PATHOLOGY
GRADUATE PROGRAM
STUDENT HANDBOOK

Last modified: January 11, 2016
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I. Introduction to the Pathology Graduate Program

The Department of Pathology at Case Western Reserve University provides extensive opportunities for graduate training in Experimental Pathology, Immunology, and Cancer Biology leading to the PhD (or MD/PhD) degree. Separate programs lead to the MS degree. Teaching faculty are based in the Department of Pathology and other basic science and clinical departments at Case Western Reserve University and affiliated hospitals, including University Hospitals Case Medical Center (UHCMC), Cleveland Clinic Foundation (CCF), MetroHealth Medical Center (MHMC) and the Louis Stokes VA Medical Center (VA). Our website provides an overview of the Program, but does NOT provide a comprehensive description of the requirements. STUDENTS ARE ADVISED TO READ THE PATHOLOGY GRADUATE PROGRAM HANDBOOK IN ITS ENTIRETY.

Major areas of research and graduate education include a wide range of topics in experimental pathology, immunology, immunopathology, inflammation, receptor signaling, infectious diseases (including HIV/AIDS, tuberculosis, malaria and others), apoptosis, neoplasia and cancer biology, stem cells, tissue injury and healing, biomaterials biocompatibility, neuropathology (including prion disorders, Alzheimer's disease and other topics), aging, diabetes and cardiovascular disease. Cutting edge research applies molecular and cellular approaches for in vitro and in vivo studies of disease mechanisms in human and animal model systems. The focus on disease fosters development of basic science and translational research that applies to clinical disorders.

PhD Training in the Pathology Graduate Program is offered in three tracks that share a common core curriculum, but provide additional track-specific curricular offerings. The track system provides a cohesive program and addresses the specific needs of different Pathology-related areas of research training.

1. Molecular and Cellular Basis of Disease Training Program (MCBTP)
2. Immunology Training Program (ITP)
3. Cancer Biology Training Program (CBTP)

The Pathology Graduate Program provides master’s degree training in the following programs.

1. MS-A Program (part-time for employees only)
2. MS-B Program (full-time)
3. MD/MS Program

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<thead>
<tr>
<th>Pathology Graduate Program Committee</th>
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<tr>
<td>*Christine Kehoe serves as Secretary to the Graduate Program Committee and as Pathology Student Affairs Coordinator.</td>
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<table>
<thead>
<tr>
<th>Name</th>
<th>Position and Representation</th>
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<tbody>
<tr>
<td>James Anderson</td>
<td>Director, Pathology Graduate Program; Chair, Graduate Program Committee; MCBDTP Director; MS-A Program Coordinator</td>
</tr>
<tr>
<td>Clive Hamlin</td>
<td>Track Thesis Committee Representative, all tracks</td>
</tr>
<tr>
<td>Clifford Harding</td>
<td>Pathology Department Chair; MSTP Representative</td>
</tr>
<tr>
<td>Mark Jackson</td>
<td>CBTP Director and track advisor, T32 Director</td>
</tr>
<tr>
<td>Brian Cobb</td>
<td>ITP Director and track advisor, T32 Director</td>
</tr>
<tr>
<td>Robert Petersen</td>
<td>Co-Director, Pathology Graduate Program; Graduate Student Admissions representative; BSTP representative (represents all 3 Tracks); Graduate Student Seminar Series Director (Path 511/512); MCBDTP Track Advisor; MD/MS Program Coordinator, MS-B Program Director</td>
</tr>
<tr>
<td>Nicholas Ziats</td>
<td>MCBDTP Curriculum Rep</td>
</tr>
</tbody>
</table>
The Pathology Graduate Program Committee administers the graduate programs and handles issues common to all PhD tracks (student admissions, mentor approval, final stages of academic review, core curriculum issues and other issues related to the general structure of the program). The MCBDTTP, ITP and CBTP each have a track-specific Steering Committee that is charged with administering activities specific to the track (curriculum development, courses, seminars, journal clubs, advising of prospective students and students in the track, recruiting efforts, faculty development).

II. Pathology PhD Program

A. Admissions

The recommended route for admission to the PhD program is through the Case Biomedical Sciences Training Program (BSTP, http://www.cwru.edu/med/BSTP/index.html); MD/PhD students are admitted through the Medical Scientist Training Program (MSTP, http://www.mstp.cwru.edu). Admission to the BSTP or MSTP automatically provides admission to the Pathology Graduate Program and all other graduate programs affiliated with the BSTP or MSTP, respectively, providing maximum flexibility for students to rotate in multiple laboratories and choose the optimum Research/Thesis Mentor and graduate program for their interests. A third mechanism is through direct admission to the Pathology Graduate Program with a pre-identified mentor, however, positions available through this pathway are limited. See the section “Admission to the Pathology PhD Program” for more detailed information. Admissions procedures for the MS-A, MS-B, and MD/MS programs are described below in the sections describing to those programs.

B. Student Support

All PhD or MD/PhD students receive full tuition support, a stipend, and health benefits. The stipend is the same for all students and is set at the level specified by the MSTP (currently $27,500/year). The stipend can be supplemented up to a $2,000 as an incentive bonus to those students who obtain their own individual extramural training support that meets the criteria specified below, e.g., an NRSA F30/F31 grant from the NIH (note that this policy is contingent on the approval of the student advisor’s home department). PhD students are encouraged to apply for independent fellowship funding (for example, an individual NRSA from the NIH). Students who earn a fellowship that provides at least 75% of the current stipend amount will be awarded an incentive supplement of $2,000 per year in addition to the BSTP MSTP stipend, pro-rated to cover the period of extramural fellowship support. A second exception is that a student who obtains an individual extramural fellowship that provides a stipend higher than the BSTP MSTP stipend will receive the level of stipend provided by the fellowship award. Note that appointment to an institutional T32 training grant does not qualify for an incentive bonus.

C. First Year: Starting the Program

Entering students follow the BSTP core curriculum (http://www.cwru.edu/med/BSTP/index.html). The BSTP allows the flexibility to rotate in laboratories in any BSTP-affiliated graduate program, including Pathology, before commitment to a particular mentor/Program. Stipend support commences upon arrival of students in the summer (preferably in July and no later than the start of the fall semester in late August). In the summer and fall semesters, students must rotate in a minimum of 3 laboratories (see Section III: Faculty Trainers). Entering BSTP students who express an interest in the Pathology Graduate Program will be assigned by the Pathology BSTP representative to a relevant Track Advisor (Robert Petersen for the MCBDTTP, Brian Cobb for the ITP or Mark Jackson for the CBTP). This advisor will assist the student in the selection of courses and laboratory rotations based on the student’s research interests. Students who are assigned advisors in other programs are encouraged to do research rotations in the Pathology Graduate Program if they have research interests in Pathology. Such students may approach faculty advisors directly or seek advice from the appropriate Track Advisor. Rotations expose students to research programs and mentors, provide conceptual and technical training in research, and are key to selecting a PhD Research/Thesis Mentor.
Coursework in the fall semester includes an integrated curriculum in cellular and molecular biology (CBIO 453 and CBIO 455, 4 graded credits each) that provides a shared foundation for many graduate programs at Case Western Reserve University School of Medicine. Students also receive 1 credit for their research rotations (BSTP 400, P/F). First year students rotating in Pathology are not required to register for PATH 511 (Pathology Seminar/Fall), but should attend the Pathology Department Seminars (Monday noon) and the Immunology Seminars (Tuesday noon), which include the Student Seminars that are integrated into these two series.

D. Selection of Research/Thesis Mentor and Track

By the end of the first semester, students select a Research/Thesis Mentor from the list of approved Faculty Trainers. Selection of a Research/Thesis Mentor indicates a commitment by the student to carry out research in that faculty member's laboratory on projects that will provide the basis for a PhD proposal and subsequent PhD thesis. Research activities must commence by Spring semester of the first year. All students must also select a track (MCBDTP, ITB or CBTP) within the Pathology Graduate Program by the end of the first semester.

E. First year: Spring Semester

In the second semester of the first year, students take a total of 9 credits with a minimum of 7 graded course credits including two core courses (see “Sample Curriculum”). Core courses include Basic Pathophysiologic Mechanisms (PATH 510), Fundamental Immunology (PATH 416) and Basic Cancer Biology and Interface with Clinical Oncology (PATH 520 with PATH 521). Students must take the core courses specified for their track. Students take the Experimental Pathology seminar course (PATH 512) this semester. In addition, students begin their PhD research in the laboratory of the PhD mentor. Finally, students MUST take the one-credit ethics course, IBMS 500, which is REQUIRED prior to the students’ thesis proposal defense. This course is offered annually in the Spring.

F. CWRU Academic Requirements for Completion of the PhD

To advance to candidacy for the PhD degree, the School of Graduate Studies of Case Western Reserve University requires a minimum of 36 credit hours of academic courses, at least 24 of which must be letter-graded. PATH 601 may be used for ungraded (P/F) credits. A Planned Program of Study Form (PPOS) must be completed online in the Student Information System (SIS) as soon as the student begins work in their selected laboratory. For SIS reference guides and manuals, go to http://www.case.edu/registrar/faculty/sisguides/. The Pathology Graduate Program requires that graded core course requirements specified by the Pathology Graduate Program and Track be completed to advance to candidacy. In addition, the Thesis Proposal Defense, which includes a qualifying exam component, must be successfully completed for the student to advance to candidacy. (The proposal may be defended while students are still completing the course requirements.) In addition to the requirements to advance to candidacy, the student must take a minimum of 18 credits of PATH 701, Dissertation PhD.. Some of the 18 required PATH 701 credits may be taken prior to advancement to candidacy with predoctoral standing approval, and students and mentors should seek this option when possible as it may accelerate completion of requirements for the PhD and minimize expenses.

Note: After advancing to candidacy, a student should register for PATH 701, not PATH 601, and may register for 1-9 credits of PATH 701 per semester. Even prior to advancing to candidacy, if a student has completed 36 “foundation” credits of graduate courses (at least 24 of which must be graded courses), the student can enroll in 1-6 credits of PATH 701 per semester after the submission and approval of the Predoctoral Standing Form. This policy will reduce the subsequent number of PATH 701 credits and tuition charges to the student’s advisor’s home department, as well as reducing the minimum time period required before the Ph.D. thesis defense and graduation can occur. Students should contact Christine Kehoe, Pathology Student Affairs Coordinator, for the Predoctoral Standing Form or with any questions (368-1993 or cxk15@case.edu).
PhD students who already hold an MS or MD degree upon admission may be excused from some requirements and may be required to take as few as 18 “foundation” credits to complete the coursework requirements for the PhD degree plus 18 credits of PATH 701 Dissertation Research. The extent of reduction in course requirements is decided upon petition to the Chair of the Pathology Graduate Program Committee, as well as the School of Graduate Studies, when the student elects to enter the Pathology Graduate Program (at the end of the first semester for BSTP students and at the time of admission for direct admit students).

G. Summary of Pathology PhD Program Curriculum Requirements

These requirements are described in more detail in other sections.

1. Coordinated Curriculum in Cell and Molecular Biology ("C3MB", including CBIO 453 and CBIO 455, 4 graded credits each). BSTP 400 (1 credit, P/F).

2. IBMS 500 Ethics course (one credit).

3. Basic Pathophysiologic Mechanisms (PATH 510, 4 graded credits) and at least one of the other core courses: Fundamental Immunology (PATH 416, 4 graded credits) and Basic Cancer Biology and Interface with Clinical Oncology (PATH 520 with simultaneous registration in PATH 521, 4 graded credits).

4. Additional graded didactic electives or core courses to a total of 24 graded credits; 2 of these courses--6 credits--must represent track electives (see Section XIV: List of Courses); the remainder may include track electives or courses offered by other departments. To optimize course planning, students must complete an online Planned Program of Study Form (PPOS) in the Student Information System (SIS) as soon as they have started work in their selected lab. If a PPOS has not been completed, the School of Graduate Studies will put a registration hold on the student’s SIS account, and the student will be unable to register.

5. Pathology Student Seminar (PATH 511/PATH 512), 1 P/F credit per semester. Students must participate fully in all semesters but formally register only for their first two semesters in the program. (See Section “J” for specific requirements.)

6. BSTP students enter the Pathology Graduate Program and their thesis laboratory at the beginning of their second semester. MSTP students enter the Pathology Graduate Program and a thesis laboratory in spring semester of their second year in the MD-PhD program (their time commitment to the laboratory generally starts in April of that year). Direct admit students are part of the Pathology graduate program and a thesis laboratory as soon as they matriculate as a graduate student.

7. During the spring semester in the first year of PhD study, students must take a course on biomedical ethics ("Being A Professional Scientist" IBMS 500). This required one-credit course is offered every spring semester. If necessary, this course can be delayed no later than spring of year 2. The ethics course MUST be completed prior to advancing to candidacy.

8. Prior to advancing to candidacy, students must take 9 credits/semester. At least 6 graded credits must be taken for each fall and spring semester until 24 graded credits have been achieved. The goal is to complete all didactic coursework within the first two years, although exceptions may occur. Courses must be taken for a letter grade unless offered only with pass-fail grading. Courses are to be selected by the student with guidance from the Research/Thesis Mentor and Thesis Committee.

9. Students must maintain a grade point average of 3.0 or better. In addition, a student receiving two or more C grades may be placed on academic probation and reviewed to determine whether he/she may continue in the program. Students who receive one “C” may be reviewed by the Pathology Graduate
Program Committee or the relevant Track Steering Committee, and tutoring, remedial coursework or other actions may be recommended to assist the student.

10. Prior to completing the course requirements for advancement to candidacy, Research Elective (PATH 601, P/F) must be taken to complete a nine-credit semester load. This course is critical to building laboratory and research skills and generating preliminary data necessary for preparation of the Thesis Proposal and advancement to candidacy for the PhD degree. Students must devote significant time to lab work and make substantial progress toward research objectives and preparation of the Thesis Proposal.

11. Students registering for PATH 601, 651 or 701 must indicate their thesis advisor as the Instructor. If a Class Section does not exist with your Thesis Advisor as Instructor, please see the Student Affairs Coordinator (Christine Kehoe) to add the Section in order for you to register.

12. The Student must work with the Research/Thesis Mentor to assemble a Thesis Committee and have its first meeting by the early in the fall semester of year 2 of the PhD program or by the end of the fall semester of year 3 in the MD-PhD program. See Section K on Preliminary Research and Selection of Thesis Committee.

13. Preparation and defense of the Thesis Proposal/Qualifying Examination should be completed by early in the spring semester of year 2 of the PhD program or by the end of the spring semester of year 3 of the MD-PhD program. Failure to meet this timetable will result in review by the Graduate Program Committee and may result in dismissal from the program. Completion of the Thesis Proposal/Qualifying Examination is a prerequisite for a student to advance to candidacy for the PhD degree. Prior to advancing to candidacy, students must complete all of the above requirements (1-11) and have a grade point average of 3.00 or better.

14. Note: After advancing to candidacy, a student should register for PATH 701, not PATH 601, and may register for 1-9 credits of PATH 701. Even prior to advancing to candidacy, if a student has completed 36 “foundation” credits of graduate courses (at least 24 of which must be graded courses), the student should apply for Pre-doctoral Standing in order to enroll in up to 6 credits of PATH 701. This policy will reduce the subsequent number of PATH 701 credits and tuition charges to the student advisor’s home department, as well as reducing the minimum time period required before the Ph.D. thesis defense and graduation can occur. Students should contact Christine Kehoe, Pathology Student Affairs Coordinator, for the Pre-doctoral Standing Form or with any questions (368-1993 or cxx15@case.edu).

15. Students must complete 18 credits of PATH 701 (PhD Dissertation, U/S) prior to graduation. IMPORTANT: STUDENTS SHOULD TAKE THE FOLLOWING STEPS TO REDUCE CHARGES TO THEIR MENTOR AND DEPARTMENT: AFTER ADVANCEMENT TO CANDIDACY, IT IS NO LONGER NECESSARY TO REGISTER FOR 9 CREDITS TO MAINTAIN FULL-TIME STUDENT STATUS. In the first semester after advancement to candidacy, students should register only for the number of credits of PATH 701 needed to bring their total number of accumulated credits of PATH 701 to 9 by the end of that semester (and should register for no other courses). In subsequent semesters, students should register for only 1 credit of PATH 701 (and no other courses), except that in the final semester registration should be for the number of credits of PATH 701 needed to complete a total of 18 credits by the end of that semester. EXCEPTION: IT IS IMPORTANT TO MAXIMIZE THE NUMBER OF PATH 701 CREDITS THAT CAN BE COMPLETED DURING PERIODS WHERE TRAINING GRANT SUPPORT IS AVAILABLE. If the student is on an NIH T32 training grant or NRSA award or other funding mechanism that supports this level of tuition, registration should be for the full 9 credits during semesters when grant support for tuition will be available, until the total credits of PATH 701 reaches 18 minus the number of semesters certainly remaining before graduation, after which registration should be for only 1 credit of PATH 701 each semester until graduation. The student MUST be registered for PATH 701 for the semester in which he/she defends the PhD thesis (MD-PhD students please inquire with the MSTP office to check whether this applies for their situation to avoid unnecessary tuition charges).
15. Summer Registration: In general, students should not register for any credits. In unusual circumstances, students may register for up to 3 credits of PATH 701 if this is needed to meet an imminent graduation date. The student MUST register for one credit of PATH 701 in the summer if the thesis will be defended in that semester. NOTE: Students who are on a J-1 Visa or receiving student loans, government support or other aid outside the Program may need to register for RSCH 750 to fulfill registration requirements for their particular funding source or situation. Students should check the guidelines of the funding source to determine whether or not they need to be registered during the summer. Most students do NOT need to register for RSCH 750.

16. The student must meet with his/her Thesis Committee at least once every 6 months and make adequate progress toward completion of the PhD. Upon entering the fifth year of study, students are required to have thesis committee meetings every 3 months (quarterly) until graduation.

17. A PhD Thesis should be completed and successfully defended by the end of the fifth year. Students will be reviewed annually by the Pathology Graduate Studies Committee beginning at the end of their fifth year and may be dismissed from the program if their progress is deemed inadequate. All students must complete the PhD by the end of the 7th year in the program.

18. Students must fully satisfy the publication requirement and Departmental Thesis (Defense) Seminar requirement.

Curriculum Modifications for Direct Admit Pathology PhD students
Direct Admit students have already identified a Research/Thesis Mentor and may start research work in the mentor’s laboratory without other rotations. With prior agreement of the Research/Thesis Mentor, students may rotate in other laboratories to gain additional relevant expertise.

H. Curriculum Modifications for MSTP Students
MSTP students must satisfy all of the PhD program requirements with the following modifications:

1. They are excused from CBIO 453 and CBIO 455 and PATH 510 due to overlap with the medical curriculum. They are excused from BSTP 400 due to overlap with the MSTP 400.

2. Unless exempted by the ITP Director, MSTP students in the ITP must take PATH 416. MSTP students in the ITP must also take PATH 465 and PATH 466. MSTP students in the MCBDTP are not required to take PATH 416 (but may still elect to take this course as a track elective) since the MD curriculum contains sufficient immunology to provide background for students who are not focusing on this area. PATH 416 and PATH 465 are track electives, not requirements, for all CBTP students.

3. They can apply up to 18 graded credits from IBIS graduate courses taken in the medical curriculum to the PhD requirements.

4. They are encouraged to take at least one Pathology core course (PATH 416 and/or PATH 520 + 521) and a track elective in the first two years of the MSTP (prior to entering the PhD phase). IT IS RECOMMENDED THAT ONE OF THESE COURSES BE TAKEN IN THE SPRING OF YEAR 1.

5. MSTP students may petition the Director of their track (MCBDTP, ITP, CBTP) to substitute a different graduate course for a track elective if the MD curriculum provides reasonable overlap with a relevant track elective. Since two core courses and two track electives are required and MSTP students are excused from Path 510, this means that an MSTP student must take at least three graduate-level courses beyond the IBIS courses in the MD curriculum.

6. When MSTP students enter the PhD phase in approximately April of their second year in the MSTP, their stage in the Pathology PhD program is similar to that of a first year BSTP student (BSTP students
start in January instead of late March and so have a 4-month head start in the lab); subsequent timing of events and expectations for progress have been adjusted accordingly.

7. MSTP students should take IBMS 500 in the spring of their second year in the MSTP.

8. Prior to the PhD phase, MSTP students are encouraged to attend the Pathology Department Seminars (Monday noon) and the Immunology Seminars (Tuesday noon), including the Student Seminars, which are integrated into these series.

I. Sample Course Schedule

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<tr>
<th>SEMESTER</th>
<th>COURSE</th>
<th>TITLE</th>
<th>CREDIT HOURS</th>
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<tr>
<td>YEAR 1 FALL</td>
<td>CBIO 453*</td>
<td>CELL BIOLOGY I</td>
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<tr>
<td>YEAR 1 FALL</td>
<td>CBIO 455*</td>
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<tr>
<td>YEAR 1 FALL</td>
<td>BSTP 400^</td>
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MENTOR AND TRACK CHOSEN

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<td>YEAR 1 SPRING</td>
<td>PATH 510</td>
<td>BASIC PATHOL MECH</td>
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<tr>
<td>YEAR 1 SPRING</td>
<td>CORE</td>
<td>CORE: PATH 416, OR PATH 520 + 521</td>
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</tr>
<tr>
<td>YEAR 1 SPRING</td>
<td>IBMS 500</td>
<td>BEING A PROF SCIENT (REQUIRED BEFORE THESIS PROPOSAL)</td>
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<tr>
<td>YEAR 1 SPRING</td>
<td>PATH 512</td>
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</tr>
<tr>
<td>YEAR 1 SPRING</td>
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<td></td>
<td>9</td>
</tr>
<tr>
<td>SUMMER</td>
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<td></td>
<td>0</td>
</tr>
<tr>
<td>SUMMER</td>
<td>TOTAL</td>
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THESES COMMITTEE CHosen; PREPROPOSAL MEETING SCHEDULED

<table>
<thead>
<tr>
<th>SEMESTER</th>
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<th>TITLE</th>
<th>CREDIT HOURS</th>
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<tr>
<td>YEAR 2 FALL</td>
<td>PATH 511</td>
<td>EXP PATH SEMINAR I</td>
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</tr>
<tr>
<td>YEAR 2 FALL</td>
<td>PATH 465 AND PATH 466 FOR ITP STUDENTS, OR TRACK ELECTIVE**</td>
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<tr>
<td>YEAR 2 FALL</td>
<td>TRACK OR OTHER ELECTIVE**</td>
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<td></td>
</tr>
<tr>
<td>Year</td>
<td>Course</td>
<td>Course Details</td>
<td>Credits</td>
</tr>
<tr>
<td>------------</td>
<td>----------</td>
<td>-----------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Year 2 Fall</strong></td>
<td>PATH 601</td>
<td>SPECIAL PROBLEMS</td>
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</tr>
<tr>
<td><strong>Year 2 Fall</strong></td>
<td>TOTAL</td>
<td></td>
<td>9</td>
</tr>
</tbody>
</table>

**Thesis Proposal Defense and Advancement to Candidacy within Next 9 Months (Note: If all required coursework is completed, students should request predoctoral standing in order to register for PATH 701 instead of PATH 601)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Course</th>
<th>Course Details</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 2 Spring</strong></td>
<td>PATH 512</td>
<td>EXP PATH SEMINAR II</td>
<td></td>
</tr>
<tr>
<td><strong>Year 2 Spring</strong></td>
<td></td>
<td>PARTICIPATE WITHOUT REGISTERING</td>
<td></td>
</tr>
<tr>
<td><strong>Year 2 Spring</strong></td>
<td></td>
<td>ELECTIVES (CORE, TRACK OR OTHER)**</td>
<td>4-6</td>
</tr>
<tr>
<td><strong>Year 2 Spring</strong></td>
<td>PATH 601 OR 701</td>
<td>SPECIAL PROBLEMS OR DISSERTATION PHD</td>
<td>3-5</td>
</tr>
<tr>
<td><strong>Year 2 Spring</strong></td>
<td>TOTAL</td>
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<td>9</td>
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<tr>
<td><strong>Summer</strong></td>
<td>NONE (OR RSCH 750, ONLY IF REQUIRED)#</td>
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</tr>
<tr>
<td><strong>Summer</strong></td>
<td>TOTAL</td>
<td></td>
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</table>

**Thesis Proposal Defense and Advancement to Candidacy Must Be Completed (Note: Once 36 credits including 24 graded credits have been completed, students should request predoctoral standing in order to register for up to 6 credits of PATH 701 instead of PATH 601 during semester in which thesis proposal takes place.**)

<table>
<thead>
<tr>
<th>Year</th>
<th>Course</th>
<th>Course Details</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 3 Fall</strong></td>
<td>PATH 511</td>
<td>EXP PATH SEMINAR I</td>
<td></td>
</tr>
<tr>
<td><strong>Year 3 Fall</strong></td>
<td>PATH 701***</td>
<td>DISSERTATION PHD</td>
<td>9</td>
</tr>
<tr>
<td><strong>Year 3 Fall</strong></td>
<td>TOTAL</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td><strong>Year 3 Spring</strong></td>
<td>PATH 512</td>
<td>EXP PATH SEMINAR II</td>
<td></td>
</tr>
<tr>
<td><strong>Year 3 Spring</strong></td>
<td>PATH 701***</td>
<td>DISSERTATION PHD</td>
<td>1-9</td>
</tr>
<tr>
<td><strong>Year 3 Spring</strong></td>
<td>TOTAL</td>
<td></td>
<td>1-9***</td>
</tr>
<tr>
<td><strong>Summer</strong></td>
<td>NONE (OR RSCH 750, ONLY IF REQUIRED)#</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Summer</strong></td>
<td>TOTAL</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td><strong>Year 4 Fall</strong></td>
<td>PATH 511</td>
<td>EXP PATH SEMINAR I</td>
<td></td>
</tr>
<tr>
<td><strong>Year 4 Fall</strong></td>
<td>TOTAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
This table shows a typical schedule of courses for a Pathology PhD student.
*Alternate courses for MSTP students: IBIS 401-404
^Alternate course is MSTP 400 for MSTP students and PATH 601 for direct admit students.
#Exception: Take 1-3 credits of PATH 701 if this will accelerate graduation. Also, take 1 credit of PATH 701 if the PhD thesis will be completed in the summer semester (including anytime after the end of the spring semester).
**PATH 416 counts as a Track Elective for CBTP students, and PATH 520 + 521 counts as a Track Elective for ITP students.
*** IMPORTANT: STUDENTS SHOULD TAKE STEPS TO REDUCE CHARGES TO THEIR MENTOR AND DEPARTMENT: See Section G, Point 15.

<table>
<thead>
<tr>
<th></th>
<th>PATH 701***</th>
<th>DISSERTATION PHD</th>
<th>1 (IF GRADUATION IS ANTICIPATED THIS SEMESTER, REGISTER FOR #CREDITS REQUIRED TO BRING 701 TOTAL TO 18)</th>
</tr>
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<tbody>
<tr>
<td>YEAR 4 FALL</td>
<td>TOTAL</td>
<td></td>
<td>1***</td>
</tr>
<tr>
<td>YEAR 4 SPRING</td>
<td>PATH 512</td>
<td>EXP PATH SEMINAR II</td>
<td>PARTICIPATE WITHOUT REGISTERING</td>
</tr>
<tr>
<td>YEAR 4 SPRING</td>
<td>PATH 701***</td>
<td>DISSERTATION</td>
<td>1 (IF GRADUATION IS ANTICIPATED THIS SEMESTER, REGISTER FOR #CREDITS REQUIRED TO BRING 701 TOTAL TO 18)</td>
</tr>
<tr>
<td>YEAR 4 SPRING</td>
<td>TOTAL</td>
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</tr>
<tr>
<td>SUMMER</td>
<td>TOTAL</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>YEAR 5 FALL</td>
<td>PATH 511</td>
<td>EXP PATH SEMINAR I</td>
<td>PARTICIPATE WITHOUT REGISTERING</td>
</tr>
<tr>
<td>YEAR 5 FALL</td>
<td>PATH 701***</td>
<td>DISSERTATION PHD</td>
<td>1 (IF GRADUATION IS ANTICIPATED THIS SEMESTER, REGISTER FOR #CREDITS REQUIRED TO BRING 701 TOTAL TO 18)</td>
</tr>
<tr>
<td>YEAR 5 FALL</td>
<td>TOTAL</td>
<td></td>
<td>1***</td>
</tr>
<tr>
<td>YEAR 5 SPRING</td>
<td>PATH 512</td>
<td>EXP PATH SEMINAR II</td>
<td>PARTICIPATE WITHOUT REGISTERING</td>
</tr>
<tr>
<td>YEAR 5 SPRING</td>
<td>PATH 701***</td>
<td>DISSERTATION PHD</td>
<td>1 (IF GRADUATION IS ANTICIPATED THIS SEMESTER, REGISTER FOR #CREDITS REQUIRED TO BRING 701 TOTAL TO 18)</td>
</tr>
<tr>
<td>YEAR 5 SPRING</td>
<td>TOTAL</td>
<td></td>
<td>1***</td>
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</tbody>
</table>
NOTE: Schedule beyond year 5 will generally be the same as for year 5.

J. Seminar Requirements

The Department seminar requirement consists of two components: attendance at research seminars and attendance at graduate student seminars. In the second semester of the first year (Spring) and the first semester of the second year (Fall), students should register for PATH 512/511, respectively. In subsequent semesters, students should not register for PATH 511/512, but they are still required to fulfill seminar attendance requirements. Attendance at seminars for ALL students MUST BE documented on sign-in sheets or by submission of the title of the seminar attended along with a synopsis to the Graduate Student Seminar Series Director. Under no circumstances should a student sign the sheet without attending the seminar. The attendance requirement is as follows:

Research Seminars:
For students enrolled in PATH 511/512, the student must attend at least 9 approved seminars, of which at least 3 seminars must be in the Monday Pathology Seminar Series and the other 6 seminars may be any combination of seminars in Pathology, Immunology, Cancer Center (Blood Club), CCF Immunology, Taussig Cancer Center or other approved seminar series (contact the Graduate Student Seminar Series Director with questions). Attendance MUST be documented by sign-in, which will be available at all approved forums (students attending CCF Immunology or Taussig Cancer Center seminars should confirm with Christine Kehoe that attendance documentation will be transmitted to the Pathology Graduate Program). A student may obtain credit for up to three seminars outside of the approved seminar series by submitting to Dr. Robert Petersen a short summary for each seminar (also indicate date, location, speaker, title and seminar/department program).

After completing PATH 511 and PATH 512, students must continue to attend at least 9 approved seminars in each semester, but there is no distribution requirement; the 9 seminars may consist of any combination of seminars in Pathology, Immunology, Cancer Center (Blood Club), CCF Immunology, Taussig Cancer Center or other approved seminar series (students attending CCF Immunology or Taussig Cancer Center seminars should confirm with Christine Kehoe that attendance documentation will be transmitted to the Pathology Graduate Program). A student may obtain credit for up to three seminars outside of the approved seminar series by submitting to Dr. Robert Petersen a short summary for each seminar (include date, location, speaker, title, and seminar/department program).

Graduate Student Seminars:
In all years in the program, attendance is required at the Pathology Graduate Student Seminars, which are integrated into the Monday Pathology Seminar series and the Tuesday Immunology Seminar series. Specific attendance requirements for each semester will be determined by the Course Director for PATH 511/512 (Dr. Petersen) based on the number of seminars scheduled in each semester. In the past, the expectation has been attendance at a minimum of 9 seminars each semester.

Grading and Disciplinary Actions:
Path 512/511 are graded Pass/Fail. Students registered in Path 512/511 will receive an Incomplete if seminar attendance requirements are not met. Senior students (those not registered in Path 512/511) will receive an Incomplete grade in Path 601 if the seminar requirement is not met; students in Path 701 may be assigned a failing grade. The incomplete can be cleared by attendance in subsequent semesters; these make-up seminars will NOT be counted toward the current semester requirement. Arrangements for make-up must be coordinated with Graduate Student Seminar Series Director, Dr. Robert Petersen.

Failure to complete these seminar requirements will result in academic probation, which ultimately may result in dismissal from the Program.
K. Preliminary Research and Selection of Thesis Committee

The student will begin research activities under the direction of the Research/Thesis Mentor at the beginning of spring semester of year 1 of the PhD program or during the spring semester of year 2 of the MD-PhD program. This work will form the basis of the PhD proposal. By early in the fall semester of the second year of the PhD program (or by the end of the fall semester of year 3 of the MD-PhD program), the student and Research/Thesis Mentor will select members of the student's Thesis Committee and have a pre-proposal committee meeting. For all three tracks (MCBDTP, ITP and CBTP), the composition of the committee requires the approval of Dr. James Anderson, Director of the Pathology Graduate Studies Program, or Dr. Robert Petersen, Co-Director of the Pathology Graduate Studies Program. The student must have one Thesis Committee meeting every 6 months through year 5; entering year 5, the student must have one Thesis Committee meeting every 3 months (quarterly).

The Thesis Committee must contain at least four Case faculty members, at least two of whom (including the Research/Thesis Mentor) must be approved Trainers in the Pathology Graduate Program. One member must have primary appointment in a department other than Pathology (Pathology-approved trainers without a primary appointment in Pathology may represent either Pathology or another department). The thesis committee must contain a significant number of faculty who are not in the immediate research group of the Research/Thesis Mentor. One feature of this (but not the sole definition) is that the committee should contain at least one member who has not co-authored a publication with the Research/Thesis Mentor. The Chair of the Thesis Committee must have either a primary or secondary faculty appointment in Pathology. The Research/Thesis Mentor may not serve as the Thesis Committee Chair. To assist the Thesis Committee Chair and to enhance consistency of procedures, the thesis committee will include the Track Thesis Committee Representative (currently Dr. Clive Hamlin for the MCBDTp, ITP, and CBTP). The Research/Thesis Mentor and at least one other member must be members of the Track selected by the student (MCBDTP, ITP or CBTP). Additional faculty, including scientists from outside Case, may be added to the committee depending on the expertise necessitated by the student's research project (members who are not Case faculty will be non-voting members). All committee members should consider themselves as a mentor of the student. Faculty composition of the committee may be changed by the advisor and student, subject to the approval of the Director of the Pathology Graduate Program, Dr. James Anderson, the Co-Director, Dr. Robert Petersen, or the Track Director. The Thesis Committee should be convened in a pre-proposal meeting prior to the student's Thesis Proposal Defense to offer the student suggestions regarding the Thesis Proposal Defense. A second Graduate Committee member will be added as a voting member of all thesis committees for the purposes of the qualifying examination/thesis proposal. This person will not submit questions for the qualifying examination and will exit the committee if the qualifying examination/thesis proposal is successfully passed (new policy). If a student fails the thesis proposal/qualifying examination, the Graduate Program Committee will review the situation and may, at its discretion, add thesis committee members or change the composition of the committee to ensure that rigorous standards are maintained for a second attempt to pass.

The responsibilities of the Thesis Committee Chair include leading Thesis Committee meetings and preparing a short progress report for each committee meeting (evaluating the student’s progress and indicating expectations for the next 6 months and beyond), and ensuring that the student makes demonstrable progress towards the PhD [monitoring of progress in course and seminar requirements, publication requirements, thesis defense preparations, required departmental lectures, participation in required track events (journal clubs, retreats) and completion of the IDP]. At the conclusion of each meeting, a Graduate Student Evaluation Form (see Forms section) must be completed and submitted along with the progress report to Christine Kehoe, Pathology Graduate Studies Coordinator (cck15@case.edu). The Thesis Committee Chair should email the progress report to the student, all committee members and the Pathology Graduate Studies Coordinator.

The student is responsible for scheduling all thesis committee meetings and informing all members of the Thesis Committee and the Graduate Program Coordinator, Christine Kehoe, of the date, time, and location of all committee meetings at least one week prior to the meeting. Substantially greater advance
notice and scheduling of preparatory steps is required for committee meetings involving thesis proposal defense or final dissertation defense, as described in other sections.

L. Individual Development Plan (IDP)

The trainee should complete the IDP in preparation for a scheduled meeting with his/her mentor. The IDP is an NIH-required planning tool that is designed to help trainees identify long-term career goals, to develop plans for improving skills, to set goals for the coming year to improve efficiency and productivity, and to foster communication with their mentor(s) about career plans and development. Students are required to complete at least one IDP per academic year. The Pathology Graduate Program uses the IDP developed by the School of Medicine Office of Graduate Education. PhD students and MD-PhD students have different IDP formats to suit their different professional development needs.

Please Note: The IDP is fundamentally a career development aid created by the trainee based on the trainee’s personal goals and interests. It is not and will not be viewed as a formal university evaluation or record-keeping document.

M. Thesis Proposal and Qualifying Examination

In the Pathology Graduate Program, the Thesis Proposal includes a Qualifying Examination component and a proposal of the student’s planned research that is modeled on the NIH R01 grant proposal. The Thesis Proposal Defense MUST be successfully completed by early in the spring semester of year 2 of the PhD program or by the end of the spring semester of year 3 of the MD-PhD program. Failure to meet this timetable will result in review by the Pathology Graduate Program Committee and may result in dismissal from the program. Defense of the Thesis Proposal has both written and oral components. The process generally requires 1-2 months to complete.

1. Guidelines for Preparation of the Written PhD Proposal

The PhD Thesis Proposal should follow the format of an NIH R01 research grant application, but some research aims may have less supporting preliminary data than a typical R01 application. The student should address the research topic in a broad and fundamental fashion. The proposal should be focused on a hypothesis and propose a feasible set of studies to test it, although students may propose studies broader than their eventual focus (in this case goals should be clearly prioritized to establish a feasible plan). The Thesis Proposal is not a final contract for the path to the PhD; as research progresses the student may add new aims and modify or delete old aims.

The Thesis Proposal should be typed single-spaced (Arial 11 font; 0.5" margins), include appropriate supporting references from the literature and ongoing work in the mentor’s laboratory, and be not more than 14 pages. This format (including font, spacing, and page limits) will be strictly enforced, as it reflects the NIH specifications for proposals. Work by other groups or collaborators may be shown in figures, but if so, the figure legends should explicitly acknowledge the person who did the work or provide a reference if the work is published. The Thesis Proposal should be organized according to the format described below*.

*Rare exceptions may be made in cases where the student has successfully applied for and received an independent NIH Fellowship grant (F30 or F31). The student, with the approval of his/her committee, may substitute the successful Fellowship grant application in lieu of the written Ph.D. proposal.

PROJECT SUMMARY/ABSTRACT (Page 1). The Project Summary is meant to serve as a succinct and accurate description of the proposed work when separated from the application. State the application’s broad, long-term objectives and specific aims, making reference to the health relatedness of the project. Describe concisely the research design and methods for achieving the stated goals. This section should be informative to other persons working in the same or related fields and insofar as possible understandable to a scientifically or technically literate reader. Avoid describing past accomplishments
and the use of the first person. Finally, please make every effort to be succinct. This section must be no longer than 30 lines of text and should be presented on a separate page.

**SPECIFIC AIMS (Page 2).** Concisely state the goals of the proposed research and summarize the expected outcome(s), including the impact that the results of the proposed research will exert on the research field(s) involved. List succinctly the specific objectives of the research proposed, e.g., to test a stated hypothesis, create a novel design, solve a specific problem, challenge an existing paradigm or clinical practice, address a critical barrier to progress in the field, or develop new technology. The Specific Aims section is strictly limited to one single-spaced independent page.

**RESEARCH STRATEGY (Pages 3-14).** Organize the Research Strategy in the specified order (see below) and using the instructions provided. Start each section with the appropriate section heading – Introduction, Significance, Innovations, and Approach. The exact page count for each section is variable, but the total may not exceed 12 pages. Do not start each subsection on a new page. It is up to the student to divide this space appropriately, although a general recommendation is provided:

**INTRODUCTION (~3-4 pages):** Provide broad scientific background for the proposal. This section serves as a test of the student’s knowledge of scientific areas related to the proposal. Critically evaluate existing knowledge and models in a thorough manner with references and discussion of key primary papers. Specifically identify gaps, problems, or questions that your research will address. You may present prior work by your mentor’s group as well as other groups. This section should be comprehensive, should provide a thorough review of relevant literature with references, and may be considered to be a preliminary draft of the Introduction section of the PhD Dissertation. If figures are taken from other publications, references and attribution must be included in the figure legends.

**SIGNIFICANCE (~half a page):** Explain the importance of the problem or critical barrier to progress in the field that the proposed project addresses. Explain how the proposed project will improve scientific knowledge, technical capability, and/or clinical practice in one or more broad fields. Finally, describe how the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field will be changed if the proposed aims are achieved.

**INNOVATION (~half a page):** Explain how the application challenges and seeks to shift current research or clinical practice paradigms. Describe any novel theoretical concepts, approaches or methodologies, instrumentation or interventions to be developed or used, and any advantage over existing methodologies, instrumentation or interventions. Finally, explain any refinements, improvements, or new applications of theoretical concepts, approaches or methodologies, instrumentation or interventions.

**APPROACH (~7-8 pages):** Describe the overall strategy, methodology, and analyses to be used to accomplish the specific aims of the project. Include how the data will be collected, analyzed, and interpreted. Discuss potential problems and alternative strategies, and benchmarks for success anticipated to achieve the aims. If the project is in the early stages of development, describe any strategy to establish feasibility, and address the management of any high-risk aspects of the proposed work. Point out any procedures, situations, or materials that may be hazardous to personnel and precautions to be exercised.

**LITERATURE CITED:** Number the references in order of appearance and provide complete citations with the names of all authors, title of the article or chapter, the name of the book or journal, volume number, page numbers, city and publisher (books and book chapters), and year of publication. There is no page limit for this section and it does not count towards the 14 page overall limit.

**FIGURES:** All figures, including their legends, should be integrated into the text of the proposal rather than presented on separate pages. As such, the space used for figures counts towards the overall page limit. It is recommended that a box be drawn around each figure to clearly separate it from the
2. Sequence of Events for Thesis Proposal and Qualifying Exam

a. The student should schedule the Thesis Committee meeting for the Thesis Proposal Defense. Pick the date with consideration of the time required to complete all steps. The student is responsible for scheduling and room arrangements. Three hours should be allowed for the Oral Defense. Note: The student may schedule the Thesis Proposal oral defense to follow immediately after his/her presentation in the Pathology or Immunology Seminar Series if this is convenient and acceptable to the Thesis Committee. The student should submit the Thesis Proposal to the Thesis Committee approximately 5 weeks prior to the oral Thesis Proposal Defense to allow time for the other steps in the process to occur.

b. Thesis Committee members review the Thesis Proposal, and each prepares at least two written questions regarding the student’s scientific field and the proposed research (these should be delivered to the student within 14 days). The student is responsible for ensuring that at least two questions have been received from each thesis committee member with the exception of the second Graduate Committee member. These questions constitute part of the Qualifying Examination and should cover a range of topics. They should test the student’s scientific knowledge, grasp of current issues and questions in the field, ability to critically evaluate data, and capacity to develop hypothesis and approaches to test them. The questions may identify areas of the Thesis Proposal that need expansion, clarification or other revisions, or they may address relevant issues that are outside the scope of the proposal document itself.

c. The student should prepare appropriate written answers to the questions within 14 days. Only library resources available on campus may be used in preparing the answers. Discussion or consultation with the Research/Thesis Mentor, committee members or other faculty or staff is not permitted (except that the student may ask an examining faculty member for clarification of a question that he/she has submitted; the Research/Thesis Mentor may help advise concerning the propriety of consolidating similar questions from different committee members). References should be included in the answers where appropriate. Each committee member is to be provided with a document containing all the questions and answers (3-7 days prior to the Thesis Proposal defense).

d. The Track Representative will bring a copy of the Graduate Student Evaluation Form (see Forms section) to the Thesis Proposal meeting.

e. The Thesis Proposal meeting will follow the general format and rules for Thesis Committee meetings but with some modifications. The student will give a 30-40 minute oral presentation of the proposal (provide a printout of the Powerpoint presentation to the committee members) and field questions. Questions will be focused on the proposal itself, the questions previously submitted by faculty members or any relevant topic that may test the student’s scientific knowledge, grasp of current issues and questions in the field, ability to critically evaluate data, and capacity to develop hypothesis and approaches to test them. The questions may probe topics that are contained in the Thesis Proposal, or they may address relevant issues that are outside the scope of the proposal document itself. The committee will then evaluate the student in closed session. The chair will convey the decision of the committee and complete the Graduate Student Evaluation Form, which will be signed by the committee members. The committee chair will prepare a summary of the committee evaluation, either on the Graduate Student Evaluation Form or in a separate email, noting specific strengths and weaknesses in the student’s performance and detailing any necessary revisions or remedial actions. If a student fails the exam or passes provisionally, he/she is given an opportunity to correct the deficiencies no later than 6 months following the initial proposal defense. If a student fails the thesis proposal/qualifying examination, the Graduate Program Committee will review the situation and may, at its discretion, add thesis committee members or change the composition of the committee to ensure that rigorous standards are maintained for a second attempt to pass. If a student fails twice he/she will not be allowed to continue in the PhD program.

f. The chair must deliver the signed Graduate Student Evaluation to the Pathology Student Affairs Coordinator (Christine Kehoe).
g. Prior to the start of the semester during which the proposal defense takes place, the student should submit for approval a Predoctoral Standing Form. This will allow the student to register for up to 6 credits of PATH 701 instead of PATH 601. Students should contact Christine Kehoe, Student Affairs Coordinator (cxk15@case.edu or 368-1993) for the Predoctoral Standing Form.

h. The Track Representative will bring the Advancement to Candidacy Form (see Forms Section XII) to the meeting. The form must be completed and submitted to the Pathology Student Affairs Coordinator (Christine Kehoe) for the Department Chair's signature. The Pathology Student Affairs Coordinator will then file this form with the School of School of Graduate Studies, leaving a copy in the student's file.

i. A Planned Program of Study (PPPOS) must be submitted online in the Student Information System (SIS) prior to advancement to candidacy.

j. Students are encouraged to use their Thesis Proposal as the basis for a pre-doctoral fellowship application at the national level.

N. Academic Progress and Thesis Committee Meetings

The Student must work with the Research/Thesis Mentor to assemble a Thesis Committee and have its first meeting (a “pre-proposal” committee meeting) by the early in the fall semester of year 2 of the PhD program or by the end of the fall semester of year 3 in the MD-PhD program. See Section K on Preliminary Research and Selection of Thesis Committee. The pre-proposal meeting should usually last one hour or less. It is intended that everyone come to know what is expected at the proposal defense. It is not a research update meeting. There should be limited data. Proposed hypothesis and aims should be described briefly, but clearly, how these aims will be tested with expected results, and what would be done if unexpected results are obtained. The presentation should be no more than 20 minutes (20 slides), with discussion following. One objective of the meeting is to ensure that the hypothesis and aims are suitable for a proposal defense, and not too broad.

The Thesis Proposal/Qualifying Examination should be completed by early in the spring semester of year 2 of the PhD program or by the end of the spring semester of year 3 of the MD-PhD program. Failure to meet this timetable will result in review by the Graduate Program Committee and may result in dismissal from the program.

Students are responsible for scheduling a Thesis Committee meeting every 6 months. Thesis committee meetings should occur once every 3 months (quarterly) for students when progress is problematic and for all PhD students beyond the 5th year of PhD study (e.g. counting from start as a BSTP student) and for all MD-PhD students beyond the 6th year of MD-PhD study (i.e. beyond 4 years in the PhD phase).

A two-hour slot should be scheduled for the meeting to insure adequate time for evaluation and discussion, but students should provide a presentation that will take no longer than 30 minutes uninterrupted. One meeting each year should be coordinated with the student’s graduate student seminar if possible, which all Thesis Committee members should attend. Note: Students should communicate with their Thesis Committee when scheduling their graduate student seminar to ensure that the committee members will be available to attend on the selected date. Once a date/time has been confirmed, this information should be communicated to the Student Affairs Coordinator. Thesis Committee meetings will be led by the Thesis Committee Chair, not the Research/Thesis Mentor. Prior to the meeting, students should email an electronic copy of their presentation to all committee members; a hard copy of the presentation should be provided to all committee members at the meeting as well as any appropriate forms.

Agenda for Thesis Committee meetings:
1. The student should bring hard copies of the PowerPoint presentation to the meeting. The Track Representative will bring a Graduate Student Evaluation Form.
2. At the beginning of the meeting, the student will leave the room for a closed meeting of the committee to discuss achievement of course requirements, grades, research progress, preparation of publications and progress toward completion of the PhD Thesis and its defense.
3. Unless the meeting has been preceded by a seminar, the student will provide a 25-30 minute oral presentation of research progress. If the meeting follows a seminar, the student should provide a brief presentation that deals with specific research progress and plans that were not covered in the seminar. Ideally this would address any outstanding concerns from the last thesis committee meeting.

4. Open discussion should include questions by faculty members to evaluate student progress and address all questions and concerns. The committee should provide advice to the student to enhance research progress. Thesis committee meetings are an extremely valuable source of advice, and students should take advantage of the very valuable resource provided by the Thesis Committee.

5. Both student and mentor leave the room, and any mentor issues are discussed. This is done as a routine, even if there are no apparent issues, to make sure that the opportunity is there to raise such concerns.

6. The Research/Thesis Mentor will then return to the meeting. The committee will discuss all aspects of student progress. The committee must vote on the adequacy of progress, with a decision determined by a simple majority.

7. The student will return to the meeting, and the Thesis Committee Chair will present the committee’s evaluation and advice.

8. The Graduate Student Evaluation Form (see Forms section) will be completed, signed and delivered to the Pathology Student Affairs Coordinator (Christine Kehoe).

9. The Thesis Committee Chair will prepare a brief report that summarizes the committee’s evaluation, decisions and advice. The report may be written on the Graduate Student Evaluation Form, although it can be communicated by e-mail to the student, all members of the committee and the Student Affairs Coordinator.

The Program Director and Track Directors will seek to identify weak performance at student seminars and institute appropriate additional assessment. If a student is identified to have unsatisfactory performance in thesis committee meetings or in student seminars, then a second Graduate Program Committee member (e.g. the Track Director) may be added to the thesis committee.

O. Thesis and Graduation Requirements

Students must satisfy the requirements of the Program for the PhD Thesis Defense; publications and a Departmental Thesis Seminar. The student should solicit advice from the Thesis Committee about when to schedule the Thesis Defense. Arrangements should be made months in advance to secure appropriate Thesis Defense times (with sufficient prior notification of Graduate Studies) and to schedule a Departmental Thesis Seminar slot. (If a slot is not available in either of the Departmental Seminar Series, the thesis seminar may be scheduled at an alternative time.) The procedure takes at least 21-35 days from submission of the dissertation to the oral Thesis Defense, but scheduling of these events must be done much farther in advance. The student is responsible for scheduling and room arrangements for both the open and closed sessions of the Thesis Defense. Please visit the School of Graduate Studies website for important graduation deadlines and forms: http://gradstudies.case.edu/

1. Checklist for Thesis Defense and Graduation

a. Students must satisfy the publication requirement and all course requirements PRIOR TO SCHEDULING THE THESIS DEFENSE. Students should forward published papers and communications indicating acceptance of papers in press to the Graduate Program Coordinator, Christine Kehoe, prior to scheduling the defense.

b. The student must schedule the Thesis Defense in consultation with all Thesis Committee members. There will be a one-hour public Thesis Defense presentation (seminar). The defense will be publicized by the School of Graduate Studies based on the Notification for Scheduling the Final Oral Exam for the PhD form, which needs to be submitted to Graduate Studies no later than 3 weeks before the defense. The student should complete this form and submit it to the Graduate Program Coordinator. A closed Thesis Defense Committee meeting follows the presentation (allow 90 minutes). The public defense seminar and the closed Thesis Defense Committee meeting must take place on the same day, as per School of Graduate Studies guidelines.
c. A Departmental Thesis Seminar should be given in a track-related research seminar series (Pathology Department Seminar or Cancer Center Blood Club Seminar) or other publicized special seminar forum, if at all possible. Students must contact the organizer of the relevant seminar series well in advance to schedule the Departmental Thesis Seminar. If no slots are available within any of the seminar series, the thesis seminar may be scheduled at an alternative time.

d. Students should check on the deadline for the Thesis Defense for graduation in a particular semester. For example, if a student defends after the deadline for Spring graduation (even if this is prior to Spring commencement ceremonies), the PhD degree will not be conferred until the graduation date for the following (summer) semester. Note: The student must be registered for PATH 701 in the semester in which the Thesis Defense occurs.

e. Students should check with the School of Graduate Studies and consult with the Student Affairs Coordinator (Christine Kehoe) to make sure that all requirements for the PhD have been met and to schedule the Thesis Defense date with sufficient advance notice to satisfy the requirements of Graduate Studies. All materials required by the Office of Graduate Studies for the Thesis Defense and graduation should be submitted to the Student Affairs Coordinator (Christine Kehoe) who will ensure that all required materials have been completed and will then submit them to the School of Graduate Studies. Copies of all materials submitted to the School of Graduate Studies will be kept in the student's Departmental file.

f. The candidate must deliver the completed dissertation (in both hard copy and electronic forms) to each committee member at least 14 days before the examination.

g. At the time of the Thesis Defense, the Track Representative will bring a blank Pathology Graduate Student Evaluation Form and all forms from Graduate Studies that require Thesis Committee signatures.

h. At the time of the defense, the Research/Thesis Mentor must identify any sections of the thesis that must be redacted to prevent public release of confidential information (e.g. data governed by Materials Transfer Agreements or other contracts governing confidentiality of data, data obtained from collaborators who have not approved its publication in the thesis, etc). Note that all information in the thesis will be published online. It is recommended that the abstract particularly be reviewed to restrict its content to general conclusions without confidential data, as it may become available sooner than the entire thesis. If there is any doubt as to whether results in the thesis will be fully published prior to the end of the embargo period (see next point), it is recommended that the specific data be redacted from the thesis after presentation to the thesis committee.

i. At the time of the defense, the Research/Thesis Mentor must indicate the period of embargo that will define the delay between the submission of the thesis and its online publication. An Electronic Thesis and Dissertation (ETD) Document Approval and Certification form will be provided by the Track Representative. Choices are anticipated to be 6 months, 12 months or 24 months. The 24 month option should be chosen unless all significant data in the thesis is already accepted for publication.

j. It is the responsibility of the student to obtain copyright permission for ALL figures that have been published, INCLUDING the student’s own prior publications. This should be done prior to the thesis defense and MUST be completed prior to final submission of the thesis. Documentation of all permissions (e.g. letters or emails from the publishers) should be transmitted to the Research/Thesis Mentor and provided at the thesis defense.

k. Following the defense seminar and examination in the closed committee meeting, the Thesis Committee will indicate its decision to approve or deny the PhD degree. It is common for approval to be contingent upon specified revisions of the thesis document; in most cases the committee will sign off and allow the Research/Thesis Mentor to monitor the final revisions and provide the final approval signature.

l. A Graduate Student Evaluation Form will be completed and submitted to the Pathology Student Affairs Coordinator. Forms in the Graduation Packet should be completed and submitted to the Pathology Student Affairs Coordinator as well.

m. When final corrections to the written Dissertation are completed, the student must submit their Dissertation electronically to the School of Graduate Studies. (See Graduation Instructions for Doctoral Candidates in the Forms Section XII.) The student is entitled to binding services for 4 copies of the Dissertation. One of the 4 is for the Pathology library, one should go to the Research/Thesis Mentor,
and the other 2 are distributed to the student. The student may order additional copies at his/her own expense. Contact the Pathology Student Affairs Coordinator.

n. Following successful completion of the defense, including any requested revisions of the thesis document, the student will be considered to be a candidate for graduation, subject to final review of graduation credentials by the School of Graduate Studies, which will coordinate details regarding Convocation.

o. The student's mentor must notify their department administrator to arrange timely termination of the stipend, thereby avoiding pay-back difficulties.

p. The student should notify the Pathology Student Affairs Coordinator of his or her post-graduate position and contact information.

2. Dissertation Requirements

Each doctoral candidate is required to submit a written dissertation and pass a final oral examination in defense of the dissertation as evidence of their ability to conduct independent research at an advanced level. The dissertation must represent a significant contribution to existing knowledge (see Publication Requirement). The examination includes inquiry into the candidate's competence in Pathology and related fields.

When it has been determined by the student and his or her Research/Thesis Mentor, in consultation with the Thesis Committee, that the research has progressed sufficiently to prepare the dissertation, the student should obtain “Graduation Instructions for Doctoral Candidates” from the School of Graduate Studies website http://gradstudies.case.edu/current/graduation/phd.html or the Department of Pathology website http://www.case.edu/med/pathology/training/forms.html. This packet will contain information on steps for scheduling the Thesis Defense; how to prepare the Dissertation document; and the necessary forms for graduation. Typically, however, all forms are provided by the Student Affairs Coordinator.

3. Composition of Dissertation Defense (Examining) Committee

The Department of Pathology requirements for the Thesis Committee comply with Graduate School requirements for the Dissertation Defense (Examining) Committee. The Thesis Committee must be approved and appointed to the examining committee by the Dean of Graduate Studies on recommendation of the Chair of the Department of Pathology. This approval is obtained by submitting a Notification for Scheduling the Final Oral Exam for the PhD form, which is part of the graduation packet that is available through the School of Graduate Studies.

4. Responsibilities of the Examining Committee

The examining committee is responsible for certifying that the quality and suitability of the material presented in the dissertation meet accepted scholarly standards. Each member must be physically present for the entire examination to vote on the acceptability of the student's performance. A student will be certified as passing the final oral examination if no more than one of the voting members of committee dissents.

5. Preparation of Written Dissertation

Guidelines on preparation of the written dissertation such as formatting requirements are included in the Graduation Packet (available through the website of the School of Graduate Studies). In addition to the resources listed in the Graduation Packet, copies of dissertations by students are available in the Department of Pathology. Contact the Graduate Program Coordinator.


The defense must be scheduled with the School of Graduate Studies no later than three weeks before the date of the examination, by submitting the Notification for Scheduling the Final Oral Exam for the PhD form. The chair of the examining committee should give approval to schedule the defense when the written dissertation is ready for public scrutiny and review by the examining committee.
7. Publication Requirements

A Pathology PhD candidate must have a minimum of two papers on which the student is first author, at least one of which must be accepted, with proof of acceptance, by a reputable peer-reviewed journal prior to scheduling of the thesis defense. The second publication, if not submitted, must be at least reviewed/approved by their Thesis Committee BEFORE scheduling the Thesis Defense, however, this second publication must be submitted prior to graduation. The two publications must be full primary research reports; reviews and other commentaries do not count toward the requirement, and short papers of lesser scope and impact will NOT be accepted for the publications requirement. The Thesis Committee has discretion to determine whether papers and manuscripts, published or submitted, meet academic expectations, and it is possible that some publications will not be counted toward this requirement. Publications resulting from work done prior to enrollment in the PhD program will not be considered for this requirement, even if they are published after the start of the PhD program. Since the PhD requires scientific mastery that is not completely defined by a number of papers, the thesis committee may require completion of work beyond publication of two papers if needed to complete a scope of work indicated for the PhD degree.

Of the two required first-authored publications, one may be fulfilled with a publication for which the student is not the first listed author, but is listed as a joint first author (or an author who contributed to a degree equal to the first listed author), as long as the following conditions are also met:

a. The published form of the paper must state that the student fulfilled the joint first author role.
b. There must be agreement between the student’s mentor and a majority of the Thesis Committee that the student did fulfill such a role.
c. There must be agreement between the student’s mentor and a majority of the Thesis Committee that the contribution of the student to this paper was of sufficient magnitude and impact to justify counting it as one of the required papers.
d. The other required first-authored paper must actually have the student listed first in the author order (the existence of other joint first authors will not affect the standing of the first-listed author).
e. The other required first-authored paper with the student first in the author order must be accepted for publication prior to the thesis defense.

8. Departmental Thesis Seminar

The Department of Pathology requires that the student give a Departmental Thesis Seminar and to defend the thesis in a private meeting of the Thesis Committee. The seminar should be scheduled with the coordinator of a relevant seminar series (Pathology Department Seminar, Immunology Seminar, or Cancer Center Blood Club Seminar); if this is not possible, a special seminar may be scheduled separate from the department series. It is the student's responsibility to notify the Thesis Committee members of the date and time of presentation and confirm their ability to attend. According to School of Graduate Studies guidelines, the Departmental Thesis Seminar is scheduled on the same day as the Thesis Defense.

P. Exceptions and Deviations from Guidelines and Timelines

ANY EXCEPTIONS TO PATHOLOGY GRADUATE PROGRAM GUIDELINES MUST BE APPROVED BY THE PATHOLOGY GRADUATE COMMITTEE PRIOR TO IMPLEMENTATION. INDIVIDUAL THESIS COMMITTEES ARE NOT EMPOWERED TO GRANT THESE EXCEPTIONS.

1. Timing of Ph.D. Thesis Defense and Publications: Students must have at least one first-authored paper accepted and another, if not submitted, at least reviewed/approved by their Thesis Committee, prior to scheduling of the Thesis Defense. Under unusual circumstances, an exception may be granted, but this is RARE and must be well justified. Such an exception must be recommended by the thesis committee AND approved by the Pathology Graduate Committee or its Chair PRIOR to scheduling of the defense. If the thesis defense proceedings are initiated under these circumstances, the Track Representative to the Thesis Committee will NOT sign the forms certifying completion of the thesis and will hold them until the student or Thesis Advisor provides evidence that at least one paper has been accepted for publication in a
reputable journal and an additional paper has been submitted. The student must be registered for PATH 701 in the semester in which these requirements are completed and the forms are submitted to Graduate Studies.

2. If the Ph.D. mentor is changed prior to the thesis proposal, an extension of the time allowed for completion of the thesis proposal may be granted upon approval by the Graduate Program Committee and its Chair (Dr. Anderson).

3. Conversion from Ph.D. to M.S. program may occur if a student cannot satisfy Ph.D. program requirements or must leave without completing the Ph.D. program. In this case, the M.S. will be governed by the rules of Master’s Plan A (research/thesis), NOT Master’s Plan B (coursework/exam).

**Q. Outside Activities and Compensation**

Pathology graduate students are expected to devote full-time attention to their studies, for which a full-time stipend is awarded. Outside employment or other time-extensive activities are discouraged and MUST not detract from the time and attention needed for the graduate program. Occasionally students will have the opportunity to serve as teaching assistants, for which some additional compensation may be offered, but placement into such a position requires the approval of the Research/Thesis Mentor and (pending policy consideration by the University) may require the approval of a Pathology Program faculty representative and the Dean of Graduate Studies (Dr. Charles Rozek). Students and faculty involved in such placements need to be aware that NIH training support (e.g. T32, F30, F31) precludes payment for such services under the category of supplementation of stipend, but does allow payment under the category of compensation contingent upon the requirements that the activity will be limited in time, is not one of the normal training activities of the program, and will not detract from or prolong the training program.

**R. Vacation, Sick Leave and Parental Leave**

These policies apply to graduate students in the School of Graduate Studies who receive stipends that support their effort toward earning a degree during the period when they receive support. They represent the minimum to which graduate students are entitled.

If a graduate student receives a stipend, they will receive support for holidays, vacations, sick leave and parental leave as set forth below. The stipend support for those days will be at the same rate as for normal work days. For all anticipated leaves longer than two weeks, appropriate departmental approvals must be obtained and paperwork submitted to the Dean of School of Graduate Studies prior to the start of the leave.

These policies do not supersede other University policies concerning attendance or residence at the University, e.g. participating in classroom activities as a student or teaching assistant. These policies only apply to student effort toward earning a degree.

**Holidays.** Graduate students are entitled to observe University closings for Holidays and other recognized events. The University currently recognizes 8 named holidays, 1 university designated holiday and 1 personal floating holiday.

**Vacations.** Graduate students are allowed two weeks of vacation per calendar year (10 traditional work days) if they receive full support during a 12-month period. Students who receive less than 12 months of support are not entitled to vacation during the period of support. Vacation is not provided during the supported period when students receive support for part of the year. The dates of vacations must be approved in advance by the student's Research/Thesis Mentor to ensure that time-sensitive work is not disrupted.
Vacation days can be accrued from one year to the next year only with the prior written approval of the Program and only up to a maximum of 20 traditional work days, to allow for international travel, for example. There is no terminal leave.

The times between academic terms and the summer are considered part of the active training period and are not to be regarded as vacation time.

**Sick Leave.** Graduate students are entitled to two weeks (10 traditional work days) of sick leave per year, with no year-to-year accrual. Sick leave may be used for medical conditions related to pregnancy and childbirth. Under exceptional circumstances, additional sick leave days may be granted following receipt of a written request from a physician, and prior written approval by the Program.

**Parental Leave.** Graduate students are entitled to paid parental leave for the adoption or birth of a child. The primary caregiver is entitled to 6 weeks leave and the other parent or domestic partner is entitled to 3 weeks leave. When both parents are supported graduate students, the leave may be used consecutively or together. The leave must be used within 12 months of birth or adoption. Parental leave must be approved in advance in writing by the Program. It is permissible to add parental leave and sick leave together for the adoption or birth of a child.

**Unpaid Leave.** Students who require additional leave beyond what is stipulated above, must seek prior written approval from the Dean of School of Graduate Studies for an unpaid leave of absence. Approval for a leave of absence must be requested in advance by the student and the student should provide documentation for the leave request and obtain approval. Conditions for the leave and approval must be submitted to the Dean of School of Graduate Studies. Continued coverage of health insurance is allowable as permitted within the guidelines of University Health Services and with written approval by the Program and Dean of School of Graduate Studies.

**Unused Leave.** A student is not entitled to receive any form of compensation for any unused holidays, vacation days, sick leave, parental leave, and/or other accrued time off.

**Disclaimers.** These policies do not supersede any HR policy. In addition, these policies do not create a contractual relationship with any student and the policies may be amended at any time by the Faculty and the School of Graduate Studies.

Approved by the Faculty Senate, November 20, 2012.

Parental Leave: The Kirschstein NRSA grants policy allows stipend for up to 60 calendar days of parental leave, “when individuals in comparable training positions at the sponsoring institutions have access to this level of paid leave for this purpose.” Accordingly, these grants will cover the period of parental leave allowed by CWRU.

**III. Faculty Trainers**

Please visit the Department of Pathology website for our current listing of Faculty Trainers: http://www.case.edu/med/pathology/faculty/trainers.html.
IV. Molecular and Cellular Basis of Disease Training Program (MCBDTP)

A. Training Objectives
The goal of the MCBDTP is to train PhD and MD/PhD scientists who will advance research in experimental Pathology and the molecular and cellular basis of disease. The MCBDTP provides a PhD training program that includes many facets of experimental pathology, including inflammation, receptor signaling, tissue injury and healing, necrosis, apoptosis, cell growth control, neoplasia, biomaterials, biocompatibility, neuropathology (including prion disorders, Alzheimers disease, and other topics), aging, diabetes, and cardiovascular disease.

The program includes basic scientific research, translational research, and applications to clinical settings. The Pathology Department and other participating departments provide a rich confluence of basic science and clinical activities and resources, enriching the training of PhD students as they engage in both basic science and translational research in Pathology. To accomplish these training goals, the MCBDTP has been developed as a track within the Pathology PhD Program.

B. Overview of the MCBDTP
Training for the PhD degree in the MCBDTP includes course work, research rotations, formal and informal seminars, a Thesis Proposal Defense/Qualifying Examination, and research experience resulting in scholarly publications and a PhD dissertation. The MCBDTP includes the core curriculum of the Pathology Graduate Program and track-specific electives. Core components of the Pathology PhD curriculum include the BSTP curriculum coursework in cell and molecular biology (CBIO 453 CBIO 455), a minimum of three research rotations and two Pathology core courses (PATH 510 Basic Pathophysio logic Mechanisms and PATH 416 Fundamental Immunology). The third Pathology core course (PATH 520 Basic Cancer Biology & Interface with Clinical Oncology with simultaneous registration in PATH 521) is optional for MCBDTP students. MCBDTP students take at least two MCBDTP Track Electives (see Section X: List of Courses) and other elective courses to meet the PhD requirements (Section II: Pathology PhD Program). Elective courses should be selected in consideration of the research emphasis of the individual student and may include a wide range of courses offered by the Department of Pathology or other basic science graduate departments. The student and his/her Research/Thesis Mentor may use the flexibility of the program to design a customized curriculum to address the specific research interests of the student. A student’s course selections must be approved by his/her Research/Thesis Mentor, and a Planned Program of Study (PPOS) must be completed online in the Student Information System (SIS) to ensure adequate planning for coursework and other curriculum components. This plan must be reviewed and approved by the MCBDTP Track Thesis Committee Representative (Clive Hamlin), and then submitted to the Pathology Student Affairs Coordinator (Christine Kehoe). The MCBDTP Track Thesis Committee Representative will be an ex officio member of all Thesis Committees for MCBDTP students and will ensure consistency in advising and adherence to guidelines.

C. Training Faculty
MCBDTP trainers are indicated in the list of Pathology Graduate Program Faculty Trainers at the Department website: http://www.case.edu/med/pathology/faculty/trainers.html.

D. Research Facilities
Trainers and research laboratories are located in the Department of Pathology and multiple other departments at Case School of Medicine and its affiliated institutions: University Hospitals Case Medical Center, the Cleveland Clinic Foundation (including the Lerner Research Institute), MetroHealth Medical Center and the Louis Stokes VA Medical Center. At Case, the Wolstein Research Building and Institute of Pathology accommodate offices and research facilities of the Department of Pathology.
E. Seminars and Journal Clubs

MCBDTP students take the PATH 511 and PATH 512 Experimental Pathology Seminar courses. These courses include two components, the Pathology Graduate Student Seminar Series, where students report on research progress, and research seminars. For the research seminar component, MCBDTP students are expected to attend the weekly Pathology Department Seminar Series, which features speakers from Case and other universities (see description of seminar requirements in Section II: Pathology PhD Program). Students must attend the seminar components of PATH 511 and PATH 512 even in semesters when they are not registered for the course. Students should also attend other relevant seminars. Finally, students present their dissertation research in a Departmental Thesis Seminar.

F. Administrative Structure

The MCBDTP Director represents this track on the Pathology Graduate Program Committee and serves as the Chair of the MCBDTP Steering Committee. The Pathology Graduate Program Committee handles issues common to all tracks (student admissions, mentor approval, final stages of academic review and other issues related to the general structure of the program). The MCBDTP Steering Committee is charged with all activities specific to the MCBDTP (curriculum development, including courses, seminar and journal clubs, advising of prospective students and students in the MCBDTP, recruiting efforts, faculty development and other issues). The two committees work together in many areas with joint efforts coordinated by the MCBDTP Director. The MCBDTP Steering Committee composition and function may be dictated by the chair of the committee. For example, a subset of the committee members may meet to deal with issues focused on their roles in the committee.

**MCBDTP Steering Committee**

<table>
<thead>
<tr>
<th>Member</th>
<th>Role</th>
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<tbody>
<tr>
<td>James Anderson</td>
<td>MCBDTP Director</td>
</tr>
<tr>
<td>Clive Hamlin</td>
<td>Track Thesis Committee Rep</td>
</tr>
<tr>
<td>Robert Petersen</td>
<td>Track Advisor</td>
</tr>
<tr>
<td>Nick Ziats</td>
<td>Curriculum Representative</td>
</tr>
<tr>
<td>Xiongwei Zhu</td>
<td>Neuro T32 Co-Director</td>
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## G. Sample Curriculum

<table>
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<tr>
<td>YEAR 1 FALL</td>
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### MENTOR AND TRACK CHOSEN

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### THESIS COMMITTEE CHOSEN; PREPROPOSAL MEETING SCHEDULED

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THESIS PROPOSAL DEFENSE AND ADVANCEMENT TO CANDIDACY MUST BE COMPLETED (NOTE: ONCE 36 CREDITS INCLUDING 24 GRADED CREDITS HAVE BEEN COMPLETED, STUDENTS SHOULD REQUEST PREDOCTORAL STANDING IN ORDER TO REGISTER FOR UP TO 6 CREDITS OF PATH 701 INSTEAD OF PATH 601 DURING SEMESTER IN WHICH THESIS PROPOSAL TAKES PLACE)
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*Alternate courses for MSTP students: IBIS 401-404
^Alternate course is MSTP 400 for MSTP students and PATH 601 for direct admit students.
#Exception: Take 1-3 credits of PATH 701 if this will accelerate graduation. Also, take 1 credit of PATH 701 if the PhD thesis will be completed in the summer semester (including anytime after the end of the spring semester).
**PATH 416 and PATH 520 + 521 count as a Track Elective for MCBDTP students.
*** IMPORTANT: STUDENTS SHOULD TAKE STEPS TO REDUCE CHARGES TO THEIR MENTOR AND DEPARTMENT: See Section II.G, Point 15.
NOTE: Schedule beyond year 5 will generally be the same as for year 5.
V. Immunology Training Program (ITP)

A. Training Objectives
The goal of the ITP is to train PhD and MD/PhD scientists who will advance research in Immunology and related fields. The program includes a wide range of Immunology-related topics, spanning from basic research in areas such as innate immunity, T cell activation, tolerance, antigen processing and presentation, MHC function, complement, antibody structure and function, and mucosal immunity to research in clinically relevant models of infectious diseases (e.g. tuberculosis, HIV), vaccine development, immunopathology, transplantation and autoimmunity. Participating departments provide a rich confluence of basic science and clinical activities and resources, enriching the training of PhD students as they engage in basic and/or translational research in the field of immunology. To accomplish these training goals, the ITP has been developed as a track within the Pathology PhD Program.

B. Overview of the ITP
Training for the PhD degree in the ITP includes course work, research rotations, formal and informal seminars, a Thesis Proposal Defense/Qualifying Examination, and research experience resulting in scholarly publications and a PhD dissertation. The ITP includes the core curriculum of the Pathology PhD Program (see Section II: Pathology PhD Program) and a well-developed curriculum focused on immunology. Core components of the Pathology PhD curriculum include the BSTP curriculum coursework in cell and molecular biology (CBIO 453 and CBIO 455), a minimum of three research rotations and three Pathology core courses (PATH 510 Basic Pathophysiologic Mechanisms, PATH 416 Fundamental Immunology, and PATH 465 Advanced Immunobiology). The third Pathology core course (PATH 520 Basic Cancer Biology & Interface with Clinical Oncology with simultaneous registration in PATH 521) is optional for ITP students. ITP students take at least two ITP Track Electives (see Section X: List of Courses) and other elective courses to meet the PhD requirements (see Section II: Pathology PhD Program). Elective courses should be selected in consideration of the research emphasis of the individual student and may include a wide range of courses offered by the Department of Pathology or other basic science graduate departments. A student's course selections must be approved by his/her Research/Thesis Mentor and must follow the program guidelines. A Planned Program of Study (PPOS) must be completed online in the Student Information System (SIS) to ensure adequate planning for coursework and other curriculum components. This plan must be reviewed and approved by the ITP Track Thesis Committee Representative (Dr. Clive Hamlin) or the ITP Track Director (Dr. Brian Cobb), and then submitted to the Pathology Student Affairs Coordinator (Christine Kehoe). The ITP Track Thesis Committee Representative will be an ex officio member of all Thesis Committees for ITP students and will ensure consistency in advising and adherence to guidelines.

C. Training Faculty
ITP trainers are indicated in the list of Pathology Graduate Program Faculty Trainers at the Department website: [http://www.case.edu/med/pathology/faculty/trainers.html](http://www.case.edu/med/pathology/faculty/trainers.html).

D. Research Facilities
Trainers and research laboratories are located in multiple departments at Case School of Medicine and its affiliated institutions, University Hospitals Case Medical Center (UHCMC), the Cleveland Clinic Foundation (CCF, including the Lerner Research Institute), Metro Health Medical Center (MHMC) and the Louis Stokes VA Medical Center (VAMC). At Case, the Wolstein Research Building houses offices and research facilities of the Department of Pathology (which includes a major emphasis on Immunology), the Center for Global Health (with multiple active programs in infectious diseases, especially parasitic diseases) and the Case Comprehensive Cancer Center (including the Center for Stem Cell and Regenerative Medicine and core facilities for FACS, microarray gene expression studies and many other cutting-edge research methods). The Division of Infectious Diseases is nearby on the Case campus and in adjacent facilities at UHCMC; in addition to a wide spectrum of research on Infectious Diseases, it
includes several specialized research facilities, including the Center for AIDS research (CFAR), AIDS Clinical Trials Unit (ACTU) and its Special Immunology Unit (SIU), and the Tuberculosis Research Unit (TBRU). The Department of Dermatology and its Skin Diseases Research Center also house immunology-related research, and the Department of Ophthalmology is building a program in ocular immunology. The CCF houses an entire Department of Immunology at its Lerner Research Institute (LRI); these faculty hold appointments in the Case Department of Molecular Medicine (based at the LRI) and ITP Trainers hold faculty or trainer appointments in the Case Department of Pathology. Other immunology research groups are located in a wide number of other departments at Case, CCF, UHCMC, MHMC and VAMC.

E. Requirements for Seminars, Journal Clubs and Retreats

ITP students take the PATH 511 and PATH 512 Experimental Pathology Seminar courses and continue to meet the seminar requirements of the Pathology Graduate Program for all semesters in the program (Section II, Part J). ITP students are required to attend at least 75% of the Tuesday noon Immunology Seminar Series (sign-in required). Students are also required to participate regularly in the weekly ITP Journal Club (scheduled by Dr. Brian Cobb), which is held at noon on Thursday in Wolstein 5136. All ITP students are required to present a paper once each year in ITP Journal Club. In addition, attendance requirements will be explained in a memo from Dr. Cobb and will be monitored by a sign-in sheet. ITP students in labs on the CCF campus are required to present one paper each year in the journal club in Wolstein, but they may satisfy their regular attendance requirement by attending the Immunology Journal Club at CCF (Dr. Fairchild, coordinator). All ITP students are required to attend the annual ITP Retreat, and students beyond the initial year in the program will give a poster or oral presentation. At the end of their PhD studies, students present their dissertation research in a Departmental Thesis Seminar.

F. Administrative Structure

The ITP Director represents this track on the Pathology Graduate Program Committee and serves as the Chair of the ITP Steering Committee. The Pathology Graduate Program Committee handles issues common to all tracks (student admissions, mentor approval, final stages of academic review and other issues related to the general structure of the program). The ITP Steering Committee is charged with all activities specific to the ITP (curriculum development, including courses, seminar and journal clubs, advising of prospective students and students in the ITP, recruiting efforts, faculty development and other issues). The two committees work together in many areas with joint efforts coordinated by the ITP Director. The ITP Steering Committee composition and function may be dictated by the Chair of the committee. For example, the chair may call a meeting of a subset of the committee members to deal with issues related to their roles in the committee.

ITP Steering Committee

<table>
<thead>
<tr>
<th>Member</th>
<th>Role</th>
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</thead>
<tbody>
<tr>
<td>Brian Cobb</td>
<td>ITP Director, Immunology Journal Club, Track Advisor, T32 Director</td>
</tr>
<tr>
<td>Robert Fairchild</td>
<td>CCF Immunology Representative, CCF Immunol Journal Club Rep</td>
</tr>
<tr>
<td>Neil Greenspan</td>
<td>MD Immunology Curriculum</td>
</tr>
<tr>
<td>Thomas Hamilton</td>
<td>Chair, CCF Dept of Immunology</td>
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<tr>
<td>Clive Hamlin</td>
<td>Track Thesis Committee Rep</td>
</tr>
<tr>
<td>Clifford Harding</td>
<td>Pathology Department Chair; MSTP Representative</td>
</tr>
<tr>
<td>James Kazura</td>
<td>Center for Global Health representative</td>
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<tr>
<td>Michael Lederman</td>
<td>CFAR/ACTU/ID representative</td>
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<tr>
<td>Alan Levine</td>
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### G. Sample Curriculum

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<td>CBIO 455*</td>
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**MENTOR AND TRACK CHOSEN**

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**THESIS COMMITTEE CHOSEN; PREPROPOSAL MEETING SCHEDULED**

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THESIS PROPOSAL AND ADVANCEMENT TO CANDIDACY WITHIN 9 MONTHS (NOTE: IF ALL REQUIRED COURSEWORK IS COMPLETED, STUDENTS SHOULD REQUEST PREDOCTORAL STANDING IN ORDER TO REGISTER FOR UP TO 6 CREDITS OF PATH 701 INSTEAD OF PATH 601 DURING SEMESTER IN WHICH THESIS PROPOSAL TAKES PLACE)
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**Summer**

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**Year 3 Fall**

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**Summer**

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*Alternate courses for MSTP students: IBIS 401-404
^Alternate course is MSTP 400 for MSTP students and PATH 601 for direct admit students.
#Exception: Take 1-3 credits of PATH 701 if this will accelerate graduation. Also, take 1 credit of PATH 701 if the PhD thesis will be completed in the summer semester (including anytime after the end of the spring semester).
**PATH 520 + 521 counts as a Track Elective for ITP students.
*** IMPORTANT: STUDENTS SHOULD TAKE STEPS TO REDUCE CHARGES TO THEIR MENTOR AND DEPARTMENT: See Section II.G, Point 15.
NOTE: Schedule beyond year 5 will generally be the same as for year 5.
VI. Cancer Biology Training Program (CBTP)

A. Training Objectives
The goal of the CBTP is to train PhD and MD/PhD scientists who will advance research on the causes, diagnosis, progression and treatment of experimental and human cancer. The CBTP provides a PhD training program that is focused on cancer research and includes the many facets of cancer biology, including cancer pathology, cancer genetics, cell signaling, control of cell growth, tumor apoptosis, cancer pharmacology, cancer therapeutics, stem cell biology, cancer imaging, tumor immunology and others. The field of cancer biology includes basic scientific research and its applications to clinical settings. The Case Comprehensive Cancer Center provides a rich confluence of basic science and clinical activities and resources, enriching the training of PhD students as they engage in both basic science and translational research in the field of cancer. To accomplish these training goals, the CBTP has been developed as an interdisciplinary track within the Pathology PhD Program and is jointly sponsored by the Case Comprehensive Cancer Center and the Department of Pathology.

B. Overview of the CBTP
Training for the PhD degree in the CBTP includes course work, research rotations, formal and informal seminars, a Thesis Proposal/Qualifying Examination, and research experience resulting in scholarly publications and a PhD dissertation. The CBTP includes the core curriculum of the Pathology Graduate Program (see Section II: Pathology PhD Program) and a well-developed curriculum focused on cancer biology. Core components of the Pathology PhD curriculum include the BSTP curriculum coursework in cell and molecular biology (CBIO 453 and CBIO 455), a minimum of three research rotations and two Pathology core courses (PATH 510 Basic Pathophysiologic Mechanisms, PATH 520 Basic Cancer Biology & Interface with Clinical Oncology with simultaneous registration in PATH 521). PATH 510 provides a solid foundation in mechanisms of disease, including topics related to cancer. PATH 520 + 521 provides a detailed survey of basic cancer biology. Together, PATH 520 and PATH 521 constitute a single coordinated 4-credit course in Cancer Biology; students register for the core didactic portion as PATH 520 (3 credits) and a coordinated seminar component represented by PATH 521 (1 credit) to constitute the entire 4-credit course. CBTP students also take at least two CBTP Track Electives (see Section X: Courses) and other elective courses to meet the PhD requirements (Section II: Pathology PhD Program). Elective courses should be selected in consideration of the research emphasis of the individual student and may include a wide range of courses offered by the Department of Pathology or other basic science graduate departments. A student’s course selections must be approved by his/her Research/Thesis Mentor and must follow the program guidelines. A Planned Program of Study (PPOS) must be completed online in the Student Information System (SIS) to ensure adequate planning for coursework and other curriculum components. The CBTP Track Thesis Committee Representative (Clive Hamlin) will be a full member of all Thesis Committees for CBTP students and will ensure consistency in advising and adherence to guidelines.

C. Training Faculty
CBTP trainers are indicated in the list of Pathology Graduate Program Faculty Trainers at the Department website and are all members of the Case Comprehensive Cancer Center:

D. Research Facilities
Trainers and research laboratories are located in multiple departments at Case School of Medicine, UHCMC (including the Ireland Cancer Center and Case Comprehensive Cancer Center), CCF (including the Lerner Research Institute and Taussig Cancer Center), MHMC (including the Rammelkamp Center for Education and Research) and the Louis Stokes Veterans Administration Medical Center. At Case, the Wolstein Research Building houses offices and research facilities of the Case Comprehensive Cancer
Center and the Department of Pathology. The Wolstein Building also houses the Center for Stem Cell and Regenerative Medicine, part of the Case Comprehensive Cancer Center.

Core Facilities: The Case Comprehensive Cancer Center supports 15 core facilities that provide expensive and/or high-end technology instrumentation and resources to Cancer Center investigators. The presence of the core facilities within the Cancer Center provides a gateway for training students in sophisticated technologies that are essential for any modern program of cancer research. The directors and staff of these facilities have cutting-edge expertise and an ongoing commitment to advance their fields. This provides students with opportunities to learn from experts and use cutting-edge technology and equipment in their research.

E. Seminars
CBTP students take the PATH 511 and PATH 512 Experimental Pathology Seminar courses and continue to meet the seminar requirements of the Pathology Graduate Program for all semesters in the program (Section II, Part J). CBTP students are required to attend some of the Cancer Center Seminar Series (sign-in required) to fulfill their Pathology Seminar requirement. Students will be required to participate in a monthly Cancer Trainee Seminar, where each student will give a presentation once a year on their research. Finally, students present their dissertation research in a Pathology Department Thesis Seminar.

F. Administrative Structure
The CBTP is sponsored by the Case Comprehensive Cancer Center and the Department of Pathology. As a track within the Pathology Graduate Program, the CBTP is represented on the Pathology Graduate Program Committee by the CBTP Director, Dr. Mark Jackson. The Pathology Graduate Program Committee handles issues common to all tracks (student admissions, mentor approval, final stages of academic review and other issues related to the general structure of the program). The CBTP Director and Steering Committee are charged with all activities specific to the CBTP (curriculum development, including courses, seminar and journal clubs, advising of prospective students and students in the CBTP, recruiting efforts, faculty development and other issues).

CBTP Steering Committee

<table>
<thead>
<tr>
<th>Member</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark Jackson</td>
<td>CBTP Director, Track Advisor, T32 Director</td>
</tr>
<tr>
<td>Gerson, Stanton</td>
<td>Director, Case Comprehensive Cancer Center</td>
</tr>
<tr>
<td>Danielpour, David</td>
<td>Curriculum Director</td>
</tr>
<tr>
<td>Clive Hamlin</td>
<td>Track Thesis Committee Representative</td>
</tr>
<tr>
<td>David Wald</td>
<td>Pathology Representative</td>
</tr>
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</table>
## G. Sample Curriculum

<table>
<thead>
<tr>
<th>Year 1 Fall</th>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CBIO 453*</td>
<td>CELL BIOLOGY I</td>
<td>4</td>
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<tr>
<td></td>
<td>CBIO 455*</td>
<td>MOLECULAR BIOLOGY I</td>
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</tr>
<tr>
<td></td>
<td>BSTP 400^</td>
<td>RESEARCH ROTATIONS</td>
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<td></td>
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### MENTOR AND TRACK CHOSEN

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<tr>
<th>Year 1 Spring</th>
<th>Course</th>
<th>Title</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PATH 510</td>
<td>BASIC PATHOL MECH</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>PATH 520 + 521</td>
<td>BASIC CANCER BIOL INTERFACE CLIN ONCOL</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>IBMS 500</td>
<td>BEING A PROF SCIENT</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>PATH 512</td>
<td>EXP PATH SEMINAR II</td>
<td>1</td>
</tr>
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### Summer

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<tr>
<td>RSCH 750</td>
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<td>TOTAL</td>
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<td>0</td>
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### Thesis Committee Chosen; Preproposal Committee Meeting Scheduled

<table>
<thead>
<tr>
<th>Year 2 Fall</th>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PATH 511</td>
<td>EXP PATH SEMINAR I</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CBTP TRACK ELECTIVE</td>
<td></td>
<td>3</td>
<td></td>
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<tr>
<td>ELECTIVES (CORE, CBTP TRACK OR OTHER)**</td>
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</tr>
<tr>
<td>PATH 601</td>
<td>SPECIAL PROBLEMS</td>
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</tr>
</tbody>
</table>

**Thesis Proposal Defense and Advancement to Candidacy with Next 9 Months:** If all required coursework is completed, students should request predoctoral standing in order to register for up to 6 credits of Path 701 instead of Path 601 during semester in which thesis proposal takes place.

<table>
<thead>
<tr>
<th>Year 2 Fall</th>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
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<table>
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<th>Year 2 Spring</th>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>PATH 512</td>
<td>EXP PATH SEMINAR II</td>
<td>PARTICIPATE WITHOUT REGISTERING</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ELECTIVES (CORE, CBTP TRACK OR OTHER)**</td>
<td>4-6</td>
<td></td>
</tr>
<tr>
<td>PATH 601 OR 701</td>
<td>SPECIAL PROBLEMS OR DISSERTATION PHD</td>
<td>3-5</td>
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<td>TOTAL</td>
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<td>9</td>
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**Summer:

<table>
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<tr>
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<th>Title</th>
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</thead>
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<td>SUMMER RSCH-PHD</td>
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<tr>
<td>TOTAL</td>
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</table>

**Thesis Proposal Defense and Advancement to Candidacy Must Be Completed:** Once 36 credits including 24 graded credits have been completed, students should request predoctoral standing in order to register for up to 6 credits of Path 701 instead of Path 601 during semester in which thesis proposal takes place.

<table>
<thead>
<tr>
<th>Year 3 Fall</th>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PATH 511</td>
<td>EXP PATH SEMINAR I</td>
<td>PARTICIPATE WITHOUT REGISTERING</td>
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</tr>
<tr>
<td>PATH 701***</td>
<td>DISSERTATION PHD</td>
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<td></td>
</tr>
<tr>
<td>Year</td>
<td>Course Code</td>
<td>Course Name</td>
<td>Notes</td>
</tr>
<tr>
<td>-------</td>
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<td>---------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Fall</td>
<td>PATH 511</td>
<td>EXP PATH SEMINAR I</td>
<td>Participate without registering</td>
</tr>
<tr>
<td>Spring</td>
<td>PATH 512</td>
<td>EXP PATH SEMINAR II</td>
<td>Participate without registering</td>
</tr>
<tr>
<td>Spring</td>
<td>PATH 701***</td>
<td>DISSERTATION PHD</td>
<td>1 (if graduation is anticipated this semester, register for #credits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>required to bring 701 total to 18)</td>
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<tr>
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<td>TOTAL</td>
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<tr>
<td>Summer</td>
<td>RSCH 750#</td>
<td>SUMMER RSCH-PHD</td>
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<td></td>
<td>TOTAL</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Fall</td>
<td>PATH 511</td>
<td>EXP PATH SEMINAR I</td>
<td>Participate without registering</td>
</tr>
<tr>
<td>Spring</td>
<td>PATH 512</td>
<td>EXP PATH SEMINAR II</td>
<td>Participate without registering</td>
</tr>
<tr>
<td>Spring</td>
<td>PATH 701***</td>
<td>DISSERTATION</td>
<td>1 (if graduation is anticipated this semester, register for #credits</td>
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<td></td>
<td></td>
<td>required to bring 701 total to 18)</td>
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<td></td>
<td>TOTAL</td>
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</tr>
<tr>
<td>Summer</td>
<td>RSCH 750#</td>
<td>SUMMER RSCH-PHD</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Fall</td>
<td>PATH 511</td>
<td>EXP PATH SEMINAR I</td>
<td>Participate without registering</td>
</tr>
<tr>
<td>Summer</td>
<td>PATH 701***</td>
<td>DISSERTATION</td>
<td>1 (if graduation is anticipated this semester, register for #credits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>required to bring 701 total to 18)</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

*Alternate courses for MSTP students: IBIS 401-404
^Alternate course is MSTP 400 for MSTP students and PATH 601 for direct admit students.
Exception: Take 1-3 credits of PATH 701 if this will accelerate graduation. Also, take 1 credit of PATH 701 if the PhD thesis will be completed in the summer semester (including anytime after the end of the spring semester).

**PATH 416 counts as a Track Elective for CBTP students.**

*** IMPORTANT: STUDENTS SHOULD TAKE STEPS TO REDUCE CHARGES TO THEIR MENTOR AND DEPARTMENT: See Section II.G, Point 15.

NOTE: Schedule beyond year 5 will generally be the same as for year 5.

### VII. MS Program

#### PLAN A

A program leading to the Master of Science degree in Pathology is available to laboratory staff who are employed by Case Western Reserve University. Students in this program must be full-time university employees and must have the agreement by their supervisor to begin studies as a part-time student. Courses are available as an employee fringe benefit (up to 6 credits per semester) and can only be taken as limited by the fringe benefit regulations.

A formal application for this program must be submitted to the School of Graduate Studies. Prior to submission of this application, the employee, the supervisor, and the Chair of the Pathology Graduate Program Committee must meet to review and facilitate the student’s application for admission.

This program leads to an MS degree through Master’s Plan A (research/thesis), not Master’s Plan B (coursework/exam). Required core courses include CBI0 453 (4 credits), CBIO 455 (4 credits), PATH 510 (4 credits), and participation in the seminar course (PATH 511 and/or PATH 512) for at least one semester. CBIO 453, CBIO 455 and PATH 510 must be taken as graded courses (not P/F).

Plan A requires a minimum of 27 total coursework credits. The student must take a minimum of 6 credits of PATH 651 Thesis, which involves research in the laboratory of the supervisor (who serves as the MS Research/Thesis Mentor) and thesis preparation. The student must register for at least one credit of PATH 651 every semester until graduation. An MS thesis must be prepared based on the research, and the student must pass an MS Degree Examination in which the thesis is defended.

A GPA of 2.75 or better must be maintained for a terminal M.S. degree student, i.e., a student who does not aspire to applying for a Ph.D. degree program here at CWRU. This is in alignment with the School of Graduate Studies requirement of a minimum 2.75 GPA for an M.S. degree. A student who wishes to enter the Ph.D. Program must have at least a 3.0 GPA for admission from the M.S. Program into the Ph.D. Program.

The MS Degree Examination Committee is chaired by the MS Research/Thesis Mentor and includes two other trainers in the Pathology Graduate Program. Members of the committee must be approved by the Chair of the Pathology Graduate Program Committee. Successful completion requires unanimous agreement of the committee members that the candidate has passed the examination. A student must be registered for at least one credit of PATH 651 during the semester in which the MS Degree Examination is completed.

#### PLAN B

Students will earn a Plan B Masters from Case Western Reserve University. The degree program is comprised of core courses in Pathology with elective course work from related disciplines, a course on research ethics, attendance of the departmental seminar series, and a comprehensive final project in the form of a review paper that will ideally be suitable for publication. The topic of the review paper will be determined by the student and their academic advisor. The core of the Program is geared toward
providing the student a solid basis in cell biology and pathology. This begins with courses in histology and cell & molecular biology (Anat 412/413 and Path 475) followed by courses in basic pathology and immunology (Path 510 and Path 416). After the first year the student can specialize by choosing electives in their area of interest. In the final semester the student will register for 3 credits of Path 601 while writing their paper. An advisor for the paper should be identified by mutual interest during the first year.

Typical Curriculum:

- **Fall 1 (10 credits)**
  - Anat 412/413 Histology (with lab) (Miller), 6 credits
  - Path 475- Cell and Molecular Foundations of Pathology* (New course), 3 credits Textbook: Medical Cell Biology, Steven R. Goodman
  - Path 511, seminar, 1 credit
- **Spring 1 (10 credits)**
  - Path 510, Basic Path Mech, 4 credits
  - Path 416, Fund Immunology, 4 credits
  - Path 512, seminar, 1 credit
  - IBMS 500, Responsible conduct of research, 1 credit
- **Summer** – (attendance optional in summer semester)
  - Gross Anatomy (elective course currently being established, 8 credits)
  - Path 524- Cell Biology of Neurodegenerative Disorders
  - Students may apply to laboratories to do research projects in related fields (e.g. cancer, immunology, neuropathology)
  - Pre-professional students may wish to spend time on school applications
- **Fall 2 (7-10 Credits)**
  - Path 511, seminar, 1 credit
  - Electives:
    - Path 422- Molecular Genetics of Cancer, 3 credits
    - Path 430- Oxidative stress and Disease Pathogenesis, 1 credit
    - Path 465- Advanced Immunobiology, 3 credits
    - Path 481- Immunology of Infectious disease, 3 credits
    - Path 488- Yeast Genetics and Cell Biology, 3 credits
    - Path 522- Skeletal biology, 3 credits
    - Path 525- Transport and Targeting of Macromolecules in Health and disease, 3 credits
    - Other electives upon approval
- **Spring 2 (7-10 Credits)**
  - Path 512, seminar, 1 credit
  - Electives:
    - Path 415 Cytoskeleton and disease, 1 credit
    - Path 432- Current Topics in Vision Research, 3 credits
    - Path 444- Neurodegenerative Diseases: Pathological, Cell and Molecular Perspectives, 3 credits
    - Path 460- Introduction to Microarrays, 3 credits
    - Path 488- Yeast Genetics and Cell Biology, 3 credits
    - Path 521- Special Topics in Cancer biology and Clinical Oncology, 4 credits
    - Path 524- Cell Biology of Neurodegenerative Disorders, 3 credits
    - Path 601, 1-3 credits
    - Other electives upon approval

Accelerated curriculum:

- **Summer 1**
• Gross Anatomy, 8 credits (elective course currently being established)
  • Fall 1 (10 credits)
    – Anat 412/413 Histology (with lab) (Miller), 6 credits
    – Path 475- Cell and Molecular Biology Foundations of Pathology* (New course), 3 credits
    – Path 511, seminar, 1 credit
  • Spring 1 (9 credits)
    – Path 510, Basic Path Mech, 4 credits
    – Path 416, Fund Immunology, 4 credits
    – Path 512, seminar, 1 credit
    – IBMS 500, Responsible conduct of research, 1 credit
  • Summer 2
    – Path 601, 3 credits.

* Students with a significant background in Cell and Molecular Biology may take Path 525 (Transport and targeting of macromolecules in health and disease) or Path 488 (Yeast Genetics and Cell Biology) instead.

VIII. MD/MS Program

The Pathology Graduate Program participates in the MD/MS combined degree program that grants an MS in Biomedical Investigation. This five-year dual degree program is designed for students who wish to prepare for careers in basic or clinical research at academic medical centers. Students pursue a joint, 5-year MD/MS at Case School of Medicine in either the University Program or the Cleveland Clinic Lerner College of Medicine (CCLCM or “College Program”). The core components of the MS curriculum within the MD/MS program are three graduate courses in a specific track (e.g., Pathology) chosen by the student based on his or her interest, six graded credits of medical school coursework, a common seminar series, training in scientific integrity, and a full-year research project culminating in a written MS thesis and examination by an MS Degree Examination Committee (Advisor plus 2 additional faculty). In addition to Pathology, tracks offered include biochemistry, clinical investigation, epidemiology, health services research, nutrition, and physiology and biotechnology. Each track has specific course requirements. There is no tuition charge for the research year, and a stipend is provided.

For more information on the MD/MS program in Pathology contact Dr. Robert Petersen 216-368-6709/rbp@case.edu.

All students begin in the University or College MD program. Students may apply to the MD/MS program at any time prior to their second year of medical school but are encouraged to apply as soon as possible to begin taking graduate courses with the medical curriculum at the earliest possible time. Applications from students in the second year of medical school may be considered, but these students may require additional time to complete the degree requirements. Admission into the MD/MS program will be decided by the MD/MS Program Oversight Committee, which will consider good academic performance in the medical curriculum and research interest as pre-requisites.
During the first year of medical school the student should identify a mentor and begin planning coursework and a research project leading to the MS degree. Because the background and interest of applicants varies widely, members of the Program Oversight Committee will assist each student in designing an individualized schedule of graduate courses for any track. Students are expected to complete at least two graduate courses (3 credits each or total 6 credits) before beginning the laboratory research period (year 3), and students should take three graduate courses before the research period if this is possible. For students to receive graduate credit for any medical coursework (as IBIS credit, e.g. IBIS 403), they must register at the beginning of the semester. Students in the MD/MS joint degree program must attain a cumulative GPA of 3.0 in the graduate courses. Students in this program may participate in any of the three tracks of the Department of Pathology Graduate Program.

IX. Admissions to the Pathology PhD Program

There are three avenues to entry into the Pathology PhD Program:

A. The Biomedical Sciences Training Program (BSTP)

The BSTP is the principal means of entry to PhD degree study at Case School of Medicine. The BSTP is comprised of 13 PhD programs, one of which is the Pathology Graduate Program. BSTP students may earn their degrees in any of these training programs, allowing students to choose their thesis topics from almost any area of biomedical research. The BSTP admissions process offers tremendous advantages to a beginning PhD student:

* Over 200 faculty members who can serve as PhD Research/Thesis Mentors
* Highly interactive relationships with faculty
* Graduate programs at a top-tier School of Medicine
BSTP program information can be found here: http://casemed.case.edu/bstp/index.php. An online application for admission to the BSTP is provided on the BSTP website: http://www.case.edu/med/BSTP/apply.html. Further information can be obtained from Deborah Noureddine, BSTP Coordinator, Case School of Medicine WG-46, 10900 Euclid Ave, Cleveland, OH 44106-4934. Phone: 216-368-3347. Email: deborah.noureddine@case.edu.

**B. The Medical Scientist Training Program (MSTP)**

A combined MD/PhD program, the MSTP is available for students desiring careers in biomedical research. The PhD degree may be pursued in any of 14 MSTP-affiliated graduate programs, including the Pathology Graduate Program. Application information is available on the MSTP website: http://mstp.case.edu. For additional information, contact Kathy Schultz, Program Manager, Case MSTP, Case School of Medicine T401, 10900 Euclid Ave, Cleveland, OH 44106-4924. Phone: 216-368-3404. Email: mstp@cwru.edu.

**C. Direct Admission to the Pathology Graduate Program**

Students who have already decided to pursue PhD studies within a particular laboratory in the Pathology Graduate Program may be admitted by a direct admission procedure, outside of the BSTP, but this application approach is only used under special circumstances. Direct admission to the Pathology Graduate Program must be initiated by a sponsoring faculty member, who must provide information and assurances as specified below. Applications will be reviewed by the Pathology Graduate Education Committee, which will make a recommendation for acceptance/rejection of the application for final consideration by the Chair of Pathology.

Final deadlines for receipt of complete applications are May 1 for matriculation in the fall semester and November 1 for matriculation in the spring semester (Spring semester matriculation may not always be available). Note that the MSTP and BSTP have earlier application deadlines (consult the websites indicated above).

**Application Procedure for Direct Admission**

1. Communicate with the sponsoring faculty member and arrange for him/her to submit materials for sponsorship, including a mentor agreement (see faculty assurances, below).
2. Complete the online application http://gradstudies.case.edu/.

**Required Faculty Assurances for Direct Admit Applicants:**

Prior to completing the online application, the applicant must obtain commitment from an approved trainer in the Pathology Graduate Program, who agrees to serve as the sponsoring faculty member and must guarantee financial commitment for student support. Applications will only be considered if accompanied by a mentor agreement (contact Christine Kehoe, cxk15@case.edu) signed by the sponsoring faculty member who assumes financial responsibility. Applicants should communicate with the sponsoring faculty member to plan arrangements for the application.

The faculty member requesting direct admission for a student must provide a letter detailing written justification for special consideration as a direct admission. This written justification should describe the reason that the faculty member desires to have the applicant in his/her laboratory, the skills, experience, and special techniques the student would bring to the laboratory and the Pathology Graduate Program, the student’s research experience in the faculty member’s area, and the publication record (peer reviewed publications) and other productivity record of the student.

For all students, and especially foreign students, who are not eligible for training grant support, the faculty member and the Chair of the department of the faculty member’s primary appointment must provide written verification that the faculty member/department will provide total support including stipend, tuition and related expenses for the student during their duration as a student in the Pathology Graduate Program.
D. Standards for Admission
Prerequisites for admission include organic chemistry and mathematics through calculus. Coursework in biology is also required and a full course in biochemistry and molecular biology is strongly recommended. Preference is also given to students with prior research experience.

E. Admission of International Students
Standards for admission to the PhD program are the same for international students and U.S. residents except for the following: International students whose first language is not English must demonstrate English proficiency by taking the Test of English as a Foreign Language (TOEFL) exam and earning a minimum score of 550.

A copy of the letter of acceptance will be sent to the International Students Office, which will process an I-20 and send it to the student. The student must then obtain a student visa to begin study in the U.S. More detailed information can be obtained from the International Students Office: http://studentaffairs.case.edu/international/

Admission to the MSTP is limited to U.S. citizens or permanent residents.

X. Alumni
Please visit the Department of Pathology website for a listing of our program alumni. **Under construction.

XI. Forms
The following forms are available on the Pathology Graduate Program website or at the School of Graduate Studies website.

Forms for students:
1. Advancement to Candidacy Form
2. Predoctoral Standing Form
3. Graduation Instructions for Doctoral Candidates
4. Graduation Instructions for Master’s Plan A Candidates
5. Graduation Instructions for Master’s Plan B Candidates
6. Waiver of Registration
7. Notification for Scheduling PhD Defense
8. ETD Submission Checklist--Doctoral
9. Formatting your ETD
11. Final Certification Ph.D.
12. Final Certification Master’s
13. Signature Sheet

Forms for faculty:
1. PhD Trainer Application Form
2. Mentor Agreement

XII. Contact Information
For further information, please contact the Pathology Student Affairs Coordinator, Christine Kehoe, at cxk15@case.edu or 216-368-1993. The mailing address is: Pathology Graduate Program, c/o Christine Kehoe, Case Western Reserve University, 10900 Euclid Ave, Cleveland, OH 44106-7288.
XIII. List of Courses

First-Year Fall Semester Core Curriculum

CBIO 453. Cell Biology (4)
Designed to give students an intensive introduction to prokaryotic and eukaryotic cell structure and function. Topics include membrane structure and function, mechanisms of protein localization in cells, secretion and endocytosis, the cytoskeleton, cell adhesion, cell signaling and the regulation of cell growth. Important methods in cell biology are also presented. Suitable for graduate students entering most areas of basic biomedical research. Undergraduate courses in biochemistry, cell and molecular biology are excellent preparation.
Prereq: BIOC 307 or BIOC 407
Instructor: Snider, M.
Offered: Fall

CBIO 455. Molecular Biology (4)
Designed to give students an intensive introduction to prokaryotic and eukaryotic molecular biology. Topics include protein structure and function, DNA and chromosome structure, DNA replication, RNA transcription and its regulation, RNA processing, and protein synthesis. Important methods in molecular biology are also presented. Suitable for graduate students entering most areas of basic biomedical research. Undergraduate courses in biochemistry, cell and molecular biology are excellent preparation.
Prereq: BIOC 307 or BIOC 407
Instructor: Snider, M.
Offered: Fall

BSTP 400. Research Rotations (1)

Core Courses for the Pathology PhD Program

PATH 416. Fundamental Immunology (4)
Introductory immunology providing an overview of the immune system, including antigen-antibody reactions, immunologically important cell surface receptors, cell-cell interactions, cell-mediated immunity and basic molecular biology of B and T lymphocytes lectures and analysis of current literature stressing interpretation of experimental data.
Prereq: Consent of Instructor, Biol 210
XLIST: Biol 416, CLBY 416
Instructors: Levine, A.
Offered: Spring

PATH 465. Advanced Immunobiology (4)
Advanced immunology topics course covering the most important and recent advancements in specific areas of immunobiology. Course organization will include lectures by the faculty to give an overview of each topic emphasizing the recent advancements in that area, followed by student presentations of important papers and discussion on related topics. Course will also include participation in an immunology journal club (literature review/discussion session).
Prereq: PATH 416
Instructor: Cobb, B.
Offered: Falls
PATH 466. Proposal Writing for Immunologists (1)
This graduate-level 1 credit course is focused upon communicating one’s ideas in writing to a diverse audience. A key aspect of a scientific career is the ability to communicate effectively. In academia, this takes the form of writing primary research articles, review articles, editorials, and (of course) grant proposals. Industrial settings are not much different, in that it can still involve publishing; however, communicating ideas to upper management and proposing research collaborations (more and more with academia) is very much a part of the job. Outside of the bench research arena, scientific policy, editing, teaching, patent law, and many other career paths all rely heavily upon written communication - and often writing with the intended purpose to persuade the reader to your point of view. As a result, the goal of this course is to provide practical tools for students to write more effectively within the scientific realm.
Prereq: PATH 416
Co-req: PATH 465
Instructor: Cobb, B.
Offered: Falls

PATH 510. Basic Pathophysiologic Mechanisms (4)
An interdisciplinary introduction to the fundamental principles of molecular and cellular biology as they relate to the pathologic basis of diseases. Lectures, laboratories, conferences.
Prereq: Consent of Instructor
Instructor: Ziats, N.
Offered: Spring

PATH 520+521. Basic Cancer Biology and the Interface with Clinical Oncology (4)
Cancer influences the lives of one in three people in the U.S. Cancer is multi-staged and is a series of diseases within every organ of the body. Recent rapid advances in the fundamental causes, treatment, and prevention of cancer make research in this area important and interesting, not just to students interested in cancer, but to those interested in other fields such as DNA Repair, Cell Cycle Regulation, Hormonal Regulation, Gene Regulation, Angiogenesis, and basic Molecular and Cellular Biology. This team-taught lecture/seminar course is an introduction to the genetics, prevention, and treatment of cancers and represents a survey covering: DNA damage and repair; cancer genetics; chemical carcinogenesis and prevention; signal transduction; cell cycle checkpoint regulation; hormonal regulation; chemotherapy and apoptosis. Includes an examination of the pathology of cancer and cancer epidemiology and biostatistics, in addition to the cellular and molecular biology of cancer. Note: PATH 521 (1 credit) must be taken simultaneously with PATH 520 (3 credits) to constitute the entire coordinated 4-credit course.
Prereq: Consent of Instructor
Instructor: Danielpour, D.
Offered: Spring

Longitudinal Requirements for All PhD Students

IBMS 500. On Being a Professional Scientist: The Responsible Conduct of Research (1)
The goal of this course is to provide graduate students with an opportunity to think through their professional ethical commitments before they are tested, on the basis of the scientific community’s accumulated experience with the issues. Students will be brought up to date on the current state of professional policy and federal regulation in this area, and, through case studies, will discuss practical strategies for preventing and resolving ethical problems in their own work. The course is designed to meet the requirements for “instruction about responsible conduct in research” for BSTP and MSTP students supported through NIH/ADAMHA institutional training grant programs at Case. Attendance is required.
Instructor: Wilson-Holden, T.
Offered: Spring
PATH 511. Experimental Pathology Seminar I (1)
Weekly discussions of current topics and research by students, staff and distinguished visitors.
Prereq: Consent of Instructor
Coordinator: Petersen, R.
Offered: Fall

PATH 512. Experimental Pathology Seminar II (1)
Weekly discussions of current topics and research by students, staff and distinguished visitors.
Prereq: Consent of Instructor
Coordinator: Petersen, R.
Offered: Spring

Research Courses (All Tracks)

PATH 601. Special Problems (1-8)
Research on the nature/causation of disease and host factors which tend to protect against disease. Special courses/tutorials in subspecialties of general and/or systemic anatomic and/or clinical pathology.
Prereq: Consent of Instructor
Offered: Spring and Fall

PATH 650. Independent Study (MS-B) (1-9)

PATH 651. Thesis (MS) (1-9)

PATH 701. Dissertation (PhD) (1-9)

Track Electives: Molecular and Cellular Basis of Disease
NOTE: PATH 520 + 521 counts as a Track Elective for MCBDTP students. See Core Courses section.

PATH 430. Oxidative Stress and Disease Pathogenesis (1)
Oxidative stress and free radicals are implicated in a number of disease processes including aging, arthritis, emphysema, Alzheimer disease and cancer. During this lecture course recent studies will be discussed concerning the formation and destructive mechanisms of free radicals in the context of various disease processes. Students will be expected to read assigned papers to discuss in class.
Prereq: Consent of Instructor
Instructors: Zhu, X.
Offered: Spring, Fall

PATH 444. Neurodegenerative Diseases: Pathological, Cell Molecular Perspectives (3)
This course, taught by several faculty members, encompasses the full range of factors that contribute to the development of neurodegeneration. Subjects include pathological aspects, neurodegeneration, genetic aspects, protein conformation and cell biology in conditions such as Alzheimer Disease, Parkinson disease, amyotrophic lateral sclerosis and prion diseases. Students will read assigned primary literature and present and discuss these in class.
Prereq: Consent of Instructor, CBIO 453, CBIO 454, CBIO 455, CBIO 456
Instructor: Petersen, R.B.
Offered: Spring
PATH 450. Interdisciplinary Musculoskeletal Research (3)
This course will stress the interdisciplinary nature (Biology, Engineering, and Clinical) nature of modern musculoskeletal research. Students will be expected to be active participants in weekly Musculoskeletal Research Seminars that include faculty lectures, journal club presentations, and research updates. Students will also be expected to participate in weekly Orthopaedic Grand Rounds as well as additional related faculty presentations.
Instructor: Greenfield, E. and Akkus, O.
Offered: Fall

PATH 488. Yeast Genetics and Cell Biology (3)
Discussion of contemporary literature exemplifying the unique accessibility of yeasts as model eukaryotes.
Prereq: CBIO 453, CBIO 454, CBIO 455, CBIO 456 or consent of instructor
XLIGHT: MBIO 488, CLBY 488, GENE 488
Instructor: Tartakoff, A.M.
Offered: Even Falls

PATH 523. Histopathology of Organ Systems (3)
First half of this course is in pathophysiology of disease covering general pathology and pathophysiology, followed by systemic pathology and pathophysiology (systems approach).
Prereq: Histology course, Consent of Instructor
Instructor: Ziats, N.P.
Offered: Spring

PATH 524. Cell Biology of Neurodegenerative Disorders (3)
Introductory course on neurodegenerative disorders intended for Master's and first- and second-year medical students. This course attempts to bridge the gap between molecular mechanisms at the cellular level with disease presentation and therapeutic options for neurodegenerative disorders of protein misfolding and metal mis-metabolism. The course will cover topics related to Alzheimer's disease, Parkinson's disease, Huntington's disease, Amyotrophic lateral sclerosis, Multiple sclerosis, Prion diseases, disorders of iron and copper metabolism, and other disorders of interest to the students.
Prereq: None
Instructor: Singh, N.
Offered: Fall

PATH 525. Transport and Targeting of Macromolecules in Health and Disease (3)
This is a graduate-level seminar course that familiarizes the students with human diseases resulting from aberrant protein biosynthesis, processing, transport, recycling, and turnover. Specific examples include but are not limited to diseases resulting from alterations at the plasma membrane (familial hypercholesterolemia), endoplasmic reticulum (cystic fibrosis), lysosomes (Krabbe disease), mitochondria, and peroxisomes (Adrenoleukodystrophy). Heavy metal mis-metabolism, especially of iron and copper (hemochromatosis, Wilson's disease) will also be covered. Other diseases will be included on popular demand. Major emphasis will be on cellular and biochemical basis of disease, not clinical presentation or treatment. The class will meet once every week and discuss key publications in each area. Students will be expected to submit a short summary of their understanding of each section, and prepare and present a small grant proposal of ~ 6 pages for their final exam.
Prereq: None
Instructor: Singh, N.
Offered: Fall
Track Electives: Immunology Training Program

NOTE: PATH 520 + 521 counts as a Track Elective for ITP students. See Core Courses section.

PATH 417. Cytokines: Function, Structure and Signaling (3)
Regulation of immune responses and differentiation of leukocytes is modulated by proteins (cytokines) secreted and/or expressed by both immune and non-immune cells. Will examine the function, expression, gene organization, structure, receptors, and intra-cellular signaling of cytokines. Topics include regulatory and inflammatory cytokines, colony stimulating factors, chemokines, cytokine and cytokine receptor gene families, intra-cellular signaling through STAT proteins and tyrosine phosphorylation, clinical potential, and genetic defects. The course includes lectures using texts, scientific reviews and research articles.
Prereq: PATH 416, Biol 210, or equivalent
XLIST: BIOL 417, CLBY 417
Instructor: Levine, A.D.
Offered: Odd Falls

PATH 480. Logical Dissection of Biomedical Investigations (3)
Upper-level graduate course encompassing discussion and critical appraisal of both published and pre-published research papers, book chapters, commentaries and review articles. Emphasis will be placed on evaluating the logical relationships connecting hypotheses to experimental design and experimental data to conclusions drawn. Thus, the course will aim to develop students' capacities for independent thinking and critical analysis. Half of the course will be devoted to an analysis of fundamental conceptual issues pertaining to Immunology, but this material will be applicable to a wide variety of fields. The other half of the course will be devoted to the analysis of papers that have been submitted for publication (with the students acting as primary reviewers of these papers). Our expectation is that this course will have practical relevance for students by providing them with methods to review their own pre-publication manuscripts and eliminate common errors. It should also give students the tools to question widely held beliefs in diverse biomedical fields.
Prereq: Completion of C3MB curriculum and 2nd-year or beyond graduate school training.
Instructor: Greenspan, N.S. and Abbott, D.
Offered: Falls

PATH 481. Immunology of Infectious Diseases (3)
Lectures and discussion on the immune response to infectious organisms, including bacteria, viruses, and parasites. Emphasis on human responses but includes discussions of animal models. Other topics include vaccines and infections in immune-compromised hosts.
Prereq: PATH 416, or instructor consent.
XLIST: MVIR 481
Instructor: Sieg, S.
Offered: Springs
**Track Electives: Cancer Biology**

NOTE: PATH 416 counts as a Track Elective for CBTP students. See Core Courses section.

**PATH 417. Cytokines: Function, Structure and Signaling (3)**

Regulation of immune responses and differentiation of leukocytes is modulated by proteins (cytokines) secreted and/or expressed by both immune and non-immune cells. This course examines the function, expression, gene organization, structure, receptors, and intra-cellular signaling of cytokines. Topics to be covered include regulatory and inflammatory cytokines, colony stimulating factors, chemokines, cytokine and cytokine receptor gene families, intra-cellular signaling through STAT proteins and tyrosine phosphorylation, clinical potential, and genetic defects. The course includes lectures using texts, scientific reviews and research articles.

**Prereq:** PATH 416, Biol 210, or equivalent

**XLIST:** BIOL 417, CLBY 417

**Instructor:** Levine, A.D.

**Offered:** Odd Falls

**PATH 418. Tumor Immunology (2)**

Interactions between the immune system and tumor cells. Topics include the historical definition of tumor specific transplantation antigens, immune responses against tumor cells, the effects of tumor cell products on host immune responses, molecular identification of tumor specific transplantation antigens and recent advances in the immunotherapy of human cancers.

**Prereq:** PATH 416 or equivalent

**Instructor:** Sy, M.-S.

**Offered:** Springs

**BIOC 408. Molecular Biology (4)**

This course will give an in-depth understanding of the flow of genetic information from DNA to RNA to protein. Topics will include: nucleic acid structure; mechanisms and control of DNA, RNA, and protein biosynthesis; recombinant DNA; and RNA processing and modification. Eukaryotic and prokaryotic systems will be compared. Special topics will be yeast as a model organism, molecular biology of cancer, and molecular biology of development. Course will also include the discussion of current literature and introduction to techniques of genetic engineering.

**Prereq:** BIOC 207, BIOC 307

**Instructor:** Samols, D.

**Offered:** Spring

**BIOC 420. Current Topics in Cancer (3)**

The molecular basis of cancer is covered in lectures and discussion of the scientific literature. The principal topics covered in this course are cellular mechanisms of carcinogenesis through the perspective of viral oncogenes and tumor suppressors. Their identification, function, role in cellular transformation, and contribution to malignant progression in humans and in animal model systems are emphasized.

**Prereq:** CBIO 453, CBIO 454, CBIO 455, CBIO 456

**Instructor:** Yang, Y-C.

**Offered:** Fall, alternate years
**Undergraduate Courses**

**Note:** Undergraduates may also take some of the 400 level courses listed above.

**PATH 390. Undergraduate Research in Cancer Biology, Immunology or Pathology (1-3)**

Students undertake a research project directly related to ongoing research in the investigator's/instructor's laboratory. Written proposal outlining research topic, a schedule of meetings and format and length of final written report is to be prepared prior to registration for credit.

**Prereq:** One year of college chemistry and consent of instructor

**Instructor:** Staff

**Offered:** Fall, Spring

**Summer Program in Undergraduate Research (SPUR) (no credit but stipend of $3,500 + $1,000 housing allowance)**

The program, funded by the Howard Hughes Foundation, supports a stipend for 10 weeks of work in the summer. The faculty mentor provides funds for the research effort as related to his/hers laboratory’s interest. Students are matched with appropriate mentors and participate in seminars and are expected to write a short paper describing the summer research project as well as present a poster at the conclusion of the session.

**Prereq:** Consent of Instructor

**Instructor:** Ziats, N.P. and Staff

**Offered:** Summer