

# Doctor of Philosophy in Biomedical Sciences



# COURSE CATALOG

2024-2026

## Accreditation

The Cedars-Sinai Graduate School in Biomedical and Translational Science is accredited by the Accrediting Commission for Senior Colleges and Universities of the Western Association of Schools and Colleges (WASC).

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## QUESTIONS?

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# STEPS TO DEGREE



## PhD Program Objectives

- Effective integration of scientific information into an understanding of its relationship to human disease.
- Effective oral communication of scientific information.
- Proficiency in conducting scientific research using modern research, methodologies, and design to critically test hypotheses and draw appropriate conclusions.
- Superior skills in grant writing and research presentations.
- Collaborative interactions with peers in a laboratory setting.
- Sound knowledge of modern-day biomedical science and the potential to translate the knowledge to medicine.

## The Doctoral Degree

### PhD Requirements

The PhD Program in Biomedical and Translational Sciences grants a doctoral PhD degree upon completion of all the requirements, which include coursework, laboratory rotations, clinical observation rotations, qualifying examination, dissertation research, and dissertation defense. Each requirement is described in more detail under the assigned heading in this catalog. Students in the program are devoted to full-time study and research.

During the first year, students must complete the core curriculum, which is comprised of lecture classes and up to three laboratory rotations. Students will complete three trimesters taken during the first year; Immunology/Infectious Diseases, Genomics/Genetics and Developmental and Cell Biology. In addition, students are expected to complete a course in Biostatistics/Bioinformatics.

Students are expected to spend half of their time on coursework and half of their time in the rotation laboratories. Students are required to participate in up to three laboratory rotations to increase their exposure to different areas of research study and to ensure that students select a thesis laboratory that matches their research interest.

Students must have passed all relevant requirements with a “B” average prior to taking the Qualifying Examination. The goal of this examination is to rigorously test the ability of the student to design a research plan, present the proposal in a formal seminar and discuss the material presented. Students are required to pass the Qualifying Examination for advancement to doctoral candidacy.

Beginning at the advancement to candidacy, students will meet with their chosen Doctoral Committee annually. This will ensure the student’s progress is on track and that the student’s thesis project is completed in a successful and timely manner. The final requirements for the doctoral degree are the thesis manuscript and the oral defense of the thesis. The oral defense will be held in front of a panel of faculty members and an external expert in the field who is outside of the Cedars-Sinai community.

## PhD Core Curriculum

All students entering the program will participate in the “core curriculum” during their first year (3 trimesters). The course will be organized as a series of three “Core Modules” (each Core runs the length of the 16-week trimester) focused on three areas of expertise here at Cedars-Sinai. Core Module instruction will take place three times a week (e.g. MWF) in 1 ½ hour blocks of instruction. Students are also expected to attend a weekly Journal Club, with active participation, including presenting, occurring in the second year.

At the end of each laboratory rotation students are expected to give a 15-minute oral presentation describing the results of their project(s). These presentations are peer reviewed.

## Qualifying Examination

At the end of year one/beginning of year two, each student will prepare a written and an oral presentation that will be submitted to the chosen Dissertation Committee for evaluation. The written portion of the Examination is submitted to the Committee followed by an Oral Examination based upon the proposal. The Qualifying Examination must be completed by the end of year two.

## Advancement to Candidacy

Once the rotations, course work, and the qualifying exam are completed successfully, the student is advanced to PhD candidacy. It is expected that a student will have a minimum of 43.5 credit hours prior to advancing to candidacy.

## Dissertation Research

At the end of the first year, students select one of the laboratories in which they rotated, for their dissertation research. Laboratory selection is based on student choice, with the consent of the laboratory head. In cases where suitable matches cannot be made, additional rotations into the second year may be required. While most the student’s time will be spent in the laboratory, ongoing clinical exposure relevant to the student’s research will be included. This exposure will assist the student in understanding the potential translational aspects of their research and facilitate communication with clinical investigators.

## Doctoral Dissertation

The PhD program requires the completion of an approved dissertation that demonstrates the student’s ability to perform original, independent research and constitutes a distinct contribution to knowledge in the principal field of study. Students will spend years three to graduation completing dissertation research, writing their dissertation, and presenting a defense of the dissertation. Students will meet annually with their Doctoral Advisory Committees and will participate in ongoing workshops, seminars, and journal clubs. It is the express job of the Doctoral Committees to look out for the best interests of the students with the goal towards graduating students with PhD degrees who will be uniquely qualified to take on their next jobs (postdoctoral fellowships, educational or industrial posts, etc.). The Doctoral Committees will base their decisions on a balanced evaluation of academic growth and maturity, problem solving skills, writing and presentation skills, and publication record.

## Doctoral Committee

The mission of the Doctoral Committee is to assess each student’s dissertation research progress and to award the PhD in Biomedical and Translational Sciences to qualified students.

The Doctoral Committee will meet twice a year to evaluate student progress and student plans. The committee will then evaluate the completed dissertation, conduct the oral defense and vote to certify the dissertation.

Membership of the Doctoral Committee will consist of six (6) members, chosen by each student. The membership is defined and approved by the PhD Program Director.



# PROGRAM OVERVIEW

## FIRST YEAR OF PROGRAM

### Trimester 1 (September to December)

- BTS 509 – Developmental and Cell Biology (4.5 Credit Hours)
- BTS 514 – Research in Progress (1 Credit Hour)
- BTS 600 – Lab Rotation (6 Credit Hours)

### Trimester 2 (January to April)

- BTS 502 – Human Genetic & Genomics (4.5 Credit Hours)
- BTS 510 – Biostatistics (3 Credit Hours)
- BTS 514 – Research in Progress (1 Credit Hour)
- BTS 600 – Lab Rotation (6 Credit Hours)

### Trimester 3 (April to August)

- BTS 501 – Immunology, Infection & Inflammation (4.5 Credit Hours)
- BTS 511 – Intro to Computation Genomics (1.5 Credit Hours)
- BTS 514 – Research in Progress (1 Credit Hour)
- BTS 600 – Lab Rotation (6 Credit Hours)

## SECOND YEAR TIL GRADUTION

### Timeline May Vary

- BTS 801 – Dissertation Research (6 Credit Hours)
  - BTS 514 – Research in Progress (1 Credit Hour)
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- BTS 800 – Qualifying Examination (0 Credit Hour)
  - BTS 802 – Dissertation Defense (0 Credit Hour)

## COURSE DESCRIPTIONS

### BTS 600: Laboratory Rotations (6 credits)

Students are required to complete three (3) laboratory rotations during the first year of the program. Laboratory rotations give graduate students an opportunity to experience several laboratory environments, research opportunities and laboratory mentors that they may be considering for their dissertation research. These rotations also allow the faculty to evaluate students in a research setting and get to know the students. Laboratory rotations run congruent with the academic trimesters.

Students are expected to fully partake in the laboratory activities including: group laboratory meetings, discussion groups and laboratory projects. Students are expected to arrange independently each of their three rotations with the Cedars-Sinai mentoring faculty who are actively participating in the program. A list of active faculty members can be procured from the Program Coordinator.

Laboratory rotation arrangements between students and laboratory needs cannot be made prior to four weeks before the rotation is scheduled to begin. Students and laboratory heads may not pre-book their laboratory rotations in advance. Students must complete the "Rotation Agreement" form and have the mentor, in whose laboratory they will be rotating, sign it. This form should be turned into the Graduate School no later than two (2) weeks prior to the start of the new rotation.

### BTS 501: Immunology, Infection & Inflammation (4.5 credits)

Immune cells play key roles in diverse processes throughout the body, including defense against pathogens, maintenance of tissue homeostasis, and tissue repair following injury. Immune deficiency or immune suppression can result in susceptibility to pathogens and tumors. Dysregulated immune responses can cause inflammatory and autoimmune diseases and contribute to degenerative pathologies and loss of organ function. This course will provide students with a solid knowledge of fundamental immunological concepts, upon which they can then build an understanding of the diverse roles of the immune system in human disease and the application of immune-based therapeutic strategies in the clinic.

### BTS 502: Genetics/Genomics (4.5 credits)

This course will cover the human genome and its impact on phenotype. Topics covered include the study of genetic mechanisms in rare disorders and the role of genetics in multi-factorial, complex disorders. Students who complete this course will understand how genes influence human development and phenotypes as well as how genetics and environment interact to dictate phenotype. This course will allow the student to utilize research tools used in gene discovery and define the errors that occur in genes and gene expression that impact human disease. Students will produce an oral presentation on a specific genetic disorder as well as complete a written final exam.



## BTS 509: Developmental and Cancer Cell Biology (4.5 credits)

This course provides instruction in fundamental mechanisms of developmental and cell biology and how these impact tissue organization and disease pathogenesis, such as in cancer. The course topics center on cellular processes, such as adhesion, cytoskeletal dynamics, and unfolded protein response, that are critical for homeostasis and are dysregulated in a range of disease processes. The course format consists of faculty-led presentations and weekly journal clubs covering timely, relevant literature.

## BTS 510: Biostatistics (3 credits)

This course introduces methods and concepts of statistical analysis. Sampling situations are utilized with special attention to those occurring in biological sciences. Topics include distributions, tests of hypotheses, estimation, types of error, significance and confidence levels, power and sample size.

## BTS 511: Intro to Computational Genomics (1.5 credits)

The goal of this course is to initiate bench scientists on the Ph.D. track to basic the basic skillset in bioinformatics and computational genomics. These skills are a prerequisite to a wide range of fields in modern molecular biology and are often overlooked. During this course we will acquire basic computer literacy needed to perform analyses of next generation sequencing experiments in all their modern forms. We will cover basic unix, project management with version control, principal components and clustering, visualization and color, single cell technologies, spatial omics, microbiome, and a brief survey of the fundamentals of Machine Learning, AI, and large language models (LLM). We will empower students with basic skills to advocate for and analyze their own data.

## BTS 514: Research in Progress (1 credit)

This course is a continuation of the journal clubs within the core curriculum and is required during the student's 1<sup>st</sup> through 4<sup>th</sup> year, all 3 trimesters. This class refines the student's knowledge of scientific literature as well as presentation skills.

## BTS 802: Dissertation Research (6 credits)

This course is taken throughout the academic year and includes the completion of an approved dissertation that demonstrates the student's ability to perform original, independent research and constitutes a distinct contribution to knowledge in the principal field of study. Students will spend years 2 through 4 on completing thesis research, writing a dissertation, and presenting a defense of the dissertation. Students will meet regularly with their thesis advisory committees during this course.

# KEY FACULTY

## PROGRAM LEADERSHIP DIRECTORS

**Lali Medina-Kauwe, PhD**

Associate Dean of PhD Programs

Director of PhD Program in Biomedical & Translational Sciences

[Lali.MedinaKauwe@cshs.org](mailto:Lali.MedinaKauwe@cshs.org)

## COURSE DIRECTORS

**Josh Breunig**

Course Director, DCCB BTS 509

**David Rincon Fernandez Pacheco**

Course Co-director, DCCB BTS 509

**Moray Campbell**

Course Director Genetics/Genomics BTS 502

**Suzanne Cassell**

Course Director Infection/Immunology, BTS 501

**Andrea Wolf**

Course Co-Director, Infection/Immunology, BTS 501

**Dennis Hazelett**

Course Director, Computational Genomics, BTS 511