



Skeletal, Craniofacial and Oral Biology (SCOB)

Area of Concentration

PhD Training Program Handbook

University of Connecticut Health Center

http://grad.uhc.edu/prospective/programs/phd_biosci/concentration/oral_bio/index.html

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This handbook describes the Skeletal, Craniofacial and Oral Biology (SCOB) Area of Concentration of the Biomedical Science (BMS) PhD Graduate Program at the University of Connecticut Health Center (UCHC). 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 SCOB Graduate Program; and that it answers most of your questions. Additional information can be found at the UCHC Graduate School website (<http://grad.uhc.edu/>)

Key Contacts

SCOB Graduate Program

Program Director

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Musculoskeletal Institute/Medicine- MC5456
MARB4051

Associate Program Director

Dr. Gloria Gronowicz
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SURGERY - MC3105
L2028A

DMD/PhD and Skeletal, Craniofacial and Oral Biology Training Grant

Program Director

Dr. Mina Mina
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Craniofacial Sciences/Pediatric Dentistry-MC1610
L6081

Associate Program Director

Dr. Jon Goldberg
Email: goldberg@uchc.edu
Reconstructive Sciences/Center for Regenerative Medicine and Skeletal Biology-MC1615
L6102

1. Information for Prospective Students

Description of the Program and its Objectives

The Health Center is the health sciences campus of the University of Connecticut. The UConn Health Center (UCHC) is home to the School of Dental Medicine, School of Medicine, a division of the Graduate School at the University of Connecticut and John Dempsey Hospital. The Health Center 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 the Health Center, graduate education leading to the PhD degree in Biomedical Science is unified under UCHC's Biomedical Science PhD (BMS-PhD) program. This umbrella program is comprised of 156 graduate faculty and 7 thematic Areas of Concentration (AoC) (http://grad.uhc.edu/prospective/programs/phd_biosci/index.html). The composition of the graduate faculty of each AoC is interdepartmental and include faculty from the Schools of Medicine and Dental Medicine. UCHC faculty sponsor approximately 175 PhD students and 120 postdoctoral fellows in the Health Center's various departments and centers. Many faculties participate in more than one AoC.

Skeletal, Craniofacial and Oral Biology (SCOB) is one of the seven AoCs of the Biomedical Science PhD Program at UCHC. This program is multidisciplinary and is associated with the Center for Regenerative Medicine and Skeletal Development. Faculty in the SCOB program includes all faculty of the Center for Regenerative Medicine and Skeletal Development, and individuals with appropriate active research programs in the Schools of Dental Medicine and Medicine.

The goal of the SCOB program is to provide fundamental training for the next generation of scientific scholars, who will study the basic biological properties of skeletal, craniofacial and oral tissues. Research in the SCOB program is multidisciplinary, incorporating contemporary research techniques of cellular and molecular biology. Among the topics currently investigated by faculty are: biomaterials, factors regulating bone turnover, osteoblast and osteoclast differentiation, growth factors and fracture repair, cartilage and skin differentiation, craniofacial and tooth development, limb development and regeneration, stem cells for skeletal tissue regeneration and repair, pathogenesis of oral opportunistic infections in the immunocompromised host, inflammation biology, cytokine biology, and pathogenesis of periodontal inflammation in chronic periodontitis.

A PhD in SCOB can be combined with DMD or MD training leading to DMD/PhD and MD/PhD degrees. A PhD in SCOB and also be combined with Dental Clinical Specialty Training. For more information about these dual degree programs visit the following web pages.

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DMD/PhD: http://grad.uhc.edu/prospective/programs/dmd_phd/index.html

MD/PhD: http://medicine.uhc.edu/prospective/md_phd/index.html.

Dental Clinical Specialty/PhD: http://grad.uhc.edu/prospective/programs/dcs_phd/index.html

The specific objectives of the SCOB program are:

1. To provide the student with a thorough understanding of the current scientific basis of skeletal, craniofacial and oral biology and how new knowledge is generated and disseminated.
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 prepare students to pursue careers as scientists and scholars in biological and biomedical science in a wide variety of settings including academia, 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://grad.uhc.edu/prospective/programs/phd_biosci/apply.html

The deadline for the receipt of all application materials for the PhD. in the Biomedical Science program is DECEMBER 15. Students need to follow two steps in applying to the PhD. in Biomedical Science Program.

1. Send a packet containing the following supporting materials to:

**Graduate Admission Office
PhD. in Biomedical Science Program
University of Connecticut Health Center
263 Farmington Avenue, MC 3906
Farmington, CT 06030-3906**

- Official Transcripts
 - Letters of Recommendation
 - Personal Statement
 - Residence Affidavit (CT Residents ONLY)
 - TOEFL Scores (International Applicants ONLY)
 - Official GRE Scores (requested from ETS to be sent directly to the UConn Health Center)
2. Complete an application form via the online or paper method.

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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:

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. Acceptances are made by November of the year prior to appointment. 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 SCOB Program.

MD/PhD Program Admissions Process

Visit the web page at http://medicine.uchc.edu/prospective/md_phd/index.html

Interested individuals may contact:

Program Director
Dr. Barbara E. Kream
Phone: 860-679-3849
Email: kream@nso1.uchc.edu

Research Areas/Faculty Research

The SCOB program has particular strengths in the following research areas and the faculty associated with each area is listed on the SCOB web page:

(http://grad.uchc.edu/prospective/programs/phd_biosci/concentration/oral_bio/areas.html)

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Oral & Craniofacial Biology:

Immunology, Infection & Disease, Cancer, Development, Stem Cells

Skeletal Biology:

Development, Homeostasis, Aging, Cancer, Disease, Stem Cells

Regenerative Engineering of Skeletal Tissues:

Biomaterials, Stem Cells

Research Facilities

Faculties in the SCOB 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. There are particularly outstanding research capabilities for fluorescent microscopy and characterization and evaluation of biomaterials; as well as videoconference meeting rooms. Faculty and students in the SCOB program have full access to these resources and facilities and other state-of-the-art information and research services at the UCHC including:

Lyman Maynard Stowe Library

<http://library.uchc.edu/>

Bioengineering Center

<http://hcrac.uchc.edu/facilities/bioengineering.html>

Biophysical Core

<http://mmsb.uchc.edu/Resources/BiophysicsCore.php>

Center for Cell Analysis and Modeling (CCAM)

<http://www.ccam.uchc.edu/>

Center for Comparative Medicine (CCM) (formerly Center for Laboratory Animal Care)

<http://www.ccam.uchc.edu/>

Division of Epidemiology and Biostatistics

<http://www.commed.uchc.edu/biostat/>

Electron Microscopy Facility

http://hcrac.uchc.edu/facilities/electron_microscopy.html

Flow Cytometry Center

<http://flowcytometry.uchc.edu/>

Gene Targeting & Transgenic Facility

<http://gttf.uchc.edu/>

Gregory P. Mullen NMR Structural Biology Facility

<http://structuralbiology.uchc.edu/>

Microtomography (MicroCT) Imaging Facility

http://researchit.uchc.edu/resources/microct_imaging.html

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Molecular Core Facility

<http://mc.uchc.edu/mc/default.htm>

National Resource for Cell Analysis and Modeling (NRCAM)

<http://www.nrcam.uchc.edu/>

Proteomics and Biological Mass Spectrometry Core Facility

Research Computing Support (RCS)

<http://itweb.uchc.edu/ES/ResearchComputingSupport.htm>

Research Histology Core

<http://researchhistology.uchc.edu/>

Research Tissue Repository Core Facility

<http://biobank.uchc.edu/>

Stem Cell Core

<http://stemcellcore.uchc.edu/>

Translational Genomics Core

<http://translationalgenomics.uchc.edu/>

Viral Vector Core

<http://viralvector.uchc.edu/>

Financial Support

Students in the SCOB 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 2010-11, which is issued in bi-weekly payments, is \$28,000 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, MD/PhD) and postdoctoral fellows in the area of Skeletal, Craniofacial & Oral Biology.

2. Information for Current Students

Program Requirements

The SCOB program follows the guidelines, requirements and milestones set by the Graduate School. The program also has a few requirements that are specific to the SCOB AoC. The program recognizes that students from different backgrounds enter our program.

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Therefore, while following specific guidelines, the program also has incorporated a degree of flexibility.

The following section describes both BMS-PhD and SCOB-specific requirements.

Requirements and Milestones Set by the BMS-PhD and Graduate School.

Students are strongly encouraged to become familiar with the BMS Graduate Student Handbook for all details pertaining to expectations and milestones set by the Graduate School. Useful web pages are:

http://grad.uhc.edu/current/student_handbook/student_handbook.pdf

<http://grad.uhc.edu/current/milestones/index.html> (this web page contains link to all necessary forms).

All students must:

Register each fall and spring semester. At least six credits/semester are required for full time status for students holding graduate research assistantships. Nine credits are required for full time status for students not on graduate assistantships. Typically during the first year students will take at least 8 to 10 credits per semester.

A total of 44-48 credits of graduate work (300 and 400 courses) are required by the University for the PhD. degree. Modifications of course requirements can be made by the Advisory Committee on the basis of the student's previous experience.

A student already holding a Master's degree in an appropriate field, with the agreement of the thesis advisory committee, may complete as few as 24 credits for the degree. Transfer credit is given as an entity when the doctoral plan of study is being approved by the thesis advisory committee. Transfer of up to 24 credits completed at another institution is approved only after the student has demonstrated the ability to do acceptable graduate work at the University of Connecticut. Such ability must be demonstrated by successful completion of graduate level University of Connecticut course work.

All students must perform laboratory rotations in the fall, spring, and summer semesters of the first year. Therefore, three laboratory rotations are normally taken. Students can petition the Graduate Programs Committee (GPC) for permission to forego the 3rd laboratory rotation. 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.

Prior to September of the second year students will select a major advisor for their thesis. Students choosing the SCOB AoC must choose a major advisor affiliated with the SCOB AoC. Students must complete a "Change of Advisor form" and obtain the appropriate signatures.

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Students must submit a “Plan of Study” by January of Year 2. This form must be submitted and on file prior to taking the General Exam.

Students doing thesis research may need to register for one of the required doctoral research courses (GRAD 6950, 6960, 6930) to bring their total credits to 44-48. Students must register each semester until the Program of Study has been completed.

Students must take and pass the General Examination, also known as the Qualifying Examination. The format for this exam is described in the following section. This exam should be taken no later than the end of the Year 2. Students must submit the “Report on the General Examination” form detailing the results of the examination immediately following the examination. It is important to remember that the General Examination must be completed at least eight months prior to completion of all degree requirements.

Students must submit a Dissertation Proposal (i.e., Thesis Prospectus) using the “Dissertation Proposal” form by the end of the third year of study. The Dissertation Proposal (i.e., Thesis Prospectus) must be submitted and on file at least 6 months prior to the PhD oral defense examination.

Students must submit the dissertation and pass the associated Oral Examination. Completion of the PhD. thesis and the associated Oral Examination has a number of requirements, which are outlined in the “*Dissertation Guidelines.*”

The Final Examination/Thesis Defense date must be listed on the UCONN Events Calendar at least two weeks prior to the defense (*for details, please see <http://www.grad.uconn.edu/announcing.html>*).

“The Report on the Final Examination” form must be submitted upon completion of the Oral Exam, along with all other necessary paperwork

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.

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.

All work must be completed within eight years of entry into the program (extensions may be requested).

In order to remain in good standing, students must maintain an overall GPA of 3.0 per the guidelines of the University of Connecticut Graduate School.

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Requirements Set by SCOB Program.

Students in the SCOB AoC should also:

- Take the courses required by the SCOB AoC.
- 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.
- Submit the Plan of Study no later than end of January of the 2nd year in PhD studies. The Plan of Study must be approved before the Graduate School will issue a permit for the student to take the General Examination.
- Take the General Examination by the end of the second academic year (end of May).
- Have meetings with their thesis advisory committee twice a year.
- Inform the 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 SCOB AoC. The faculty and students in the SCOB program are expected to attend these events.

Skeletal, Craniofacial and Oral Biology Program Curriculum

Course Work

Courses are chosen to provide a broad background in Skeletal, Craniofacial and Oral Biology, 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. For students on Graduate Program Committee Assistantships, first year faculty advisors are appointed by the Associate Dean of the Graduate School. 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 SCOB Journal Club every semester, with a final-semester exemption for a student writing his/her dissertation.

To remain eligible for continued Health Center assistantship support, second year students must complete at least 8 credits of regularly graded courses.

DMD/PhD and MD/PhD Students: The SCOB Graduate Program recognizes the extensive course work taken in phase 1 of the MD/PhD and DMD/PhD 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 PhD. degree requirements.

Students who decide to pursue their thesis work in the SCOB AoC must take:

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- Logic of Modern Biology (MEDS 5327, 4 credits) (MD/PhD trainees are not required to take this course. However, DMD/PhD are required to take this course because this course is 1) an excellent introduction to contemporary topics in modern biology, 2) is one of the few courses available that prepares the students in grant writing, and 3) allows to the DMD/PhD student to become integrated in the Graduate School.
- Skeletal Biology (MEDS 6445, 2 credits)
- Craniofacial and Oral Biology (MEDS 5415, 2 credits)
- Responsible Conduct of Research (MEDS 5310, 1 credit),
- SCOB 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 SCOB 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.
- Logic of Modern Biology (MEDS 5327, 4 credits)
- SCOB 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)
- Cell Biology I (MEDS 5380, 4 credits)
- SCOB Journal Club (MEDS 6497-43, 1 credit)
- Presentation of Scientific Data (MEDS 6447, 1 credit) and/or
- Introduction to Developmental Biology (MEDS 5322, 2 credits)
- Laboratory Rotation MEDS 6496 (1 credit)

Other Relevant Courses

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

- Immunobiology I, MEDS 5329, 2 credit
- Cell Biology I, MEDS 5380, 4 credits
- Introduction to Biomaterials and Tissue Engineering, MEDS 5313, 3 credits
- Stem Cells & Regenerative Biology, MEDS 5418, 4 credits
- Advanced Genetics and Molecular Biology, MEDS 6369, 3 credits

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- Advanced Cell Biology: From Microscope to Model—Quantitative Approaches to Cell Biology, MEDS 5382-40, 2 credits
- Introduction to Cancer Biology, MEDS 6413, 2 credits
- Optical Microscopy and Bioimaging, MEDS 6450, 3 credits
- Bioinformatics and Computational Molecular Biology, BE 5800, 3 credits
- Critical Analysis of the Biological Literature, MEDS 307, 2 credits
- Molecular Basis of Disease, MEDS 5309, 2 credits.
- Immunobiology II, MEDS 5330, 2 credits

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 (http://studentservices.uchc.edu/registrar/gradschool/forms/form_labrotation.pdf).

Students who want to explore research in Skeletal, Craniofacial and Oral Biology are encouraged to perform these rotations in laboratories of faculty of the SCOB 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 SCOB Program laboratories are also encouraged to present a talk at the annual symposium described below.

Skeletal, Craniofacial and Oral Biology (SCOB) Journal Club (MEDS 6497-43, 1 Credit): SCOB Journal Club, which meets each Friday from noon – 1pm during the school year, is a major focal point of the SCOB AoC. Students are required to participate in SCOB 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 UHC SCOB 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

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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 SCOB 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 weekly 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 weekly written assignments and class participation.

Annual Symposium

Each year, the SCOB program holds an off-site 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.

Student Advisory System Overview

First Year Advisors: Upon entering the BMS-PhD program, a student will be assigned to a first year advisor and co-advisor. These individuals assist the students in the selection of suitable courses and laboratory rotations during the first year prior to selection of an AoC.

Major Advisor and Thesis Advisory Committee: At the end of the first year of study, students will formally select a Major Advisor and the AoC for their studies. After these selections, the Major Advisor and the student jointly form a Thesis Advisory Committee. This committee consists of the major advisor and at least two other faculty members of the SCOB program.

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This committee may be expanded to up to five members. Additional advisors may be members of other AoC at UCHC, or another program within the UConn graduate faculty. If desired, an external associate advisor from the faculty of another university may be added to the committee if the individual is considered to be expert in the area of the student's dissertation research. In such a case, the student's major advisor must write a letter to the Graduate School requesting such status for the external advisor, and submit the individual's curriculum vitae.

The Advisory Committee will monitor the student's progress, help organize the Plan of Study (i.e., select courses to be taken in remaining years) and serve in a general advisory capacity. The committee, with the major advisor, will be involved in the General Examination. After completion of the General Examination, the advisory committee will serve as the PhD. thesis advisory committee, meeting with the student twice a year.

General Examination Committee. This committee is formed by the student and the Thesis Advisory Committee and will consist of at least 6 members including the Thesis Advisory Committee and director or associate director of the SCOB graduate program. This committee is a temporary committee that is involved in the administration of the General Examination.

Plan of Study

With the guidance of 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 needs 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 of 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 SCOB 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 goals of the General Examination are:

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- 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.

The General Examination will focus on a research proposal that is prepared and defended 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.

Format and Overview of the General Examination

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

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:

Selection of the General Examination committee: This committee will consist of at least 6 members including the Thesis Advisory 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 SCOB graduate program. The program director or associate director should ensure that all the exams are administered fairly and in a uniform fashion. The candidate, following consultation with the thesis advisor and advisory committee, can invite any additional faculty outside the SCOB 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.

Selection of a chair for the examination committee. The General Exam committee will select a chair (other than the major advisor) who will be the primary person responsible for communications with the student and for organization of the exam.

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After the selection of the committee and the chair, student will meet with the committee to go over the Plan of Study and grades. The committee should ensure that student has and will continue to take appropriate courses that are required by the Graduate School and the AoC (a total of 44-48 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 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.

The committee (with the student) should review the topic for the exam. 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.

The Committee should go over the procedures associated with the exam.

After discussion the student should submit a 2-page outline of the proposal no later than 2 weeks after the initial meeting. This 2-page outline should include a brief background, identify the gaps in current knowledge that are being addressed, specific aims, experimental design and selected references. The committee will review this document. If revisions are necessary, the committee will submit their suggestion in writing to the student and the student will be given 2 weeks to submit a revision of the 2-page outline to the Chair of the examination committee. The revised documents will be sent to the examination committee for their approval (only one revision is allowed). In situations in which revisions are not fully approved but are sufficient, the student will be allowed to proceed to the next steps in the General Examination process.

Once the 2-page document is approved, the specific aims should not be substantially changed without approval of the examining committee.

After the approval of the 2-page outline by the committee, the student will be given 4 weeks to complete and submit the written 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 two to three year research project.

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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. How the data will be collected, analyzed, and interpreted. Discuss potential problems, alternative strategies, for each aim.

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- 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 given a temporary "fail" at this point and 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;

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or interrupted 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. The final results, bearing the signature of each Examination Committee member, will then be reported to the Graduate Records Office.

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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 and summarized on the Graduation Checklist. The University of Connecticut awards degrees three times a year (August, December and May). The Health Center 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 SCOB AoC should have a meeting with their thesis advisory committee (“private defense”), to review the progress in their research. At this time the 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. Tentative approval of the written dissertation must be granted by the committee prior to scheduling the public defense.

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 SCOB 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. The complete and final document should be submitted to the Thesis Advisory Committee prior to the public defense.

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 public defense must be announced through the Graduate School and the SCOB program director at least 2 weeks ahead of time. 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 take a final (private) 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 the Faculty

Program Administration

Director and Associate Director of the Program

The Director of the SCOB Program serves a 2-year term from July 1st to June 30th of the second year, following their term as Associate Director.

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 SCOB 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) overseeing Program activities during recruitment weekends.

The Associate Director is elected by a majority vote of the SCOB program faculty from nominations made by the Executive Committee. 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) attending the Student Progress Review Committee, which meets biannually after the fall and spring semesters; 4) providing formal written reports/updates to the Executive Committee on student progress; 5) substituting for the Director at 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 SCOB AoC serve 2-year terms from July 1st to June 30th of the second year. The Directors are selected by nominations from the Executive Committee and SCOB faculty. 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

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Director of the T90/R90 training grant. A student representative and the director of the Center for Regenerative Medicine and Skeletal Development will be invited to these meetings on an ad-hoc basis.

This committee meets monthly to review program policy and the rules outlined in this handbook. The frequency of the meetings can be increased if needed. This committee also monitors progress of the students from the time they enter the program until they have completed their dissertation. As part of this monitoring, the Associate Director submits a formal report of every SCOB student's progress in research, publications and the biannual Thesis Advisory Committee reports once a year (at the end of each academic year). 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 directors of existing courses (Skeletal Biology; Craniofacial and Oral Biology; and Skeletal, Craniofacial and Oral Biology Journal Club) and one additional SCOB 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, regularly 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 SCOB faculty. The SCOB faculty will vote on changes and recommendations. Final decisions on new courses are made by the Executive Committee based on the recommendation SCOB 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://studentservices.uchc.edu/registrar/gradschool/index.html>) and that each course is represented at the Course Fair preceding registration.

Elections

Nominations for various positions are sought from Program faculty and the Executive Committee prior to the meeting of the Executive Committee in May preceding the change in Directorship on June 1. 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 plurality of the votes cast will be elected.

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Faculty Meeting

There will be a SCOB 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 UHC and to the SCOB program. Additional meetings will be scheduled as needed.

Guidelines for Graduate Faculty in the SCOB PhD Program

Definition

Graduate Faculty of the Skeletal, Craniofacial and Oral Biology (SCOB) Program in Biomedical Sciences maintain active research programs in areas related to the general field of Skeletal, Craniofacial and Oral Biology and/or participate in the activities listed under “Active Participation” below. The policies of the SCOB 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 SCOB 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 SCOB Graduate Faculty will submit a written request to the director of the program that 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 SCOB Graduate Faculty is made by a majority vote of the SCOB Graduate Faculty. The new faculty member should give 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, SCOB faculty should attend faculty meetings and

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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 a temporary advisory committee.
- Participating on student preliminary examination committees.
- Interviewing and evaluating potential students.
- Teaching a SCOB graduate course.
- Accepting SCOB students for laboratory rotations.
- Actively participating in the SCOB Journal Club or Annual Retreat/Symposium.
- Serving on SCOB 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 SCOB 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 SCOB 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 SCOB 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 SCOB Graduate Faculty.