

2023-2024



MASTER OF SCIENCE

in Anatomy and Cell Biology



Department of Ophthalmology, Visual and Anatomical Sciences (OVAS)

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Useful Weblinks: <http://wayne.edu/gradschool/> provides important information on all graduate degree requirements.

Current Training Faculty

Name	Email	Phone	Lab/Office	Track
Elizabeth Berger, PhD	eberger@med.wayne.edu	7-0286	8263 Scott Hall	R/E
Bruce Berkowitz, PhD	baberko@med.wayne.edu	7-9035	7339 Scott Hall	R
Rodney Braun, PhD	rbraun@med.wayne.edu	7-4764	8300 Scott Hall	E
Maria Bykhovskaia, PhD	mbykhovs@med.wayne.edu	7-9744	363 Lande	R
Tiffany Cook, PhD	tiffany.cook2@wayne.edu	7-9463	3206 Scott Hall	R
Dennis Goebel, PhD	dgoebel@med.wayne.edu	7-8724	9345 Scott Hall	E
Linda Hazlett, PhD	lhazlett@med.wayne.edu	7-1079	7341 Scott Hall	R
A. Genene Holt, PhD	agholt@med.wayne.edu	7-5073	454 Lande	R/E
Ahmed Ibrahim, PhD	ahmed.ibrahim@wayne.edu	7-7854	7133 Scott Hall	R
Tomomi Ichinose, PhD	tichinos@med.wayne.edu	7-0836	8314 Scott Hall	R
Ryan Insolera, PhD	rinsolera@wayne.edu	7-4093	9327 Scott Hall	R
Renu Kowluru, PhD	rkowluru@med.wayne.edu	3-6714	K-404 (KEI)	R
Ashok Kumar, PhD	akuma@med.wayne.edu	7-7922	K-417 (KEI)	R
Zhuo-Hua Pan, PhD	zhpan@med.wayne.edu	7-9830	8360 Scott Hall	R
Jean Peduzzi-Nelson, PhD	jp peduzzi@med.wayne.edu	7-8995	7133 Scott Hall	R/E
Daniel Rathbun, PhD	drathbu2@hfhs.org	874-9171	5D46 HFHS	R
Nikhlesh Singh, PhD	nsingh2@wayne.edu	7-5442	3414 IBio	R
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Jena Steinle, PhD	jsteinle@med.wayne.edu	7-9731	9312 Scott Hall	R
Susmit Suvas, PhD	ssuvas@med.wayne.edu	7-9820	7223 Scott Hall	R
Ryan Thummel, PhD	rthummel@med.wayne.edu	7-7762	8327 Scott Hall	R/E
Paul Walker, PhD	pdwalker@med.wayne.edu	7-5678	9352 Scott Hall	E
Shunbin Xu, PhD	sxu@med.wayne.edu	7-1061	8137 Scott Hall	R
Fu-Shin Yu, PhD	fyu@med.wayne.edu	7-1657	K-417 (KEI)	R

Track Key:

R = Research Track Mentor

E = Education Track Mentor

Mission Statement

The Master of Science (MS) Program in Anatomy & Cell Biology prepares graduate students for research or teaching careers in various areas encompassed by anatomy, visual science and neuroscience. Goals include providing students with a basic background in biomedical science, expertise in multiple sub-disciplines of anatomy and cell biology, proficiency in higher level instruction of anatomy-related courses, competence in a variety of experimental techniques, ability to read and understand current scientific literature, and experience in the development and implementation of experiments to test specific hypotheses. The primary audience of the program is undergraduate or post-baccalaureate level students who show potential for future success as independent researchers or educators at the highest academic levels.

Learning Outcomes

1. Demonstrate mastery of all subject material related to the program curriculum and thesis project.
2. Conduct scholarly activities in an ethical manner, following the principles of the scientific process.
3. Effectively communicate scientific material publicly in both written and oral formats.
4. Produce and defend an original significant contribution to scientific knowledge.

Program Description

The Anatomy & Cell Biology MS program offers two tracks: a research-oriented track with an emphasis on acquiring specialty training and skills related to vision science or neuroscience; and a teaching-oriented track focused on preparing students to carry out formal instruction of anatomy-related courses in higher education (human gross anatomy, histology/embryology, neuroanatomy). Both tracks require a minimum of 32 credits and are generally completed in two years. Each student will carry out thesis research under the supervision of a faculty member within their respective track, which will culminate in the oral defense of a written thesis.

Curriculum Requirements

Each track has a clearly defined curriculum that has been specifically developed to give the student an immersive, hands-on experience. Each program consists of 32 (minimum) credit hours over the course of two years culminating in a capstone Master's Thesis Research experience.

Research Track Requirements: Whether the student chooses to focus on a Vision or Neuro subspecialty, completion of core courses, seminar, research rotations, and research are required, as detailed below. Optional electives are available, as well.

* required for Vision Track

† required for Neuro Track

‡ waiver required for enrollment

Fall Semester – Year 1 (minimum 8 credits)

MGG 7010	Molecular Biology and Genetics (4 credits)
ANA 7996	Research Rotations (1-3 credits)
ANA 7890	Seminar (0-1 credit)

Optional:

ANA 7055	Biology of the Eye (3 credits)
ANA 7030	Human Microscopic Anatomy (4 credits)

Winter Semester – Year 1 (minimum 8 credits)

ANA 7890	Seminar (0-1 credit)
ANA 7065*	Mechanisms of Ocular Disease (2 credits)
ANA 7130†	Neuroanatomy (4 credits)
ANA 7996	Research (1-6 credits)

Optional:

IBS 7050‡	Biomedical Neurobiology (2 credits)
IBS 7090‡	Biomedical Immunology (2 credits)
IBS 7030‡	Functional Genomics and Systems Biology (2 credits)
IBS 7130‡	Systems Neuroscience: Structure and Function of the Nervous System (2 credits)
ANA 7130	Neuroanatomy (4 credits)
PYC 7010	Neurobiology I (3 credits)

Spring/Summer Semester – Year 1 (0 - 2 credits)

ANA 7996	Research (0-2 credits)
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Fall Semester – Year 2 (minimum 8 credits)

GS 0900	Essential Research Practices: Responsible Conduct of Research (0 credits)
ANA 8999	Master's Thesis Research and Direction (1-8 credits)
ANA 7890	Seminar (0-1 credit)

Optional:

FPH 7015	Biostatistics I (3 credits)
ANA 7075*	Mechanisms of Ocular Disease II (2 credits)

Winter Semester – Year 2 (minimum 8 credits)

ANA 8999	Master's Thesis Research and Direction (1-8 credits)
ANA 7890	Seminar (0-1 credit)

Optional:

FPH 7020	Biostatistics II (3 credits)
IBS 7110‡	Introduction to the Business of Biotechnology (3 credits)

Total minimum credits = 32

Education Track Requirements: For the Education Track, completion of core courses are paired with credits for Special Dissection (ANA 7260), Special Projects (ANA 7270), research, and seminar.

Fall Semester – Year 1 (12 credits)

ANA 7010	Human Gross Anatomy (8 credits)
ANA 7030	Human Microscopic Anatomy (4 credits)
ANA 7890	Seminar (0 credit)

Winter Semester – Year 1 (8 credits)

ANA 7130	Neuroanatomy (4 credits)
ANA 7260	Special Dissection (4 credits)
ANA 7890	Seminar (0 credit)

Spring/Summer Semester – Year 1 (0 - 2 credits)

GS 0900	Essential Research Practices: Responsible Conduct of Research (0 credits)
ANA 7260	Special Dissection (2 credits)

Fall Semester – Year 2 (8 credits)

ANA 7270	Special Projects in Anatomy (4 credits)
ANA 8999	Master's Thesis Research and Direction (2 - 4 credits)
ANA 7890	Seminar (0 -2 credit)

Winter Semester – Year 2 (4 - 6 credits)

ANA 7270	Special Projects in Anatomy (2 credits)
ANA 8999	Master's Thesis Research and Direction (2 - 4 credits)
ANA 7890	Seminar (0 credit)

Total minimum credits = 32

Progression through the ACB MS Program

The MS program in Anatomy & Cell Biology provides checklists for both the Research and Education Tracks to successfully guide the student through the program. Respective outlines for each track follow:

Research Track: During Year 1, students are expected to officially select their lab rotations by submitting the *Selected Rotations Form* by September 15. Three lab rotations (~4 weeks each) must be arranged with the option for the student to officially select a lab after the completion of two rotations. Laboratory rotations allow students to become acquainted with the diverse research interests of the faculty and to obtain hands-on experience in selected techniques. Upon selection of a lab, an *Advisor Agreement Form* must be completed by January 15. A *Research Proposal and Timeline* must be filed by February 1. This form will provide the overall layout of the research project, including scientific premise, proposed specific aims/goals and expected timeline. The student will then work with their advisor to immediately establish a thesis advisory committee, which will consist of the faculty advisor and two additional faculty members. Although not a requirement, a single committee member may be from an outside (external) department. It is the student's responsibility to formally request each faculty member to join their committee. Once the committee is established, the *Thesis Advisory Committee Formation Form* must be submitted by March 1.

There will be quarterly advisory committee meetings that will be formally recorded using the *Quarterly Advisory Committee Meeting Form* with the following deadlines:

- Meeting #1 - April 1 (Year 1)
- Meeting #2 - July 1 (Year 1)
- Meeting #3 - October 1 (Year 2)
- Meeting #4 - January 1 (Year 2)

A *Plan of Work* must also be submitted to the Office of Research and Graduate Programs of the School of Medicine by February 15. This document provides the student and graduate school with an official outline of the planned coursework that will satisfy the minimum 32 graduate credits. The Plan of Work requires approval of the advisor and MS Program Director, who will help each student develop the plan.

As an extension of the Plan of Work, the student will complete the *Summer Research Expectations Form* with their advisor by June 1 to establish the student's efforts to carry out research during the summer term. Upon completion of the summer term, a *Summer Research and Timeline Assessment Form* will also be completed by the student and their advisor and submitted by August 15.

During Year 2, the student will hold the remaining two quarterly meetings and then submit their *Formal Approval/Delay to Write MS Thesis* by January 1. A decision for approval or delay will be made between the student and their committee as part of the final quarterly meeting. This will be followed by the submission of the *Formal Approval/Delay to Defend MS Thesis* due April 1, with the expectation that the MS Thesis Defense will be held before the end of April and submission of the *MS Thesis Defense Assessment Form* by May 1.

Education Track: During the Fall of Year 1, the student will select a minimum of four (4) instructors to shadow within ANA 7010 Human Gross Anatomy (2 labs) and ANA 7030 Human Microscopic Anatomy (3 labs) by submitting the *Shadowing Selection Form - Fall* by September 15. During the Winter of Year 1, the student will select a minimum of three (3) instructors to shadow within ANA 7130 Neuroanatomy (2 labs) and ANA 7010 Human Gross Anatomy (2 labs) by submitting the *Shadowing Selection Form - Winter* by December 15. A *Plan of Work* must also be submitted to the Office of Research and Graduate Programs of the School of Medicine by December 15. This provides the student and graduate school with an official outline of the planned coursework that will satisfy the minimum 32 graduate credits. The *Plan of Work* form requires approval of the MS Program Director, who will help each student develop the plan. An education advisor will be officially selected through the submission of the *Advisor Agreement Form*, due by April 1. A *Research Proposal and Timeline* must be filed by April 15. This form will provide the overall layout of the research project, including scientific premise, proposed specific aims/goals and expected timeline. The

student will work with their advisor to immediately establish a thesis advisory committee, which will consist of the faculty advisor and two additional faculty members. Although not a requirement, a single committee member may be from an outside (external) department. It is the student's responsibility to formally request each faculty member to join their committee. Once the committee is established, the *Thesis Advisory Committee Formation Form* must be submitted by May 1.

There will be quarterly advisory committee meetings that will be formally recorded using the *Quarterly Advisory Committee Meeting Form* with the following deadlines:

Meeting #1 - June 1 (Year 1)

Meeting #2 - October 1 (Year 2)

Meeting #3 - January 1 (Year 2)

In anticipation of graduate teaching, the student will officially choose (pending course director approval) either Gross Anatomy Labs or Histology Labs as part of the Special Projects in Anatomy course by submitting the *Graduate Teaching Assistant Form* by April 1. As an extension of the Plan of Work, the *Summer Research Expectations Form* will be completed by the student with their advisor by June 1 to clearly define expectations for continued progress toward the capstone research project. Upon completion of the summer term, a *Summer Research and Timeline Assessment Form* will be submitted by August 15.

During Year 2, the student will hold the remaining two quarterly meetings and then submit their *Formal Approval/Delay to Write MS Thesis* by January 1. A decision for approval or delay will be made between the student and their committee as part of the final quarterly meeting. This will be followed by the submission of the *Formal Approval/Delay to Defend MS Thesis* due April 1, with the expectation that the MS Thesis Defense will be held before the end of April and submission of the *MS Thesis Defense Assessment Form* by May 1.

Opportunities to Develop Presentation Skills

Departmental Seminar: Students are required to attend departmental seminars with the expectation for meaningful interaction as outlined in the syllabus. The departmental seminar series usually runs from September through May and is held in the OVAS Library (8366 Scott Hall) or virtually on Thursdays at 12p EST.

Vision Research Workshop: This is an annual one day conference, typically held in October, aimed to highlight trainees in the OVAS department who are working on vision research.

Translational Focus Groups: There are three translational focus groups in the department - Retina: Development, Function and Restoration (contact: Dr. Zhuo-Hua Pan); Ocular Infection/Inflammation (contact: Dr. Fu-Shin Yu); and Translational Approaches to Vascular and Neurological Diseases (contact: Dr. Renu Kowluru). These groups meet monthly and include both basic science and clinical faculty.

Graduate Student Research Presentation Day: All graduate students are encouraged to present their research in poster or oral format at the annual WSU Graduate Student Research Day, which is held in September at the School of Medicine. Participation in this event is considered important in the overall training experience offered by all MS and PhD programs at the School of Medicine. For more information: [GSRPD](#)

Graduate Student Exhibition: All graduate students are encouraged to present their research in poster or oral format at the annual WSU Graduate Student Exhibition, which is held in the Spring on the University Main Campus. Participation in this event is considered important to "showcase" the overall scholarly activity and creativity of graduate students across the University campus. For more information:

Medical Education Research and Innovation Conference: This annual conference aims to showcase

completed and in-progress medical education research and innovation projects conducted by students, residents, staff and faculty. Topics are related to the learning process that occurs within a medical education setting, including learner characteristics, optimizing the learning process, assessment and evaluation, professional development, instruction design, technology in the learning environment, wellbeing, and innovative curricula addressing current issues within medical education. For more information: [MERI](#)

Preparing for the Written MS Thesis

Following the formal approval to write MS Thesis, the student should:

1. Meet with your advisor to plan the outline of the written thesis as well as the structure of the thesis committee.
 - a) Thesis Proposal contains the following information:
 - § Scientific Background of the Project
 - § Central Hypothesis/Description of Problem and Specific Aims
 - § Experimental Design & Methods
 - § Primary Outcomes/Data & Significance
 - § Future Directions

The document must demonstrate the student's depth of knowledge about the overall project and is developed in consultation with the permanent advisor. The central hypothesis or problem may be hypothesis-driven vs critical need-driven as it relates to each track. Please note that some modifications to the aforementioned outline may be warranted depending on the nature of the study. The usual size of the document is 20-30 pages and should not exceed 50 pages, excluding References.

2. Prepare the written document and submit the first draft of the written document to your advisor. It may take several rounds of revisions in order to obtain the advisor's approval.
3. When approved by your advisor, submit the final revised written document to the committee.
4. One week after written document submission, the committee will either formally approve or delay the defense of the MS Thesis.
 - a) If approved, the student will schedule the oral presentation before May 1.
 - b) If delayed, the student should anticipate extending their timeline by one semester and defending by the end of the Spring/Summer Term. As a first step, the student will schedule a meeting with each committee member to discuss comments/suggestions and potential corrections to the written document and make appropriate revisions. Once approved, the student should schedule an oral defense by July 1.

Preparing for the Oral Defense of the MS Thesis

The public oral defense of the MS Thesis should be completed before the end of Year 2 in the program. Following approval to defend, it is expected that the MS Thesis Defense will be held before the end of April. The oral examination consists of a 40-45 min presentation followed by 60-90 minutes of committee questions based upon the written document and oral presentation. The defense is conducted in the presence of the public, the student's MS committee, and the MS Program Director to act as the Moderator. Another member of the MS Committee can substitute if the MS Program Director is not available.

1. Meet with your Advisor to plan the outline of the oral seminar. The oral seminar outlines the scientific background and rationale of the project, including the specific aims, experimental design, preliminary studies, and predicted outcomes.
2. Contact each committee member and MS Program Director and seek open dates to schedule the exam. Also contact Selina Hall in the departmental office to reserve the conference room and create a public announcement of the defense.
3. Construct and rehearse a 40-45 min powerpoint presentation that will serve as the oral seminar of the MS Thesis defense. Rehearse your oral presentation with your advisor and other colleagues. Ask for sample questions from the audience to test your knowledge.
4. Send emails to the committee one (1) week prior to the exam as a reminder about the date and time of the oral defense.

Note: The talk is immediately followed by a ~15 min public question & answer session. At the conclusion of the public questions, the public will be dismissed and a private question & answer session will commence between members of the committee and the student. After the question period is over, the student is briefly dismissed while the committee decides whether the student has demonstrated sufficient mastery of the scientific background, experimental design and methods of their research project based upon the oral presentation and response to committee questions.

If the student passes the exam, the committee will sign the oral defense form that will be submitted to the Office of Research and Graduate Programs of the School of Medicine.

If the student fails the exam, a second attempt will be scheduled at a later time. The date cannot be within the same semester as the first attempt. Failure of the student to pass on the second attempt will result in dismissal from the program.

Guidelines for Thesis Advisory Committee Meetings

The purpose of the thesis advisory committee is to provide a wide range of faculty expertise that will contribute ideas and suggestions to the progression and successful completion of the MS thesis project. Students are required to meet with their thesis committee as outlined for each respective track above.

Format for the Thesis Committee Meeting

It is the student's responsibility to schedule each thesis committee meeting before the stated deadlines. Each meeting consists of a student oral presentation (powerpoint talk) that briefly updates the committee of the specific aims of the research project (Research Track) or research topic (Education Track) before proceeding to results obtained from each specific aim.

After the student's presentation, each member of the thesis committee will have an opportunity to make comments and suggestions designed to strengthen the project. The MS Program Director will take careful notes on committee suggestions during the meeting that will be referred to in future meetings.

During the meeting, the advisor should not attempt to speak on behalf of the student. The advisor can help ensure that committee suggestions stay within the boundaries of the project and inform the committee whether the suggestions are feasible within a reasonable time frame that will ensure the successful completion of the project.

All subsequent meetings should focus on the progress of the project. The student should present these results in powerpoint format at each meeting. If significant changes are made to the project that go beyond the original project description, the student should provide this information, as well.

How to Act Upon Committee Suggestions

The student is expected to act upon the suggestions of the committee in consultation with the advisor. The student and advisor may decide jointly that certain suggestions should be incorporated into the project while other suggestions may be rejected. Under circumstances of rejection, the student must convey the rationale for rejection in writing (email is acceptable) to the committee. Sample reasons include problems of feasibility or detracting from the original specific aims of the project. If the rationale for rejecting a suggestion is not considered acceptable by committee members, the MS Program Director will review this decision and resolve the issue.

Thesis Committee Meeting Report

During the meeting, the MS Program Director records committee suggestions on a departmental *MS Thesis Committee Meeting Report* form. This form provides written documentation of committee suggestions that must/may be addressed at future committee meetings. The *Formal Approval/Delay to Write MS Thesis* should be used as the final report prior to the writing phase of the MS Thesis.

Assessment of Learning Outcomes (LO)

Assessment of LO1: Demonstrate mastery of all subject material related to the program curriculum and thesis project.

- Mastery of the program curriculum will be assessed by grades obtained in each course.
- Mastery of research area and thesis project will be assessed by the thesis advisor, during thesis committee meetings, and at the final thesis defense.
- Ability to critically read and evaluate pertinent literature will be assessed by participation in the departmental seminar series/course, journal clubs, and quarterly meetings.

Assessment of LO2: Produce original significant contributions and effectively communicate scientific material formally in both written and oral formats.

- Ability to formally present scientific material will be assessed by internal and/or external conference presentations of original research, journal club presentations, thesis committee meetings, and the final thesis defense. The quality of the presentations and proficiency of the student will be assessed by the thesis advisor and committee.
- Demonstration of proficiency in scientific writing will be assessed by the quality and clarity of any abstract submissions, original research publications, and the final thesis document.
- The primary advisor will also complete a series of evaluations documenting student progress pertaining to the thesis project and honors/awards relevant to the student's professional career path.

Assessment of LO3: Conduct scholarly activities in an ethical manner, following the principles of the scientific process.

- Mandatory enrollment in BMS6010- Responsible Conduct in Biomedical Research.
- Plagiarism will be monitored through the regular use of Safe Assign for written documents produced by the student.
- Students will demonstrate appropriate use of the scientific method and the proper use of statistics in the biological sciences, as assessed by the thesis advisor and committee members.

Student Academic Success Services

Health and wellness are important aspects of student academic success. Students are encouraged to achieve and maintain a healthy lifestyle through student health services offered by WSU. [Student Affairs](#) promotes and enhances student personal health and wellness. Numerous services are offered, including [Counseling and Psychological Services](#) (CAPS) and [Title IX Sexual Misconduct](#) support.

Leave of absence: A student may request a leave of absence (LOA) for personal or medical reasons. A formal written request for a LOA must be made to the Graduate Program Director(s). All LOAs are part of the student's official record. The leave type, start and end dates are entered into the WSU information system and recorded on the official transcript. Once a LOA is approved by the Graduate Program Director(s), there is a reasonable expectation that the student will return to the MS program. Once placed on leave, a student remains on leave until approved to return and resume coursework. Students placed on a LOA will be considered withdrawn from coursework. A LOA does not retroactively nullify course failure.

Personal Leave of Absence (PLOA): Approval of PLOA is discretionary by the Graduate Program Director(s) and will only be granted where reasonably necessary and in collaboration with the student's mentor. A student's written request should specify the beginning and end dates of the leave. In order to return from an approved PLOA, the student must confirm the expected return date as outlined in the leave letter before returning to their medical studies.

Medical Leave of Absence (MLOA): A student's written request for a medical LOA requires authorization from a licensed healthcare professional certified to treat the specific illness, indicating that the student is unable to perform the functions and responsibilities of their MS studies for a specified period of time. The certification letter must state the beginning and end dates for which the MLOA is deemed to be medically necessary. In order to return from an approved MLOA, the student's healthcare provider must affirm in writing that the student is fit to return to their MS studies. Such notification must be received as outlined in the leave letter before the anticipated return to school. Health providers who are family members may not provide the certification letter.

It is important to note that most federal loans will enter repayment once you withdraw from school. The grace period on your loan is a set period of time after you graduate, leave school or drop below half-time enrollment before you must begin repayment on your loan. Not all federal student loans have a grace period. For most loans, interest will accrue during your grace period.

For more information on loan repayment and grace periods, please visit: <https://studentaid.gov/manage-loans/repayment#when-begin>

Scholarships: A limited number of partial scholarships may be available to assist with costs for tuition and fees. Please reach out to the MS program director for further information on the availability of these funds for each semester.