

STUDENT AND FACULTY HANDBOOK

**INTEGRATED PROGRAM IN
BIOMEDICAL SCIENCES**

**THE COLLEGE OF GRADUATE
HEALTH SCIENCES**

**UNIVERSITY OF TENNESSEE HEALTH
SCIENCE CENTER**

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Introduction

The Integrated Program in Biomedical Sciences (IPBS), a research-oriented interdisciplinary graduate program, involves faculty from the Departments of Anatomy and Neurobiology, Molecular Sciences, Pathology, Pharmacology, Pharmacy, and Physiology and their affiliate faculty from St. Jude Children's Research Hospital and the Veterans Affairs Medical Center. Unlike traditional, department-based graduate programs, the IPBS provides the Ph.D. or M.D./Ph.D. degree-seeking student a broad-based, cross-disciplinary training that is all but essential in today's competitive research environment. The IPBS consists of seven tracks: Cancer and Developmental Biology; Cell Biology and Biochemistry; Genetics, Functional Genomics, and Proteomics; Microbial Pathogenesis, Immunology, and Inflammation; Molecular, Cellular, and Systems Physiology; Molecular Therapeutics and Cell Signaling; and Neurosciences. Significantly, faculty members based in several different departments contribute to a single track, thereby enhancing the interdisciplinary training of students.

Faculty

Faculty contributing to the IPBS can be grouped into three categories: (i) regular faculty, (ii) affiliate faculty, and (iii) outside members from non-participating UTHSC departments or other institutions. Regular faculty members are those with full-time primary appointments in one of the participating departments at UTHSC. Affiliate faculty members are employees of St. Jude Children's Research Hospital or the Veterans Affairs Medical Center who have received a primary academic appointment in one of the participating departments. Faculty mentors, whether regular or affiliated faculty, are

expected to cite their UTHSC affiliation on all publications in which IPBS students are coauthors. Outside members with primary academic appointments from non-participating departments or who are from other institutions may serve on student committees but may not be a research advisor. Outside members are the only faculty not required to retain graduate faculty status. A complete list of the graduate faculty can be found at www.utm.edu/grad/ADMIN/Admin_Grad_Faculty.php.

Faculty members select a primary IPBS appointment in one of the seven tracks, and may select one or two secondary appointments among the remaining tracks. They must notify the IPBS Director of desired appointments or any changes in appointment status. Faculty members may mentor students in any of the tracks in which they have primary or secondary appointments, as the student's track affiliation is determined by the student's research topic and academic plan of study. Consequently, faculty may have students in their laboratories at the same time who are earning degrees in different tracks. Faculty may serve as outside committee members for students pursuing degrees in tracks in which they do not have a primary appointment. A complete list of primary faculty appointments in IPBS tracks can be found at www.utm.edu/grad/IPBS/Faculty.htm.

Students

The IPBS enrolls approximately 20-25 students each year. Three types of Ph.D. degree-seeking students matriculate into the IPBS: (i) "typical" students who enter with no formal declaration of track affiliation and select a Research Advisor only after completing a series of laboratory rotations, (ii) students who select a Research Advisor at the time of acceptance and directly enter a laboratory, and (iii) students seeking a dual

M.D./Ph.D. degree. Second and third year medical students are eligible to enter the dual degree program, and are expected to identify a Research Advisor prior to CGHS matriculation or after completion of a limited number of abbreviated laboratory rotations.

Stipends, Scholarships, Fellowships, and Training Grants

All students enrolled in the IPBS receive a waiver of tuition for six years of study. The IPBS provides two years of stipend support for typical students who complete four laboratory rotations before selecting a Research Advisor. Subsequent stipend support is provided by the Research Advisors. Under certain conditions, Research Advisors may elect to defer payment of the second-year stipend to a later date if adequate grant funds are available. Should a Research Advisor lose funding, the IPBS can provide a “safety net” in which the student stipend will be covered by the program for a short period of time not to exceed nine months. Eligibility is contingent upon re-submission of a grant application by the Research Advisor. Should a Research Advisor fail to acquire funding at the end of nine months, then additional student support may be apportioned on a case-by-case basis only after discussions involving the Research Advisor, Track Head, IPBS Director, Departmental Chair, and Dean of the CGHS.

M.D./Ph.D. students receive one year of stipend support from the IPBS; subsequent stipend support is provided by the Research Advisors. Students who directly enter a laboratory must receive stipend support from the Research Advisor upon matriculation. Students who directly enter a laboratory and M.D./Ph.D. students are not eligible for safety net protection; consent on rare occasions may be obtained from the

Dean of the CGHS. If financial assistance is not approved by the Dean, such students must identify a new, financially-supporting Research Advisor or leave the program.

The CGHS provides up to \$3,000 of additional annual funding to select students who qualify for Alumni Endowment Scholarships. These scholarships are intended to enhance the recruitment of outstanding applicants who are nominated at the time of application. Eligible students must have maintained an undergraduate grade point average of at least 3.4 from an accredited US institution and obtained a combined score of 1350 or greater on the verbal and quantitative portions of the Graduate Record Exam. Students must remain in good academic standing to continue receiving the scholarship.

Many fellowships are also available to supplement the stipends of IPBS students. A complete list may be found at

www.utm.edu/grad/MISCELLANEOUS/Scholarships.htm. The Hal and Alma Reagan Fellowship provides an annual stipend that is \$1,000 above the general stipend amount and \$1,000 in supplies and travel monies. Reagan Fellowships are awarded through competition to outstanding graduate students conducting cancer research.

Training grants awarded to participating faculty may also be used to provide stipend support to eligible students. Principal investigators applying for training grants are encouraged to request tuition and fee support for students as well.

Academic Standards

The admission, retention, and graduation standards are the same as those of the College of Graduate Health Sciences (CGHS). All students are subject to the CGHS Honor Code (www.utm.edu/grad/MISCELLANEOUS/Honor_Code.htm).

Core Curriculum

All IPBS students participate in a core curriculum during the first year. The following core courses or their equivalent are required. Credits for prior training of all listed courses are possible, but require the approval of the IPBS Director.

IP 805	Essentials of Molecular Biology	3 credit hours
IP 806	Biochemistry	3 credit hours
IP 841	Essentials of Cell Biology	3 credit hours
IP 844	Organ Systems and Disease	3 credit hours
IP 810	IPBS Seminars	1 credit hour
IP 900	Doctoral Dissertation and Research	1 credit hour

Note: Biochemistry and Essentials of Molecular Biology occupy the first 10 weeks of the fall semester and Organ Systems and Disease runs the final 7 weeks of the fall term. Essentials of Cell Biology runs the entire fall semester. IPBS Seminars follows a journal club format in which students present papers representing a wide-range of topics from the current literature. It is offered in both the fall and spring terms, and all students are required to enroll each semester for the first year of the program.

Additional Curriculum Requirements

All IPBS students must continue to participate in a journal club or course that follows a journal club format (such as **PATH 834** Pathology Seminars or **ANAT 821** Neurosciences Seminar) during the second year of study. Certain tracks may require participation for additional years.

In addition to the core curriculum, all IPBS students are required to pass a minimum of six elective hours. Elective courses are selected and approved through consultation with the Research Advisor, Track Head, or Program Director. Students may opt to enroll in an elective course during their first year or may defer until a track and Research Advisor have been selected. A particular track may expect students to enroll in specific elective courses; this information can be found in Appendix 2 of this handbook. A complete listing of elective courses can be found in the course catalog at the University's website (www.utmem.edu/grad/COURSES/Courses.htm).

All Ph.D.-seeking students in the CGHS must also pass **IP 801** Integrity in the Conduct of Scientific Research. This course is typically taken in the spring semester of the second year.

Research Colloquia and Laboratory Rotations

Before the start of each fall semester, faculty members are contacted by their Track Head to identify those wishing to accept a student into their laboratories in the upcoming academic year. This list is provided to the Program Director who compiles the track lists into a single document provided to the incoming students. To be eligible, a faculty member must be a member of the graduate faculty and have financial approval from his/her departmental Chair.

During the first weeks of the fall semester, first-year IPBS students attend a series of seven Research Colloquia (one for each track) in which eligible faculty members of each track provide a brief (15 minute) overview of their laboratories' research programs. Interested students may then arrange for a subsequent meeting with particular faculty

members or a tour of the laboratories. All first-year IPBS students must attend at least four of the seven colloquia.

After completion of the Research Colloquia, students identify at least four different laboratories in which they will rotate for six weeks each. Students may identify all four laboratories at the end of the Research Colloquia, but are encouraged to make their selections progressively as they are exposed to various facets of the IPBS. Confirmation of a rotation laboratory is through mutual agreement between the student and faculty member. Faculty members may accept no more than two students during a single rotation period.

The rotation process enables students to be exposed to the diversity of research laboratories within the IPBS. The fall core curriculum schedule has been designed to allow laboratory research time most afternoons and all day Wednesday (beginning in late October). However, faculty members may not ask students to spend more than 20 hours per week performing rotation research. This limitation is intended to protect the student's time needed to perform well in classes. At the end of each rotation period, students will provide a brief (two page) summary of their rotation research and submit the summary to the laboratory faculty member and the IPBS Director. For doing so, students will receive one credit hour each semester in **IP 900** Doctoral Dissertation and Research.

Selection of Research Advisor and Faculty Committee

By the end of the first academic year, students select a track and Research Advisor from within the graduate faculty and with whom the student performed a research rotation. Factors involved in the final selection of a Research Advisor include:

(1) mutual acceptance by the student and advisor, (2) certification by the Graduate Studies Council of the faculty member to direct Ph.D. work, (3) the ability of the faculty member to provide financial support for the research project, including the student's stipend after the IPBS fulfills its commitment, and (4) approval by the faculty member's Chair and the IPBS Director.

During the second year of study, the student and Research Advisor select a Faculty Committee composed of five members of the graduate faculty, including the Research Advisor who serves as Chair. The Student Committee Appointment form may be found at www.utmem.edu/grad/MISCELLANEOUS/Resources.htm. One or more members must have a regular full-time appointment with UTHSC, at least two members must come from within the track, and at least one member must come from outside of the track. One outside member may be from a non-participating institution. The purpose of the Faculty Committee is to assist the student and ultimately to approve the dissertation.

Students keep the Faculty Committee up to date on the progress of their research through annual committee meetings. The CGHS requires that students have at least one documented committee meeting each year. The Annual Student Progress Report can be found at the CGHS website (www.utmem.edu/grad/MISCELLANEOUS/Resources.htm).

Qualifying Examinations for Admission to Candidacy

Students must pass two examinations for formal admission to Ph.D. candidacy: a written qualifying examination offered in June of the second year of study and a written and oral defense of the proposed research topic.

Written exam

The written exam consists of two parts: a core section which all students answer and a track-specific section. The track-specific section reflects the elective courses taken by students during their first two years. The exam is open book; students receive the exam at 9 am on Monday and return it by noon the following Monday. Exam questions are designed to test a student's ability to apply knowledge and not simply recall facts learned in class.

In the core section of the exam, students must answer 4 of 6 questions relating to the Biochemistry, Essentials of Molecular Biology, Essentials of Cell Biology, and Organ Systems and Disease course material. It is expected that each question will take approximately one-half day to complete.

In the track-specific section of the exam, students must answer 3 of 5 questions. It is expected that each question will take approximately one day to complete, allowing for a more in-depth probing of the student's knowledge in his/her area of emphasis compared to the core section of the exam.

All questions will be graded on a pass/fail basis. Passing students may fail only one question in the core section and one question in the track-specific section. If a student fails one section, that section only will be re-tested 4-8 weeks after receipt of the score. If a student fails both sections of the exam, the entire exam will be re-tested. Students who fail to pass the re-examination or opt not to be re-tested may be offered the chance to receive an M.S. degree.

Defense of Proposed Research Topic

By the end of the third year, students must defend their proposed research topic to the Faculty Committee. To do so, the student develops the overall design of the project

and several potential specific aims through discussions with the Research Advisor and through annual Faculty Committee meetings. The student then schedules a committee meeting, no later than early in the third academic year, and proposes the specific aims and presents supporting preliminary data to the Faculty Committee. Following committee input and initial topic approval, the student then prepares a written proposal.

The written proposal of the research plan adheres to the format of a mini-NIH proposal (10-15 pages): 1 page of specific aims, 3-4 pages of rationale and background, 3-5 pages of preliminary results, and 3-5 pages of experimental design and anticipated results. In addition, the proposal must include a complete list of literature cited. Students typically require 4-6 weeks to prepare the written proposal, and it is the responsibility of the Research Advisor to provide the student with sufficient time to do so. The written proposal is intended to demonstrate the student's understanding of the research plan and should be written in his/her own words. Consequently, the proposal should not be directly edited by the Research Advisor nor members of the Faculty Committee prior to its distribution. However, this does not preclude the student from consulting with the Research Advisor, Faculty Committee, or any other colleague on specific issues that may arise during the writing of the proposal. Input should be in the form of indications where changes are needed and suggestions for improvements with the student being required to act on those criticisms to finally produce the proposal.

The written proposal is provided to the Faculty Committee at least two weeks prior to a meeting held to discuss the proposal. When the meeting convenes, the student will be asked to leave the room briefly. At that time, the Research Advisor should remind the committee members of the courses that the student has completed so that they

have a reference point for testing the student's fund of knowledge. A chair of the meeting will be selected; this cannot be the Research Advisor. The chair will be responsible for running the meeting and for writing up a synopsis of the meeting once it is completed. The student will be asked back into the room and should proceed with about a 30 minute presentation of his/her proposal. Interruptions should be limited to points of clarification. After the presentation, the chair will ask a committee member to initiate the questioning. The Q&A session should last no more than two hours. Questions should begin with the proposal, but may branch out to test the student's knowledge in pertinent areas.

After the Q&A session, the student will be asked to leave the room and the committee will discuss his/her performance on both the written and oral portions of the exam. A single pass or fail is determined for the entire exam; a simple majority determines the vote. However, if the student passes, he/she may be asked to re-write portions of the proposal if parts are deemed weak or the student may be told that at the next meeting he/she will be tested on a weak knowledge area. If the student barely fails, he/she may not be required to completely re-write the proposal or the Q&A may be of a shorter duration in the re-examination. If the student completely fails, then a full second exam will be required at a later date.

After a decision has been reached, the student will rejoin the room and the chair will summarize the discussion leading up to the decision. Other committee members may give additional advice as they see fit. If the student passes, he/she should have each committee member sign the [admission to candidacy exam form](#). The student will deliver the form to the Program Director's office along with the written summation of the exam

by the chair and a copy of the student's unofficial transcript. Assuming the student is in good standing and has met all core and elective requirements, the Program Director will in turn pass this along to the Dean's office.

Master's Degree Requirements

While all students accepted into the IPBS program are expected to pursue the Ph.D. degree, some will opt for a terminal M.S. degree instead. It is anticipated that such a decision will not be made until after the completion of the first-year curriculum. There are several key differences between the requirements for the M.S. degree and the Ph.D. degree. For the M.S. degree, students must be enrolled a minimum of four semesters. They will complete the same first-year core curriculum as Ph.D. candidates, but are only required to acquire 3 elective credit hours. In the second year, M.S. candidates must participate in a journal club, however they are not required to complete **IP 801** Integrity in the Conduct of Scientific Research nor will they take part in the second year written exams required of Ph.D. candidates. Candidates for the M.S. degree will select a Research Advisor at the end of the first year and form a Faculty Committee composed of the advisor, one Track faculty member, and one outside Track faculty member. The candidate should meet with the committee soon after the decision to opt for an M.S. degree has been made to outline the research objectives. The research component of the M.S. degree requires publication quality data that may not stand alone, but which will contribute significantly to an eventual publication. The work should at least begin to test a hypothesis and serve as the focus of appropriate introduction and general discussion chapters of a thesis. To complete the degree, candidates will write a thesis and defend it

in the form of an oral presentation before an open audience and the Faculty Committee, followed by a question and answer session with the Committee alone. The format and applicable deadlines for the thesis and its defense are those defined in the CGHS Bylaws.

The Report of Final Examination from can be found at

www.utmem.edu/grad/MISCELLANEOUS/Resources.htm.

Student Transfer or Termination from a Laboratory

Just as the initial selection of a Research Advisor and laboratory is predicated on mutual consent, continuance in a laboratory is dependent upon sustained agreement between the student and Research Advisor. While not encouraged, in certain situations a student may leave a laboratory and perform a limited number of abbreviated rotations to identify a new Research Advisor. Transfers should be initiated only after extensive discussions between the student, Research Advisor, Track Head, and IPBS Director. A Research Advisor may also ask a student to leave his/her laboratory even though the student is in good academic standing. However, demonstrated research deficiencies of the student must be recorded through Faculty Committee meetings before termination may be initiated. Dismissal from one laboratory does not necessarily preclude the student from entering another laboratory to complete his/her degree. Requests for student transfers and dismissals must be in writing and must be approved by the Dean.

Please Note: Neither the IPBS nor participating departments will be financially obligated if a student who directly enters a laboratory or an M.D./Ph.D. student opts or is asked to leave a Research Advisor's laboratory. The inability of such a student to find a new, financially-supporting Research Advisor will result in dismissal from the program.

Academic Due Process

If a student is denied continuation in the IPBS, by failing to maintain good academic standing for an extended period of time, by failing admission to candidacy, or through termination from a research laboratory, the student has a right to a hearing. The IPBS adheres to the appeal process of the CGHS, the specifics of which can be found in *The Centerscope* (www.utmем.edu/centerscope).

Dissertation Defense

Students write their dissertation after completion of experiments and with the approval of the Faculty Committee. The dissertation is submitted to the Faculty Committee prior to an oral, public defense of their work which is followed immediately by a separate oral defense to the Faculty Committee alone. The format and applicable deadlines for the dissertation and its defense are those defined in the CGHS Bylaws. The Report of Final Examination form can be found at www.utmем.edu/grad/MISCELLANEOUS/Resources.htm.

Summary of Academic Program

YEAR 1

Fall term

- August
- Begin courses in Biochemistry, Essentials of Molecular Biology, Essentials of Cell Biology, IPBS Seminars, and Doctoral Dissertation and Research.
 - Begin attending Research Colloquia.
- Mid-October
- End Research Colloquia.
 - Begin first laboratory rotation.
- Late October
- End courses in Biochemistry and Essentials of Molecular Biology.
 - Begin course in Organ Systems and Disease.
- December
- End courses in Essentials of Cell Biology and Organ Systems and Disease.
 - End first laboratory rotation.

Spring term

- January
- Continue courses in IPBS Seminars and Doctoral Dissertation and Research.
 - Begin elective courses.
 - Begin second laboratory rotation.
- Mid-February
- Begin third laboratory rotation.
- April
- Begin fourth laboratory rotation.

May • End IPBS Seminars, Doctoral Dissertation and Research, and elective courses.

June • Final date to select Research Advisor.

YEAR 2

Fall term

July • Begin dissertation research.

August • Begin elective course and journal club.

December • End elective course.

Spring term

January • Continue dissertation research.
• Begin course in Integrity in the Conduct of Scientific Research.

March • Final date to select Faculty Committee.

May • End journal club and Integrity in the Conduct of Scientific Research course.

June • Take written Admission to Candidacy examination.

YEAR 3

Fall term

July • Continue dissertation research.

Spring term

January • Continue dissertation research.

June • Final date for defense of proposed research topic.

Year 4 and beyond

- Fall and Spring terms • Continue dissertation research.
- Doctoral dissertation defense.

Appendix 1: Core Course Descriptions

IP 805 Essentials of Molecular Biology MWF 8:30-9:50 am, first 10 weeks of the fall semester (3 credit hours)

This course covers the essentials of prokaryotic and eukaryotic molecular biology. Topics include DNA and RNA structure; DNA replication, repair, and recombination; the mechanism and regulation of transcription; and protein translation. Fundamental concepts are reinforced by the discussion of human genetic diseases. Recommended text: Alberts et al., *Molecular Biology of the Cell*, 5th Ed.

IP 806 Biochemistry MWF 10:30-11:50 am, first 10 weeks of the fall semester (3 credit hours)

The course presents the fundamental aspects of biochemistry including biochemical and biophysical principles (bonding, properties of water, thermodynamics, ionization and acid-base theory, and enzymology); structure, synthesis, and function of proteins and enzymes; metabolism of sugars, amino acids, nucleotides, nucleosides, vitamins, coenzymes and lipids; energy production and conversion; mitochondria and bioenergetics; photosynthesis; membrane transport proteins; and cytochrome P450. Recommended text: Devlin, *Textbook of Biochemistry with Clinical Correlations*, 6th Ed.

IP 841 Essentials of Cell Biology TuTh 9-10:20 am, fall semester (3 credit hours)

This course provides an introduction to the cell and includes topics such as: animal cell structure; membrane compartmentalization; membrane transport; nuclear structure and dynamics; protein transport and modification; receptor signaling; cell

motility and migration; cell cycle regulation; extracellular matrix and cell adhesion; general principles of development; and bacterial cell structure. Recommended text: Alberts et al., *Molecular Biology of the Cell*, 5th Ed.

IP 844 Organ Systems and Disease MTuThF 9-10:20 am, final 7 weeks of the fall semester (3 credit hours)

The course is intended to allow the beginning graduate student to develop an understanding of selected organs systems, their structure, function and relationship to disease. Students will acquire a basic understanding of tissue and organ structure and function as well as the processes of immunity and infection. Diseases affecting the cardiovascular and central nervous system along with cancer are specific areas of focus and will be discussed with affected organ systems.

IP 810 IPBS Seminars F 1-1:50 pm (1 credit hour)

IPBS Seminars features student presentations of research articles from the current literature. In each class session, two students each give a 20 minute presentation followed by a brief question and answer period. Each student will present once a semester, and overall, twice during the first year of the program. Articles for presentation are chosen by the course director or by the presenting student with course director approval. All students are expected to read the presented articles prior to class.

Appendix 2: Track-Specific Guidelines

Cancer and Developmental Biology

The Cancer and Developmental Biology Track requires that students complete **IP 940** The Molecular Biology of Cancer and at least one additional elective course, chosen in consultation with the research advisor. Students are also required to participate in the Cancer and Developmental Biology Seminars.

Cell Biology and Biochemistry

The Cell Biology and Biochemistry Track requires Research Advisor-designed independent study of the student's thesis topic area, and attendance at departmental seminars in the Research Advisor's department. In addition, students select from the following electives:

- MSCI 812** Physical Biochemistry and Applications in Structural Biology
- MSCI 840** Special Topics: Advanced topic courses in appropriate areas of Cell Biology and Biochemistry, potentially covering topics such as advanced metabolism, cell signaling, proteins and enzymes, regulation of gene expression, and regulation of intracellular trafficking.
- MSCI 861** Cellular Signaling

Genetics, Functional Genomics, and Proteomics

The Genetics, Functional Genomics, and Proteomics Track requires students to select from the following electives:

- MSCI 814** Bioinformatics I (strongly encouraged)
- MSCI 815** Bioinformatics II
- MSCI 911** Applied Proteomics

Genetics, Functional Genomics, and Proteomics (cont'd)

MSCI 928 Principles of Mass Spectrometry

MSCI 929 The Tools of Molecular Biomedical Research

ANAT 825 Developmental and Molecular Neuroscience

Microbial Pathogenesis, Immunology, and Inflammation

The Microbial Pathogenesis, Immunology, and Inflammation Track requires students to complete three 2 credit hour courses:

MSCI 931 Immunity and Inflammation

MSCI 932 Viral Pathogenesis

MSCI 933 Molecular Basis of Bacterial Pathogenesis

Electives may also be obtained by enrolling in **MSCI 840** Special Topics, which covers focused areas of research in immunology, microbial pathogenesis, or virology.

During the second year, students are required to serve as teaching assistants in the laboratory portion of the medical microbiology course.

Molecular, Cellular, and Systems Physiology

The Molecular, Cellular, and Systems Physiology Track requires students to complete **CMED 711** Essentials of Animal Experimentation and **PHYS 819/919** Physiology Seminar. Elective credits may be obtained by enrolling in **PHYS 911/912** Advanced Topics in Physiology, in which the following subject areas are offered on a rotating basis: recent advances in endocrinology, cardiovascular and pulmonary aspects of perinatal physiology, advanced respiratory physiology, topics in comparative physiology, muscle physiology, mechanisms of host defense and inflammation, the biology of fever, physiological adjustments to stress, and integrative functions of the

hypothalamus. Students may also obtain elective credits by enrolling in other graduate level courses with the approval of the Research Advisor and Faculty Committee.

Molecular Therapeutics and Cell Signaling

The Molecular Therapeutics and Cell Signaling Track recommends that students complete advanced courses in pharmacologic approaches to the development of therapeutic compounds and the study of research problems. Students in this track are also encouraged to take electives in other tracks related to areas of their research project.

Neuroscience

The Neuroscience Track requires students to enroll in **ANAT 821** Neuroscience Seminar in both semesters of the first and second years. Enrollment in **ANAT 826** Neuroscience Symposium is required for the Spring semester each year. Students are required to take **ANAT 827** Functional Neuroanatomy and at least two of the following neuroscience electives:

ANAT 823 Cellular Neuroscience

ANAT 825 Developmental and Molecular Neuroscience

ANAT 841 Behavioral Neuroscience

A statistics course is highly recommended.

Sometime after the first year, students will be required to serve as teaching assistants in the laboratory portion of the medical neuroanatomy course for two terms. If possible, students should take **ANAT 827** Functional Neuroanatomy before completing this teaching requirement.