

# DEPARTMENT OF PATHOLOGY AND HUMAN ANATOMY

The School of Medicine's Division of Anatomy offers curricula leading to the Master of Science or the Doctor of Philosophy degree. The core curriculum coursework provides a broad biomedical background, with opportunities for qualified students to not only study all aspects of human morphology from both didactic and investigative points of view, but to also develop a special area of research interest. Study and research on other species and in other biomedical disciplines may be included in the student's curriculum. While working on a significant research problem, students are introduced to research methods through scientific literature and the laboratory. They acquire experience in scientific communication by participating in seminars, writing critical reviews, and reporting results of research experience either in thesis/dissertation form or as publishable/published papers.

The Doctor of Philosophy degree is designed to prepare the graduate for a career in independent research and teaching in university, clinical, biotechnological, or government environments. In addition to technical skills, doctoral degree students are expected to develop creativity and independence.

The Master of Science degree provides content appropriate for persons preparing to teach at the secondary level or in related professional school areas, or for persons intending to pursue careers as research technicians.

## Program learning outcomes

By the end of the anatomy program, the graduate should be able to:

1. Apply the biomedical sciences to the study of human anatomy.
2. Demonstrate mastery of molecular, cellular, and integrative aspects of anatomy.
3. Interpret current literature in anatomy.
4. Make original contributions to biomedical science.
5. Demonstrate scientific and professional ethics.
6. Explain the process of applying for external funding.\*

*\*This objective is not applicable to M.S. degree students.*

## First-year curriculum (Ph.D. degree)

The first-year curriculum includes a course sequence taught by an interdisciplinary faculty that integrates all disciplines of the biomedical basic science areas—moving from molecules through cellular mechanisms to integrated systems. In addition, a supplemental course covers research-related topics such as scientific communication and integrity, information handling and statistics, and successful grant-proposal writing. Students learn of new developments in the biomedical sciences through weekly seminars and gain presentation skills in a weekly student presentation seminar series. During the subsequent years, formal courses continue to broaden and integrate, into a meaningful whole, an understanding of the clinical consequences of cellular events.

## Religion requirement

Students in the Master of Science (M.S.) degree curriculum are required to complete one, 3-unit graduate-level religion course (RELT 617 Seminar in Religion and the Sciences). Students in the Ph.D. degree curriculum are required to complete three graduate-level religion courses of 3 or

more units each. These must include RELT 617 Seminar in Religion and the Sciences, as well as RELE 525 Ethics for Scientists and RELR 588 Personal and Family Wholeness. A course in biblical studies (RELT 559 New Testament Thought, RELT 560 Jesus the Revealer: The Message of the Gospel of John, RELT 564 Apostle of Hope: The Life, Letters, and Legacy of Paul, or RELT 565 Vision of Healing: The Message of the Book of Revelation) may be substituted for either the ethical or relational course.

## Research units

A student will, at all times, enroll for research units. An IP will be assigned until the student registers for new units. The units should be spread over the time it takes to complete the thesis or dissertation research satisfactorily. An IP may not be carried longer than five quarters.

### Chair

Paul C. Herrmann

### Program co-coordinators

Kirby C. Oberg

Kenneth R. Wright

### Primary faculty

John C. Banks

Denise L. Bellinger

Cody Carter

Resa C. Chase

Laura Denham

Bertha C. Escobar-Poni

Paul C. Herrmann

Mary Kearns-Jonker

Zhongrong Luo

P. Ben Nava, Jr.

Kirby C. Oberg

Bethania Siviero

Salvador Soriano

Kenneth R. Wright

### Secondary faculty

Olivia Francis-Boyle

### Pathologists' Assistant Program primary faculty

Meghan Dorrell

Cheryl Germain

### Pathologists' Assistant Program clinical faculty

Bonnie Lyra Rohweller

## Admissions

In addition to Loma Linda University (<http://llucatalog.llu.edu/about-university/admission-policies-information/#admissionrequirementstext>)

application requirements, the applicant must also complete the following requirements:

- A bachelor's degree from an accredited U.S. college or the equivalent from an international university.
- General test of the Graduate Record Examination (GRE): A total (verbal plus quantitative) score of no less than the sum of the scores corresponding to the 50th percentile of each, with neither score less than the 35th percentile; analytical writing 4.0. GRE scores older than five years from the date of matriculation are not considered.
- A full year of each of the following undergraduate courses:
  - General biology
  - General chemistry
  - Organic chemistry
  - General physics
  - Biochemistry (a minimum of one quarter/semester)
- Strongly recommended:
  - Upper-division biology (such as cell and molecular biology)
  - A full year of biochemistry with labs
  - Research experience
  - Calculus

**PLEASE NOTE:** CLEP (College-Level Examination Program), pass/fail performances, and online classes are not acceptable for the science required courses. Additionally, science credits earned in professional schools (e.g., allied health professions, business, dentistry, nursing or pharmacy) do not fulfill requirements for admissions to the graduate program.

The program reserves the right to decide on the equivalence of courses presented by the applicant.

## Programs

Anatomy – M.S. (<http://llucatalog.llu.edu/medicine/pathology/anatomy-ms/>), Ph.D. (<http://llucatalog.llu.edu/medicine/pathology/anatomy-phd/>)  
 Comparison (<http://llucatalog.llu.edu/medicine/pathology/comparison/>)

Pathologists' Assistant – M.H.S. (<http://llucatalog.llu.edu/medicine/pathology/path-assistant-mhs/>)

## Anatomy Courses

### **ANAT 301. Head and Neck Anatomy, DH. 4 Units.**

Gross anatomy of the head and neck. Lecture and demonstration.

### **ANAT 303. General and Oral Histology and Embryology. 3 Units.**

Microscopic study of fundamental cells, organs, tissues, and systems of the body. Analyzes in detail the pulp, periodontal tissues, alveolar process, oral mucosa, and calcified tissues of the tooth. Includes development of head and neck structures.

### **ANAT 507. Stem Cell Biology and Medicine. 4 Units.**

Provides students with information on the latest developments in animal and human stem cell research and on the potential application of stem cells to medicine. Explores the derivation, manipulation, and differentiation of embryonic, germ, and adult stem cells. Lectures presented by faculty participating in stem cell research in areas of their expertise.

### **ANAT 510. Gross Anatomy. 8.5 Units.**

Supports the organ system curriculum in the first year of medical education. Teaches students the morphological setting upon which clinical knowledge and experiences are built. Approaches anatomy from a gross structural perspective. Students use knowledge to recognize clinical variations and abnormalities in preparation for their medical careers.

### **ANAT 515. Human Embryology. 2 Units.**

Reviews the morphologic processes and molecular basis of human development. Includes the production of human gametes, fertilization, gastrulation, placentation, and development of the major organ systems. Emphasizes clinically relevant features of pregnancy and developmental processes that are susceptible to malformation.

### **ANAT 516. Neuroscience GS. 6 Units.**

Integrated approach to the fundamentals of neuroanatomy and neurophysiology, with applications to clinical neurology.

### **ANAT 525. Special Topics: Advanced Dissection. 1-4 Units.**

Detailed dissection of a specified body region. Demonstration and lecture. May be repeated for additional credit. Offered on demand. Prerequisite: ANAT 541; or equivalent with approval of program director or department chair.

### **ANAT 527. Advanced Clinical Anatomy for Nurse Anesthetists. 5 Units.**

Emphasizes detailed description and applied anatomy of the body systems (cardiovascular, respiratory renal, hepatic nervous, and endocrine) relevant to the nurse anesthetist.

### **ANAT 529. Gross Anatomy and Embryology. 10.5 Units.**

Provides the morphological foundation upon which clinical knowledge and experiences are built. Supports the organ-system curriculum in the freshman year. Approaches anatomy from gross structural and embryological perspectives. Provides students with the knowledge necessary to recognize clinical variations and abnormalities during their medical careers.

### **ANAT 541. Gross Anatomy GS. 7 Units.**

Anatomy of the head, neck, locomotor system, thorax, abdomen, pelvis, and perineum. Correlated with radiology, applied features, and embryological development. Summer and Autumn quarters.

### **ANAT 542. Cell Structure and Function GS. 7 Units.**

The microscopic structure of cells, tissues, and organs of the human body. Autumn Quarter.

### **ANAT 544. Human Embryology Lecture. 2 Units.**

The plan of development as it pertains to humans. Considers principles.

### **ANAT 548. Introductory Flow Cytometry. 1 Unit.**

Introduction to basic flow cytometry-based techniques used to identify experimental, basic science and translational research questions, and to develop research proposals. Includes flow cytometry sample preparation, and data collection, analysis, and presentation.

### **ANAT 558. Applied Gross Anatomy GS. 3 Units.**

Emphasizes practical application of the anatomical knowledge covered in human gross anatomy. Considers applied anatomy problems involving biomechanical functions of the body, as well as application of anatomical principles to specific fields of human activity. Prerequisite: ANAT 541; or consent of instructor.

### **ANAT 594. Directed Study in Anatomy. 1-7 Units.**

Intensive study of a selected topic approved by the chair of the department. Individual guidance by a staff member.

**ANAT 697. Research. 1-8 Units.**

**ANAT 699. Dissertation. 1-5 Units.**

**ANAT 891. Anatomy Elective. 1.5-18 Units.**

A self-designed and self-directed dissection elective in the fourth year of the MD curriculum with emphasis on the head, neck, abdomen, pelvis, thorax, back, or limbs—correlating basic anatomy with clinical applications.

## Pathology Courses

**PATH 501. Anatomy and Pathology I. 4 Units.**

A systems-based approach to the study of human anatomy utilizing cadaver dissection, correlating gross and microscopic anatomy and associated pathologies.

**PATH 502. Anatomy and Pathology II. 4 Units.**

A systems-based approach to the study of human anatomy utilizing cadaver dissection, correlating gross and microscopic anatomy and associated pathologies.

**PATH 517. Human Systemic Pathology. 9.5 Units.**

Application of basic science principles to patient care. Introduction to important diseases and anomalies of each human organ system and their impacts on patients. Emphasizes etiologies, pathogenesis, macroscopic and microscopic morphologic features, pathophysiologies, biologic behaviors, and relevant laboratory findings. Addresses analytical thinking, productive skills of cooperation among team members, and appropriate use of laboratory testing.

**PATH 521. Anatomical Techniques I. 3 Units.**

Designed specifically for pathologists' assistant students. Comprehensive coverage of surgical and autopsy pathology techniques. Incorporates histology and medical terminology, including clinical and pathologic correlations.

**PATH 522. Anatomical Techniques II. 3 Units.**

Designed specifically for pathologists' assistant students. Comprehensive coverage of surgical and autopsy pathology techniques. Incorporates histology and medical terminology, including clinical and pathologic correlations.

**PATH 524. Clinical Microbiology for Pathologists' Assistants. 3 Units.**

Studies of pathologically pertinent microbes and pathogenic mechanisms; overview of methods of identification and antibiotic sensitivities.

**PATH 534. Civic Engagement and Poverty: Service Learning. 1 Unit.**

Instructs students in working closely with community partners to examine local or international community resilience in response to poverty. Students reflect on how community members and society, as a whole, are affected and fight the effects of poverty, as well as on how a pathologists' assistant can serve a local community. Prerequisite: Matriculated Pathologists' Assistant Student, PGY 1.

**PATH 551. Disease Mechanisms I. 3 Units.**

Comprehensive study of mechanisms of disease and clinical correlations, based on Robbins' Pathologic Basis of Disease.

**PATH 552. Disease Mechanisms II. 3 Units.**

Builds on the basic courses in the pathologists' assistant curriculum. Requires students to use critical-thinking skills in the participatory discussion sessions. Prepares students for clinical practicum experiences.

**PATH 564. Biomedical Photography. 1 Unit.**

Investigates the use of digital cameras, scanners, Adobe®, photomicrography, and macrophotography. Examines fundamental processes applied in digital photography to a wide range of specimen types.

**PATH 581. Basic Pathologic Microanatomy. 2 Units.**

Designed specifically for pathologists' assistant students. Covers normal microanatomy, including clinical correlations and grossing techniques. Lectures enhanced by multihead microscopy sessions.

**PATH 582. Advanced Microanatomy. 2 Units.**

Designed specifically for pathologists' assistant students. Covers disease states in microanatomy, including clinical correlations. Lectures enhanced by multihead microscopy sessions.

**PATH 598. Clinical Laboratory Management. 2 Units.**

Laboratory organization and examination of principles and practices of laboratory management.

**PATH 599. Directed Study. 1.5-18 Units.**

**PATH 644. Clinical Pathology Seminar. 2 Units.**

Provides pathologists' assistant students with an overview of clinical pathology, relating clinical testing to disease processes.

**PATH 741. Pathology Review I. 2 Units.**

An intense review of clinical and anatomical pathology theory with assigned presentations and clinical cases.

**PATH 742. Pathology Review II. 2 Units.**

An intense review of clinical and anatomical pathology theory with assigned presentations and clinical cases.

**PATH 743. Pathology Review III. 2 Units.**

An intense review of clinical and anatomical pathology theory with assigned presentations and clinical cases.

**PATH 744. Pathology Review IV. 2 Units.**

An intense review of clinical and anatomical pathology theory with assigned presentations and clinical cases.

**PATH 761. Pathologists' Assistant Practicum I. 9 Units.**

Rotations in surgical and autopsy pathology to include forensics and pediatrics in a variety of clinical settings, such as academic health centers, community hospitals, and private laboratories.

**PATH 762. Pathologists' Assistant Practicum II. 9 Units.**

Rotations in surgical and autopsy pathology to include forensics and pediatrics in a variety of clinical settings, such as academic health centers, community hospitals, and private laboratories.

**PATH 763. Pathologists' Assistant Practicum III. 9 Units.**

Rotations in surgical and autopsy pathology to include forensics and pediatrics in a variety of clinical settings, such as academic health centers, community hospitals, and private laboratories.

**PATH 764. Pathologists' Assistant Practicum IV. 9 Units.**

Rotations in surgical and autopsy pathology to include forensics and pediatrics in a variety of clinical settings, such as academic health centers, community hospitals, and private laboratories.

**PATH 891. Pathology Elective. 1.5-27 Units.**

Offers fourth-year medical students the opportunity to explore various areas of pathology, including but not limited to hematopathology, molecular embryopathy, and research.