STEM CELL BIOLOGY AND REGENERATIVE MEDICINE

Courses offered by the Program in Stem Cell Biology and Regenerative Medicine are listed under the subject code STEMREM on the Stanford Bulletin’s Explore Courses web site.

Graduate Program in Stem Cell Biology and Regenerative Medicine

The Stanford Stem Cell Biology and Regenerative Medicine (SCBRM) program is dedicated to doctoral education that translates basic science to clinical applications, typically referred to as Translational Science, and of intense interest internationally in medical schools and universities. Our doctoral program provides exceptional didactic education and research experience in the basic sciences underlying stem cell biology. In addition, program participants will receive specialized training in the development and clinical application of discoveries in the basic sciences to achieve regenerative therapies. Thus, our graduates will be uniquely positioned to develop successful translational careers in Stem Cell Biology and Regenerative Medicine, and will emerge prepared to deliver on their passion to improve the human condition. The core curriculum is combined with unique research and clinical/professional immersion rotations to provide opportunities for doctoral students to specialize in the broad subject of translational medicine and yet focus specifically on fundamentals of SCBRM. The curriculum combines education in genetics and developmental biology with an introductory laboratory-based stem cell course, an advanced course in stem cell biology and regenerative medicine, and a clinical rotation with alternative opportunities in law, business and/or engineering.

The mission of the SCBRM graduate program is to produce future leaders in translational science through a combination of basic science and clinical/professional immersion. The program aims to be innovative and to change the landscape for graduate education in the biomedical sciences by having the immersion tailored to each student’s translational goals. The program accommodates students who wish to focus primarily at the basic science level alongside those who wish to focus specifically on innovation such as a new device to solve a clinical problem. In the former case, the student might seek out a primary mentor affiliated with the basic sciences and take electives that reflect the more basic interest. In the latter case, the student might select an elective with an engineering focus and seek out primary mentorship with a more clinically or engineering focused mentor. In this way, graduates from our doctoral program receive exceptional didactic education and research experience and are well positioned to develop successful translational careers in SCBRM by applying their knowledge and passion to improve human health.

COVID-19-Related Degree Requirement Changes

For information on how Stem Cell Biology and Regenerative Medicine degree requirements have been affected by the pandemic, see the "COVID-19 Policies tab (p. 3)" in this section of this bulletin. For University-wide policy changes related to the pandemic, see the "COVID-19 and Academic Continuity (http://exploredegrees.stanford.edu/covid-19-policy-changes)" section of this bulletin.

Master of Science in Stem Cell Biology and Regenerative Medicine

University requirements for the M.S. degree are described in the "Graduate Degree (http://exploredegrees.stanford.edu/graduatedegrees)" section of this bulletin.

Students in the Ph.D. program in SCBRM may apply for an M.S. degree in SCBRM, assuming completion of appropriate requirements. The program does not accept applications for a standalone M.S. degree.

To receive an M.S. in Stem Cell Biology and Regenerative Medicine, Students must complete the following:

1. Four full-tuition quarters of residency as a graduate student at Stanford.
2. At least 45 units of academic work, all of which must be in courses at or above the 100 level, 16 units of which must be at or above the 200 level.
3. Four quarters of graduate research, consisting of rotations in the labs of at least three SCBRM faculty members.
4. Course work in Stem Cell Biology and Regenerative Medicine as well as other core requirements:
   a. STEMREM 200 Stem Cell Intensive hands-on immersion to learn basic methods of tissue culture, mouse embryo fibroblast (MEF) preparation, embryonic stem and induced pluripotent stem (ES/iPS) cell culture, differentiation, DNA isolation, polymerase chain reaction (PCR), sequencing, and basic microscopy.
   b. BIOS 200 Foundations in Experimental Biology focuses on the broad themes of Evolution, Energy and Information.
   c. STEMREM 201A Stem Cells and Human Development: From Embryo to Cell Lineage Determination and STEMREM 201B Stem Cells and Human Development Laboratory develop a fundamental understanding of introductory stem cell principles in human development, aging, and disease accompanied by a laboratory-based module with immersion in stem cell-based methods (embryology, embryonic stem cells, reprogramming, adult stem cells).
   d. STEMREM 202 Stem Cells and Translational Medicine, advanced topics related to individual organ systems, cancer stem cells, translational principles of medicine, and immunology as related to regenerative medicine, as well as bioengineering and bioinformatics as related to stem cell biology.
   e. STEMREM 203 Stem Cells Immersion: Applications in Medicine, Business and Law, students specialize and choose a clinical immersion, rotation in a biotechnology company or venture firm, or further delve into cutting edge technologies, bioinformatics, materials and/or engineering approaches for stem cell applications in industry, diagnostics and medicine.
   f. STEMREM 250 Regenerative Medicine Seminar Series, a forum for researchers to meet and discuss Stem Cell Biology and Regenerative Medicine and to spark collaborations. 6 units of this course is required.
   g. STEMREM 280 Stem Cell Biology and Regenerative Medicine Journal Club, review and discussion of current literature in both basic and translational medicine as it relates to stem cell biology and/or regenerative medicine.

| Units |
|-----------------------------|-----------------------------|
| STEMREM 200 Stem Cell Intensive | 1 |
| BIOS 200 Foundations in Experimental Biology | 6 |
| STEMREM 201A Stem Cells and Human Development: From Embryo to Cell Lineage Determination | 1-2 |
| STEMREM 201B Stem Cells and Human Development Laboratory | 3 |
of the SCBRM program is to provide an avenue for graduate education to translate the best of basic research into a clinical setting.

**Application and Admission**

Applications are made through the Graduate Admissions (http://gradadmissions.stanford.edu) website.

Applicants will be assessed based on their undergraduate transcripts, test scores, research experience, statement of purpose and letters of recommendation that document exceptional potential, ability, or achievements.

Students admitted to the program are offered financial support covering tuition, a living stipend, and insurance coverage. Applicants are urged to apply for independent fellowships such as from the National Science Foundation. Fellowship applications are due in November of the year prior to matriculation in the graduate program, but SCBRM graduate students may continue to apply for outside fellowships after matriculation. Because of the small number of department-funded slots, students who have been awarded an outside fellowship have an improved chance of acceptance into the program. Upon matriculation, each student is assisted in selecting courses and lab rotations in the first year and in choosing a lab for the dissertation research. Once a dissertation adviser has been selected, a dissertation committee is composed to include the dissertation adviser and two additional SCBRM faculty, to guide the student during their dissertation research. The student must meet with the dissertation committee at least once a year.

**Degree Requirements**

Candidates for Ph.D. degrees at Stanford must satisfactorily complete a program of study that includes 135 units of graduate course work and research.

Requirements for the Ph.D. degree in SCBRM include:

1. Completion of at least 3 research rotations in the labs of SCBRM faculty members.
2. Completion of the following courses:
   a. **STEMREM 200** Stem Cell Intensive hands-on immersion to learn basic methods of tissue culture, mouse embryo fibroblast (MEF) preparation, embryonic stem and induced pluripotent stem (ES/iPS) cell culture, differentiation, DNA isolation, polymerase chain reaction (PCR), sequencing, and basic microscopy.
   b. **BIOS 200** Foundations in Experimental Biology focuses on the broad themes of Evolution, Energy and Information.
   c. **STEMREM 201A** Stem Cells and Human Development: From Embryo to Cell Lineage Determination and STEMREM 201B Stem Cells and Human Development Laboratory develop a fundamental understanding of introductory stem cell principles in human development, aging, and disease accompanied by a laboratory-based module with immersion in stem cell-based methods (embryology, embryonic stem cells, reprogramming, adult stem cells).
   d. **STEMREM 202** Stem Cells and Translational Medicine advanced topics related to individual organ systems, cancer stem cells, translational principles of medicine and immunology as related to regenerative medicine, as well as bioengineering and bioinformatics as related to stem cell biology.
   e. **STEMREM 203** Stem Cells Immersion: Applications in Medicine, Business and Law students specialize and choose a clinical immersion, rotation in a biotechnology company or venture firm, or further delve into cutting edge technologies, bioinformatics, materials and/or engineering approaches for stem cell applications in industry, diagnostics and medicine.
   f. **STEMREM 250** Regenerative Medicine Seminar Series a forum for researchers to meet and discuss Stem Cell Biology and...

**COVID-19-Related Degree Requirement Changes**

For information on how Stem Cell Biology and Regenerative Medicine degree requirements have been affected by the pandemic, see the "COVID-19 Policies tab (p. 3)" in this section of this bulletin. For University-wide policy changes related to the pandemic, see the "COVID-19 and Academic Continuity (http://exploredegrees.stanford.edu/covid-19-policy-changes)" section of this bulletin.

**Doctor of Philosophy in Stem Cell Biology and Regenerative Medicine**

University requirements for the Ph.D. are discussed in the “Graduate Degrees (http://exploredegrees.stanford.edu/graduatedegrees)” section of this bulletin.

The Stem Cell Biology and Regenerative Medicine curriculum, combined with the research and rotation opportunities, provides a flexible educational opportunity for doctoral students to specialize in the broad subject of translational medicine while being focused more specifically on the fundamentals of Stem Cell Biology and Regenerative Medicine while training in the laboratories of participating SCBRM faculty. The goal...
The Stanford community caused by the pandemic itself. University transitioned to online learning on March 9, 2020, in addition to reflecting the disruption that students and instructors experienced when the impacted Winter and Spring quarters 2019-20. Those changes, as they made a number of emergency changes to policies and procedures that In response to the COVID-19 pandemic in 2020, Stanford University bulletin. COVID-19 pandemic, see the "COVID-19 and Academic Continuity For a complete overview of academic policy changes related to the Doctoral Programs

Requirements

COVID-19 Policy Changes to Degree Requirements

On this page: Winter Quarter (p. 3) • Spring Quarter (p. 3) • Doctoral Programs (p. 3) (if applicable)

For a complete overview of academic policy changes related to the COVID-19 pandemic, see the "COVID-19 and Academic Continuity (http://exploredegrees.stanford.edu/covid-19-policy-changes/ #winterquarteracademicchangestext)" section of this bulletin.

In response to the COVID-19 pandemic in 2020, Stanford University made a number of emergency changes to policies and procedures that impacted Winter and Spring quarters 2019-20. Those changes, as they relate to degree programs, are compiled on this page. These changes reflect the disruption that students and instructors experienced when the University transitioned to online learning on March 9, 2020, in addition to the disruption to the Stanford community caused by the pandemic itself.

Winter Quarter 2019-20

• University-wide Winter Quarter Academic Changes (http://exploredegrees.stanford.edu/covid-19-policy-changes/ #winterquarteracademicchangestext)

The Committee on Undergraduate Standards and Policy (C-USP) and the Committee on Graduate Studies (C-GS) approved an exception for Winter Quarter 2019-20 to permit students to request late class withdrawals and/or changes to class grading basis to CR/NC (for those classes that had CR/NC as an option).

Graduate Degree Requirements

Grading Requirements

The Program in Stem Cell Biology and Regenerative Medicine did not make any changes to graduate degree grade requirements for classes taken in Winter Quarter 2019-20.

Other Requirements

If a student has difficulty completing a graduate degree requirement due to the COVID-19 pandemic, (e.g., a study abroad requirement, a laboratory research requirement), the student should consult with the Director of Graduate Studies to identify academic options to fulfill degree requirements.

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Spring Quarter 2019-20

• University-wide Spring Quarter Academic Changes (http://exploredegrees.stanford.edu/covid-19-policy-changes/ #winterquarteracademicchangestext)

The Faculty Senate approved a policy requiring that all undergraduate and graduate classes in Spring Quarter 2019-20 be offered only on the 'S/ NC' (Satisfactory/No Credit) grading basis.

Graduate Degree Requirements

Grading Requirements

The Program in Stem Cell Biology and Regenerative Medicine counts any Spring Quarter 2019-20 class in which the student received a final grade of 'S' towards graduate degree requirements that otherwise require a letter grade.

Other Requirements

If a student has difficulty completing a graduate degree requirement due to the COVID-19 pandemic, (e.g., a study abroad requirement, a laboratory research requirement), the student should consult with the Director of Graduate Studies to identify academic options to fulfill degree requirements.

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Doctoral Programs

The Faculty Senate confirmed that doctoral programs have discretion to delay candidacy decisions through the end of Autumn Quarter 2020-21. It also confirmed that students have the option to defer the candidacy process (e.g., qualifying exams) to Autumn Quarter 2020-21 without penalty.

Program in Stem Cell Biology and Regenerative Medicine

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Graduate Advising Expectations

The Program in Stem Cell Biology and Regenerative Medicine is committed to providing academic advising in support of graduate student
scholarly and professional development. When most effective, this
advising relationship entails collaborative and sustained engagement
by both the adviser and the advisee. As a best practice, advising
expectations should be periodically discussed and reviewed to ensure
mutual understanding. Both the adviser and the advisee are expected to
maintain professionalism and integrity.

Faculty advisers guide students in key areas such as selecting courses,
designing and conducting research, developing of teaching pedagogy,
navigating policies and degree requirements, and exploring academic
opportunities and professional pathways.

Graduate students are active contributors to the advising relationship,
proactively seeking academic and professional guidance and taking
responsibility for informing themselves of policies and degree
requirements for their graduate program.

For a statement of University policy on graduate advising, see
the "Graduate Advising (http://exploredegrees.stanford.edu/
graduatedegrees/#advisingandcredentialtext)" section of this bulletin.

Program Director: Theo D. Palmer

Teaching Faculty:

• Arash A. Alizadeh (Assistant Professor, Medicine/Oncology and
  Member of Bio-X, Child Health Research Institute and Stanford
  Cancer Institute)

• Philip A. Beachy (Professor, Institute for Stem Cell Biology
  and Regenerative Medicine, Department of Biochemistry and
  Developmental Biology and Member of Bio-X and Stanford Cancer
  Institute)

• Michael F. Clarke (Professor, Institute for Stem Cell Biology and
  Regenerative Medicine and Department of Medicine/Oncology and
  Member of Bio-X and Stanford Cancer Institute)

• Tushar Desai (Assistant Professor, Medicine/Pulmonary & Critical
  Care Medicine and Member of Bio-X, Child Health Research Institute
  and Stanford Cancer Institute)

• Maximilian Diehn (Assistant Professor, Radiation Oncology/Radiation
  Therapy and Member of Bio-X and Stanford Cancer Institute)

• Margaret T. Fuller (Professor, Developmental Biology, Genetics and
  Obstetrics & Gynecology/Reproductive Biology and Member of Bio-X, Child
  Health Research Institute and Stanford Cancer Institute)

• Sarah C. Heilshorn (Associate Professor, Materials Science and
  Engineering and (by courtesy) Chemical Engineering and Member of
  Bio-X, Child Health Research Institute and Stanford Neurosciences
  Institute)

• Stefan Heller (Professor, Otolaryngology/Head and Neck Surgery
  and Member of Bio-X, Stanford Cancer Institute and Stanford
  Neurosciences Institute)

• Kyle Loh (Assistant Professor, Developmental Biology and Member of
  Bio-X, Institute for Stem Cell Biology and Regenerative Medicine,
  Stanford Neurosciences Institute, and Faculty Fellow, Stanford ChEM-
  H)

• Michael T. Longaker (Professor, Surgery/Plastic and Reconstructive
  Surgery, and (by courtesy) Bioengineering and Materials Science and
  Engineering and Member of Bio-X, Child Health Research Institute and
  Stanford Cancer Institute)

• Ravindra Majeti (Associate Professor, Medicine/Hematology and
  Member of Bio-X and Stanford Cancer Institute)

• Michelle Monje-Deisseroth (Assistant Professor, Neurology &
  Neurological Sciences and Member of Bio-X, Child Health Research
  Institute, Stanford Cancer Institute and Stanford Neurosciences
  Institute)

• Hiromitsu Nakauchi (Professor, Institute for Stem Cell Biology and
  Regenerative Medicine and Department of Genetics and Member of
  Bio-X)

• Aaron Newman (Assistant Professor, Department of Biomedical Data
  Science, Member of Bio-X and Institute for Stem Cell Biology and
  Regenerative Medicine)

• Roeland Nusse (Professor, Developmental Biology and Member of
  Bio-X and Stanford Cancer Institute)

• Anthony Oro (Professor, Dermatology and Member of Bio-X, Child
  Health Research Institute and Stanford Cancer Institute)

• Theo D. Palmer (Associate Professor, Neurosurgery and Member of
  Bio-X, Child Health Research Institute, Stanford Cancer Institute and
  Stanford Neurosciences Institute)

• Sergiu Pasca (Assistant Professor, Psychiatry & Behavioral Sciences/
  Stanford Center for Sleep Sciences & Medicine and Member of Bio-X,
  Child Health Research Institute and Stanford Neurosciences Institute)

• Matthew Porteus (Associate Professor, Pediatrics/ Stem Cell
  Transplantation and Member of Bio-X, Cardiovascular Institute, Child
  Health Research Institute and Stanford Cancer Institute)

• Maria Grazia Roncarolo (Professor, Pediatrics/ Stem Cell
  Transplantation and Medicine/Blood & Marrow Transplantation
  and Member of Bio-X, Child Health Research Institute and Stanford
  Cancer Institute)

• Vittorio Sebastiano (Assistant Professor, Obstetrics & Gynecology/
  Reproductive Biology and Member of Bio-X and Child Health
  Research Institute)

• Judith Shizuru (Professor, Medicine/Blood & Marrow Transplantation
  and Member Stanford Cancer Institute)

• Irving L. Weissman (Professor, Institute for Stem Cell Biology and
  Regenerative Medicine, Department of Pathology and Developmental
  Biology and (by courtesy) Department of Biology and Member of Bio-
  X and Stanford Cancer Institute)

• Marius Wernig (Associate Professor, Institute for Stem Cell Biology and
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  Health Research Institute, Stanford Cancer Institute and Stanford
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• Joseph C. Wu (Professor, Medicine/Cardiovascular Medicine and
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  Child Health Research Institute and Stanford Cancer Institute)

• Sean M. Wu (Associate Professor, Medicine/Cardiovascular Medicine and
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  Institute and Child Health Research Institute)

• Joanna Wysocka (Professor, Chemical & Systems Biology and
  Developmental Biology and Member Bio-X and Stanford Cancer
  Institute)