Year 2 – Changing your advisor:** By the end of year 1 ideally you will have selected a mentor's lab to carry out your thesis work. Your new mentor will become your new advisor. Therefore, please fill out 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

2. Things to know for Year 2:

- **Organize a Thesis Committee:** With the selection of your thesis lab, in addition to your major advisor, you will need to select at least 2 other SBR faculty members to make up your Thesis Advisory Committee. 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 of 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":** by the end of May of year 2, students will take the General Exam. For this, students need to select 6 faculty to comprise a General Exam Committee. This general exam committee needs to include members of your Thesis Advisory Committee, Director or Associate Director of SBR, and other SBR or graduate faculty. 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
  Note: It is important to remember that the General Examination must be completed at least eight months prior to completion of all degree requirements. ***Details of the SBR requirements for the General Exam are found below (pages 16-21 of this document).***

3. 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.
- **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). 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 end of Year 3 and beginning of Year 4, 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). *Note: The prospectus must be ready for review at least 6 months prior to your expected date of completion and the approved prospectus must be filed in the Graduate Records Office at least 3 months prior to completion of the PhD.*
  https://registrar.uconn.edu/wp-content/uploads/sites/1604/2018/02/Dissertation-Proposal-for-Doctoral-Degree.pdf

4. Things to know in order to graduate:

- **Thesis Committee Approval:** In order to graduate, students must obtain written approval to defend their PhD thesis from each member of their Thesis Advisory Committee at least two weeks prior to the Oral Defense. This approval may be in the form of an email.

- **Notify SBR Program Director:** Students must also inform the SBR Program Director of the Final Examination/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.

- **Announce Your Oral Defense Date:** The Final Examination/Thesis Defense date must be listed on the UCONN Events Calendar at least two weeks prior to the defense.

- **Check List and Necessary Forms:**

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

  Dissertation Tentative Approval Page
  (https://registrar.uconn.edu/wp-content/uploads/sites/1604/2018/03/Dissertation-Tentative-Approval-Page.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.

Skeletal Biology and Regeneration Program Curriculum

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 (see student advisory system in the Skeletal Biology and Regeneration Graduate Training handbook). 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, the student will 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 decide to pursue their thesis work in the Skeletal Biology and Regeneration AoC must take:

- Foundations of Biomedical Science I (MEDS 6448, 4 credits) and Foundations of Biomedical Science II (MEDS 6449, 3 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 because this course 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.

- Skeletal Biology (MEDS 6445, 2 credits) AND/OR Craniofacial and Oral Biology (MEDS 5415, 2 credits)
- Responsible Conduct of Research (MEDS 5310, 1 credit)
- Skeletal Biology and Regeneration Journal Club (MEDS 6497-43, 1 credit/semester). All students in the program are required to participate in the journal club multiple semesters (see course description below)
- Laboratory Rotation MEDS 6496 (1 credit)

A suggested timeline summary for the first-year students interested in the Skeletal Biology and Regeneration AoC is as follows:

Fall Semester-Year 1
• **Skeletal Biology (MEDS 6445, 2 credits) OR Craniofacial and Oral Biology (MEDS 5415, 2 credits) whichever is being offered that semester**
• **Foundations of Biomedical Science I (MEDS 6448, 4 credits)**
• **Skeletal Biology and Regeneration Journal Club (MEDS 6497-43, 1 credit)**
• **Laboratory Rotation MEDS 6496 (1 credit)**

Spring Semester-Year 1
• **Responsible Conduct of Research (MEDS 5310, 1 credit)**
• **Foundations of Biomedical Science II (MEDS 6449, 3 credits)**
• **Tool Kit for Scientific Communication (MEDS 6447, 1 credit)**
• **Skeletal Biology and Regeneration Journal Club (MEDS 6497-43, 1 credit)**
• **Laboratory Rotation MEDS 6496 (1 credit)**
• **An additional relevant course (1-2 credits) appropriate for the research interests of the student. Additional course descriptions can be found in the graduate Course Catalog.**

Laboratory Rotation (MEDS 6496, 1 credit): In addition to course work, all doctoral degree students are expected to perform 3 separate laboratory rotations in the fall, spring, and summer semesters of the first year. During each rotation, the student will spend one full-time semester or summer in a hands-on laboratory learning experience. As mentioned above, students can petition the Graduate Programs Committee (GPC) for permission to forego the 3rd laboratory rotation.

These rotations are designed to allow the student to get a detailed exposure to the research interests of different laboratories before selecting a major advisor under whom the student will do his/her dissertation research. Students on assistantships from the Graduate Program Committee must obtain permission from their first year advisors to register for laboratory rotation. Registration requires a lab rotation form.

Students who want to explore research in Skeletal Biology and Regeneration are encouraged to perform these rotations in laboratories of faculty of the SBR AoC. Students should confer with their first year Faculty Advisors in choosing their first laboratory rotation. The rotation project will be presented in a short talk (15 min) to fellow students and faculty at the end of the semester in the “rotation talks” organized by Office of the Graduate studies. All students performing rotation research projects in SBR Program laboratories are also encouraged to present a talk at the annual symposium described below.

Skeletal Biology and Regeneration Journal Club (MEDS 6497-43, 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 in SBR Club (MEDS 6497-43) 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.

Craniofacial and Oral Biology (MEDS 5415, 2 credits): Craniofacial and Oral Biology is 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.

Skeletal Biology (MEDS 6445, 2 credits): Skeletal Biology is 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.

<u>Other Relevant Courses</u>

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

- Stem Cells & Regenerative Biology, MEDS 5418, 3 credits
- Advanced Genetics and Molecular Biology, MEDS 5369, 3 credits
- Molecular Basis of Disease, MEDS 5309, 2 credits
- Developmental Biology, MEDS 5322, 2 credits

- Immunobiology I, MEDS 5329, 2 credits
- Immunobiology II, MEDS 5330, 2 credits
- Introduction to Cancer Biology, MEDS 6413, 2 credits
- Optical Microscopy and Bioimaging, MEDS 6450, 3 credits
- Molecular Basis of Disease, MEDS 5309, 2 credits.
- Medical Microbiology, MEDS 6444, 3 credits
- Biochemistry II (Biophysical Methods), MEDS 5351, 3 credits
- Introduction to Systems Biology, MEDS 6455, 3 credits

Annual Symposium

Each year, the SBR program holds symposium and retreat. All trainees attend and present their work. Trainees are included in the symposium planning committee and have the responsibility for organizing and chairing the scientific program. Career development sessions are also a part of the symposium.

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*.

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. Each SBR AoC student must take the General Examination by the end of the second academic year (end of May) in order to remain in good standing and to receive continued support of tuition and stipend.

- *The student and the major advisor should start the process for the General Examination in the beginning of 2nd (spring) semester of the 2nd year in PhD studies and follow the guidelines described below.*

❖ **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 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.

❖ *Steps leading up to the General Exam*

1. Organize a General Exam Committee, Which Must Consist of:

- At least **6** faculty members
- Members of your Thesis Advisory Committee
- Your Major Advisor*
- Director or Associate Director of the SBR graduate program[#]
- Faculty outside the SBR graduate faculty to join the examining committee if needed
- 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.

*The major advisor should not participate in formulating the specific aims of the proposal but should advise the student concerning the overall suitability of the topic. The major advisor will participate in the examination committee as an observer and will participate in the final decision on the outcome of the exam.

[#]To assure uniformity of this exam, at least one member of the student's General Exam committee must be the director or associate director of the SBR graduate program. The program director or associate director should ensure that all the exams are administered fairly and in a uniform fashion.

2. **Create a research topic and prepare a 2-3 page mini-research 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 2-3 page document should include some background information, identified gap(s) in knowledge that will be addressed, specific aims, experimental design and selected references.

3. **Set up an initial meeting with your general exam committee:** At the first general exam committee meeting three things will happen:

   a) The committee will go over your 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, and 24 credits for students with Masters. These credits should include 15 doctoral research credits.) At this meeting, 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 should 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.

   b) Amongst your committee members a chair will be assigned. The General Exam committee will select a chair (other than the major advisor) who will be the primary person responsible for communication with the student and for organization of the exam. This chair will serve as a person the student can use for advice on grant writing and to relay information to the rest of your committee. The chair will also provide detailed feedback from other committee members to the student, as an aid to improve your research plan.

   c) Your 2-3 page mini-research plan will be discussed (See below).

4. ***Work with your committee to establish a research plan:*** The aims and objectives of the research plan proposed by the student must first be approved by his/her general exam committee prior to writing the full grant proposal. This will require a meeting where the student and general exam committee discuss the research plan. At least one week prior to this meeting, the student should email the members of the general exam committee a short 2-3 page document (mini-proposal) containing a brief description his/her research plan. In this way, your committee can be informed of your research plan and ask appropriate questions to discuss the proposal at this first meeting.

- It is not uncommon for the general exam committee to ask the student to revise and/or make modifications to his/her mini-proposal. 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 their 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.

  - **After approval of the 2-3 page document by the committee, the student will be given 4 weeks to complete and submit the written proposal**.

❖ Overview of the General Examination

The General Examination has two parts: Part One is a written research proposal and Part Two is an oral examination based on the submitted proposal.

Part One: The Written Research Proposal

The research proposal should be prepared in the format of an NIH R-type grant application and suitable for a three year research project.

In preparation of the application 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.

In preparing the proposal, it will be very helpful to look at the instructions for the Research Plan (Section 5) of a Public Health Service grant application (PHS 398) available from the Office of Extramural Research of the National Institutes of Health. *(http://grants.nih.gov/grants/funding/phs398/phs398.html)*. As mentioned before, the guidelines for preparation of this proposal is similar but not identical to the instruction provided by NIH. The application should follow the instructions listed below:

The total length of the proposal (including figures but not References) should not exceed 15 pages and should resemble a professional grant proposal. The page limit

listed here is different from the NIH R-type grant application and is intended to allow the students to include the following materials listed below:

- Title Page: (one page). Proposal Title, Student's Name, and Major Advisor.
- 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 (up to 12 pages) The Research Strategy should include

    (a) Preliminary results (No preliminary data are required but may be included if available)
    (b) Significance. This section should contain a critical evaluation of existing knowledge and identify the gaps that the project is intended to fill.
    (c) Innovation. Explain how the application 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).
    (d) Approach (Experimental Design) Describe the overall strategy, methodology, and analyses to be used to accomplish the specific aims of the project. Discuss how the data will be collected, analyzed, and interpreted. Discuss potential problems, alternative strategies, for each aim.

- Bibliography and References Cited - Provide a bibliography of any references cited in the Proposal. Each reference must include names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. While there is not a page limitation, it is important to be concise and to select only those literature references pertinent to the proposed research.
- Animal Care Considerations (if animals are to be used). All NIH grants require justification of the animal numbers to be used in the experiments proposed. The student should give some brief explanation of the numbers of animals proposed in the experiments in this section. This is usually based on a power analysis to calculate the number estimated to give statistical significance. The thesis advisor or other committee members can help with this section. This section is not counted in the total page allotment.

In preparing the research proposal, the student may consult any faculty member, or any other source, for information on experimental methods and approaches. 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.

Part Two: The Oral Examination

The Oral Examination should be scheduled no later than 2 weeks after the submission of the written proposal. Students should plan on the examination lasting approximately 2 hours.

At the beginning of the Oral Examination, the chair should ask the student to leave the room briefly. The committee will discuss the quality of the written proposal. If the quality is unacceptable, the student can be asked to revise the application based on the feedback from the committee. Student will have two weeks to submit the revised proposal.

If the proposal is generally acceptable, any specific deficiencies in the written proposal should be identified and subject to further discussion in the Oral Examination.

The committee should review the guidelines and expectations for the Oral Examination. The student has the opportunity to give a 15-minute presentation. This brief presentation is to 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. The committee members should decide in advance if they plan to let the student do the presentation uninterrupted and ask questions at the end; or interrupt with questions during the presentation. The student will then be invited back and will be informed about the format of the exam.

Exam questions should be designed to probe the student's depth of knowledge on the chosen subject of the proposal (relevant biological principals and knowledge of the techniques proposed). Exam questions should determine the student's general knowledge 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 an appropriately 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, he/she will ask the committee to start their evaluation.

Evaluation. 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 present during these deliberations and 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 will vote on the outcome with a simple majority deciding. Grading will be on a pass-fail basis. Separate entries for the written and oral sections are made into the records. There will be an overall grade for the entire examination. The committee can recommend unconditional pass, incomplete pending specific remediation, or failure. In cases of incomplete, specific instructions for remediation and the amount of time available for completion of the remediation will be submitted to the student in writing by the committee. This remediation could include revising and re-defending the proposal. If the subsequent remedial activity is inadequate, the student will fail the exam and will be asked to withdraw from the program.

The student will then be asked to re-enter the room and the Chair of the Examination Committee will communicate the outcome to the candidate. After the General Exam, the Report on the General Exam form must be signed by each member of the General Exam Committee and submitted by the Advisor to the UConn Health Registrar's Office.

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 at the following site: http://health.uconn.edu/student-services/registrar/current-uconn-health-graduate-school-students

The University of Connecticut awards degrees three times a year (August, December and May). The UConn Health Commencement ceremony is held in May. Graduation in May of a given year is dependent on meeting the deadlines set by of the Graduate School.

In preparation for the thesis defense, students in the SBR AoC should have a meeting 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.

After this meeting, the student, in consultation with the Major Advisor, writes the Dissertation. 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.

A Tentative Approval page signed by all members of the Thesis Advisory Committee must be submitted to the Graduate School two weeks prior to the Oral Defense. In addition the Program Director of SBR should be informed of the Final Examination/Thesis Defense date *at least two weeks prior to the defense*. The Program Director will inform the faculty and students of the SBR AoC, who are expected to attend these events.

This final examination entails a formal seminar presented by the student to an audience that must include at least 5 faculties and must include all members of the Advisory Committee. At this public defense the student will answer questions and will be evaluated based on their presentation, knowledge of the literature and the significance and limitations of their research. 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 thesis. The Thesis Advisory Committee will vote to accept or reject the dissertation. The report on the Final Examination is then signed by faculty and submitted to the Graduate School.

3. Information for Faculty

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 Jan 1 and ends Dec 31.

The Director performs a number of important 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, 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 this 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 or Annual Retreat/Symposium.
- 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.