MASTER OF TRANSLATIONAL RESEARCH

Institute for Translational Medicine and Therapeutics

STUDENT HANDBOOK

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INTRODUCTION

The Master of Science in Translational Research (MTR) is the lead educational initiative within the Institute for Translational Medicine and Therapeutics (ITMAT). The core missions of this institute are (i) to provide an intellectual home and core critical mass for those who pursue translational research; (ii) to expand the number of faculty pursuing translational research at Penn through direct recruitment and enhancement of recruitment packages of any academic entity; (iii) **to expand this critical mass by educating trainees and faculty in translational research**; and (iv) to become a unified point of contact for Penn investigators seeking information and support to pursue translational research as well as for outside agencies wishing to engage with Penn in this area. The primary educational vehicle to achieve this goal is the MTR program.

The rationale for the development of this program was to improve the spectrum and quality of research training by providing an educational curriculum to teach the fundamental skills needed to perform translational research. The primary objective is to produce a cadre of highly trained and sophisticated investigators adept in the skills necessary for the translational investigator; to prepare students for an academic career and to position them for future careers as successful academic researchers who will become leaders in their field of research interest.

The program is designed to meet these objectives though the provision of didactic in-depth instruction, a formal mentorship program, formal (wet or dry) laboratory training, and specific ongoing guidance with hands-on exposure to protocol and grant development.

Upon successful completion of the MTR program graduates are expected to have developed a strong foundation in the fundamental techniques of translational research. They should be able to apply contemporary research tools to clinically relevant areas of investigation. The MTR program will produce investigators who are competitive in seeking research support and who are knowledgeable about the complex issues associated with conducting sound translational research. The MTR program will also assist in the promotion of translational research as a discipline within the Penn community.

CORE TENETS OF MTR TRAINING

Institutional Commitment to the MTR program

The University of Pennsylvania is committed to both maintaining the highest standards when training pre and postdoctoral students and providing a program sufficient to ensure that, when completed, the trainee can function independently as a scientific professional. The responsible institutional official for research training is Jonathan Epstein, MD. He has designated the oversight for all the Perelman School of Medicine Masters Programs to the SOM Office of Masters Programs. The daily operations of the MTR program are the responsibility of the ITMAT education administrative support staff under the direction of the Program Director, Emma Meagher, MD.

Quality Training in the MTR Program

The goal of the MTR program is to train future translational scientists. Individuals in this program are provided with the expertise and methods required to attain this goal. This includes the basic components of scientific training, the specific methods associated with their translational research interest as well as training in biomedical research ethics and good clinical practice. MTR appointees learn how to independently formulate meaningful hypotheses, design and conduct interpretable experiments, adhere to good laboratory and clinical practices, analyze results critically, understand the broad significance of their research findings, and uphold the highest ethical standards in research. The development of additional skills—including oral and written communication, grant writing, and laboratory management—are considered integral to this training.

Mentoring of MTR students

Effective mentoring is a critical component of research training. It facilitates the development of the trainee and conversion into becoming an independent investigator. Mentoring requires that the primary mentor dedicate substantial time to ensure personal and professional development. The MTR program recognizes that a good mentor builds a relationship with the trainee that is characterized by mutual respect and understanding. The MTR mentoring program recognizes that the attributes of a good mentor include being approachable, available, and willing to share his/her knowledge; listening effectively; providing encouragement and constructive criticism; and offering expertise and guidance.

Master of Translational Research Degree Requirements

The MTR degree is composed of 12 credit units

6 core courses (6 c.u.)

1. MTR 600 Introductory Biostatistics
2. MTR 601 Scientific Writing I - Review Writing
3. MTR 602 Proposal Development
4. MTR 603 Disease Measurement
5. MTR 604 Scientific and Ethical Conduct
6. MTR 605 Scientific Writing II – Manuscript Writing

2 elective courses (2 c.u.)

2 laboratory experiences (2 c.u.)

2 thesis credits (2 c.u.)

Description of Required Course Work

MTR 600 Introductory Biostatistics: 1 c.u. (Fall session - year one)

This course approaches statistics from an applied as well as theoretical point of view. Students learn the correct application and interpretation of basic statistical concepts and techniques. The course covers probability estimation, hypothesis testing, nonparametric tests, tests for categorical data, correlation, and regression.

MTR 601 Scientific Writing I - Review Writing: 1 c.u. (Summer II session - year one)

This course leads students through the process of writing a Review Article during their first Summer within the MTR program. Review articles will be authored with the student's primary mentor and will be used to accomplish the following goals: 1) Attain rapid familiarity with background in their new area of study; 2) a mechanism for mentor and student to create a productive working/writing relationship; 3) help the student identify key gaps in the literature and/or areas of controversy that would benefit from pivotal experiments; 4) understand the factors that contribute to variability in research outcomes in their area and; 5) introduce the student to other scientists in their new area through an initial publication early in their career. Mentors will be asked to agree to participate in this process, or identify another senior individual in their group who would perform the function as a condition to have MTR students funded in their program. The course director and members of the curriculum committee will provide guidance and critical reviews throughout the process.

MTR 602 Proposal Development: 1 c.u. (Summer II semester - year one)

Content includes study design and protocol development as they relate to the studies that probe the mechanism of disease and the study of complex traits. It discusses concepts such as writing a background section, asking a research question, designing a study, use of biomarkers, writing a research proposal and feasibility issues. Early development of the research protocol starts during this course and is evaluated prior to course completion.

MTR 603 Disease Measurement: 1 c.u. (Fall semester - year one)

Acquire the knowledge to rationally and effectively incorporate disease measurements, including emerging technologies, into the design of translational and clinical research protocols. Gain a basic understanding of measurement methodologies used in clinical medicine. Understand how "normal" values are determined, and how to interpret test results in the context of patients/research subjects. Approach disease measurements (tests) as a mean of answering questions, and to be able to choose appropriate tests to answer the questions being posed. The measurement aspects of the students' research protocol are written and evaluated during this course.

MTR 604 Scientific and Ethical Conduct: 1 c.u. (Spring semester - year one)

In this course, students will learn the foundational principles of scientific and ethical conduct of research, complete directed experience in evaluating these principles through IRB membership and ultimately be able to apply them to their own work. By the end of the foundational class sessions, students will understand scientific conduct, ethical considerations including human subjects and animal protections, regulations governing the use of health information, drugs, and devices, good laboratory practices, conflict of interest, and ethics in challenging new research domains. The directed experience will include membership for six months on an Institutional Review Board (IRB) at either Penn or CHOP. This membership experience will expose students to real issues, considerations, and solutions in human subjects research and study design.

MTR 605 Scientific Writing II - Manuscript Writing: 1 c.u. (Summer I session – year two)

Students will write a primary data manuscript for publication with their primary lab mentor. Emphasis will be placed on identifying publishable data that was either generated by the student, or which is made available to the student for analysis from the mentor's lab (e.g. perform a new analysis across data from multiple studies, organize and analyze data that is 'laying in wait' for someone to publish it). The student will be expected to learn the role of first author including 1) coordination with the senior mentor to write the introduction, 2) organize data, analyses and figures; 3) obtain or write methods and results from collaborators; 4) writing a discussion and; 5) "getting it out the door". The authorship for the publication is left to the discretion of the mentor in consultation with the originator of the data and the MTR student. This will both teach the student the value of publishing as an integral part of academic life, and will facilitate their success with subsequent grant applications. The course director will provide guidance and critical review of work

throughout the process. Mentors will be asked to agree to participate in this process, or identify another senior individual in their group who would perform the function.

MTR 607 & 608 Thesis: 2 c.u.

Registration for the thesis units represents that the student has completed the fundamentals of the program. Candidates are expected to complete and defend a research thesis. The thesis project is described in detail in a later section. Evidence of hands-on experience in formulating one or more research questions; searching the medical literature; translating research question(s) into an appropriate research design; assessing study feasibility; writing a detailed study protocol; designing data collection instruments; and implementation of the research protocol.

Completion of the thesis units should reflect all of the above in addition to performance of data analysis. Overall completion should 1) represent the student's knowledge of the principles and practice of translational research; 2) provide evidence of their first experience in writing a comprehensive NIH grant style proposal; 3) provide documentation of the development, implementation and analysis of the data collected from the research project and; 4) present a summary of the results in 1-2 publishable manuscripts melded into the form of a thesis ready to defend at a public seminar.

MTR 999 Laboratory Rotations: 2 c.u. (flexible timing)

Completion of 2 lab rotations is required. Examples of lab rotations include, but are not limited to, a traditional wet bench experience to learn how to develop / perform an assay or measurement technique; a clinical lab rotation learning how to perform /analyze a technique in your specialty; a rotation in a bioinformatics laboratory or a rotation in an imaging laboratory. The lab experiences are selected based on the student's proposed project and targeted to his/her overall research aims. See the Registration section for information on how to register for a lab.

Internship Program: The MTR program, in collaboration with its corporate partners, will provide an opportunity for two students per semester to learn about translational medicine in a Pharmaceutical Industry Internship. The internship will include approximately 10 hours per week for one semester (10 weeks). Internships may span across every facet of the pharmaceutical industry, including discovery, development, regulatory affairs and commercialization. Students will gain hands on experience "translating technology" and will receive independent study credit for the internship. This program will foster greater interactions between industry and academia by exposing MTR students to the roles they can play in the pharmaceutical industry as a potential career path. Students will be expected to work on site at the corporate partners location for 1 day per week, with additional time dedicated to background research and preparation. The industrial internship will be considered equivalent to laboratory credit (MTR 999).

Internship evaluation process: Students will have both a university and corporate mentor that will participate in training and evaluation. Steven Siegel will serve as the university

mentor for all MTR-industry interns. Corporate mentors will be assigned based on the specific content and department in which the internship is performed. Mentors will work together to ensure that interns are meeting the goals and expectations of the internship and the MTR 999 course.

Description of Elective Course Work

In addition to the required courses, trainees must enroll in two electives that total two course units. These must be graduate level courses in an area of concentration that complements the student's future career plans in translational research. The student's primary mentor and the MTR Programmatic Mentor must approve of the elective courses chosen by the student at least two months prior to course registration. If approved by the Mentoring Committee, the student must contact the course instructor to request permission to enroll in the elective. Once the instructor grants permission then the student must notify the MTR coordinator who will request that a "permit" be entered into SRS to complete the elective registration. Elective courses outside the School of Medicine are considered but require prior approval by the program director.

The list below is a representative sample of the elective course options taken by students. **A longer list of suggestions is available on the MTR Program site.**

MTR 535-401/402 Intro to Bioinformatics - Lecture/Lab: 1 c.u. (Spring semester)

The course provides a broad overview of bioinformatics and computational biology as applied to biomedical research. Course material will be geared towards answering specific biological questions ranging from detailed analysis of a single gene through whole-genome analysis, transcriptional profiling, and systems biology. The relevant principles underlying these methods will be addressed at a level appropriate for biologists without a background in computational sciences. This course should enable students to integrate modern bioinformatics tools into their research program.

MTR 606 Grantsmanship: 1 c.u. (Rotates semesters)

Students will learn to write a mentored career development or new investigator NIH grant proposal. More specifically, students will: Understand how grant proposals are reviewed by NIH and which NIH resources are available to investigators; Learn how to find and follow the multiple sets of instructions that apply to many NIH proposals; Develop a method to assemble, write and track the parts of an application; Write an organized and concise Specific Aims page; Develop a research proposal that specifically addresses review criteria; Gain an improved understanding of how to present your statistical analysis; Review classmates' proposals and receive coaching on how to improve their own proposal; Understand how to develop a budget and how budgets are handled in the University system.

MTR 620 Translational Therapeutics: 1 c.u. (Spring semester)

Content is focused on an overview of methodological approaches to the discovery, preclinical evaluation, and clinical development of novel therapeutics including devices, small molecules, biologics, vaccine, cell based therapies, and antibodies. Practical steps needed for real world transfer of academic technology to the patient setting will be emphasized including disclosure, patenting, licensing, business development and marketing.

MTR 660 Independent Study: 1 c.u.

MTR students may perform an independent study for credit based on meeting specific educational requirements. All independent study courses require a designated MTR independent study supervisor and prior approval from at least one member of the curriculum committee, who will serve as course director for the class. All members of the MTR curriculum committee are eligible to be MTR 660 course directors. MTR Independent study courses can be performed in a broad range of activities and settings, as long as the mission and content of the class are consistent with the overarching goals of the MTR and similar material is not available as an existing class. Independent study plans must have a learning objective, plan of study and methods of assessment. These elements should be drafted by the student and must be approved by both the MTR designated course director and content specific independent study mentor at least 6 weeks prior to the planned start date. Independent study plans are expected to consist of approximately 10 hr per week of activities for 10 weeks and may take place in any semester throughout the academic year.

An Example of a Plan of Study

Year	Summer	Fall	Spring
1	MTR 601 MTR 602	MTR 600 MTR 603	MTR 604 Elective 1
2	MTR 605 MTR 999	MTR 999 Elective 2	MTR 607 MTR 608

MENTORING

An essential component of the MTR degree program is the mentoring program. As previously stated, effective mentoring is critical not only for research training but also to allow the trainee to develop into an independent investigator. Mentoring requires that the primary mentor dedicate substantial time to ensure personal and professional development. A good mentor builds a relationship with the trainee that is characterized by mutual respect and understanding. Attributes of a good mentor include being approachable, available, and willing to share his/her knowledge; listening effectively; providing encouragement and constructive criticism; and offering expertise and guidance. We recognize the importance of these attributes and the significant time required to mentor effectively. For this reason we have in place the MTR mentoring program.

The program requires the establishment of specific milestones and the definition as to when these milestones should be accomplished within the training period. Examples of such milestones are 1) data acquisition and analysis; 2) preparation and submission of manuscript(s); 3) grant submission; 4) conditions regarding authorship; 5) mentor expectations of the mentee and; 6) mentee expectations of the mentor.

The Mentoring Committee

All students enrolled in the MTR degree program have a Mentoring Committee. This is composed of the lead (primary) mentor, a biostatistics mentor and a programmatic mentor. In addition the student may elect to have a secondary mentor to be part of the committee. This mentoring committee functions as an ongoing monitoring group for the candidate's progress. Its members are faculty with expertise relevant to both the basic and clinical aspects of the candidate's research, and each is expected to contribute their expertise to fostering the candidate's research progress.

The primary mentor typically provides the direction for the research project and basic science components of training. S/he will also guide and instruct the student through the science writing and grantsmanship courses and towards independence and self-sufficiency in publication and in funding. The Biostats mentor provides guidance in the development of the analysis plan at study inception and during the data analysis period in manuscript and thesis development. The programmatic mentor is responsible for the overall transition of the student through the program for both the completion of the curricular elements as well as the research project.

The student identifies the primary mentor prior to enrollment. The programmatic mentor and the biostatistics mentor are assigned to the student by the program director. The mentorship committee meets with the student at the commencement of the program, at the end of year one, and in advance of thesis defense. The primary mentor discusses the mentoring compact with the student and sets expectations, and meets with the student on a weekly to biweekly basis. Additionally, the student meets with the programmatic mentor at the end of the fall semester of the first year and second year to ensure ongoing progress

through the program. Additional *ad hoc* meetings may occur as required. The mentoring committee will hold a pre-graduation meeting two to four months prior to the student's thesis defense.

RESEARCH PROJECT AND THESIS

Translational research training is an integral component in the preparation of physician/scientists for career advancement as scientific professionals. The MTR trainee will undertake scholarship and research that together provide a training experience essential for career advancement in the science of translational research. The training component is conducted in an apprenticeship model where she/he works under the supervision of an investigator who is qualified to fulfill the responsibilities of a mentor.

Students are required to engage in a research project of their own design under the supervision of the primary mentor. At the time of application, each student specifies the project they will pursue, along with the primary mentor who will supervise the clinical research project. Students will use class material and homework assignments to assist in protocol development.

The research should be translational in nature and involve direct measurements on patient-derived samples or the use of innovative therapeutic or diagnostic techniques with laboratory-based elements. There should be demonstrable clinical relevance. The protocol is to be designed by the student under the direct supervision of the mentor. Where appropriate, dual mentorship should be considered; including a basic scientist expert in the technology being used and a clinical investigator expert in the condition being studied. The primary protocol should account for at least 75-80% of the student's commitment to the program.

Trainees are expected to complete a thesis that involves designing a research project, writing a formal research proposal, performing the study described in it, preparing 1-2 comprehensive scholarly scientific paper(s) reporting the results, and presenting and defending the thesis at a public seminar. The defense portion of the seminar will be a formal oral defense of the thesis with three examiners.

The thesis should consolidate students' knowledge of the principles and practice of translational research, and provide their first experience in writing a comprehensive NIH grant style proposal. Students are expected to develop, implement, and analyze the data collected from the research project and summarize the results in a publishable manuscript(s). The thesis provides hands-on experience in formulating one or more research questions; searching the medical literature; translating research question(s) into an appropriate research design; assessing study feasibility; writing a detailed study protocol; designing data collection instruments; conducting the research, performing data analysis, where appropriate; and preparing a manuscript for publication. The MTR program requires that a student obtain experience in each of these facets of research. The structure of the proposal is expected to follow the NIH-R01 PHS-398 format as much as possible. Refer to the NIH website link: https://grants.nih.gov/grants/how-to-apply-application-guide/forms-d/general/g.400-phs-398-research-plan-form.htm#Intro

Types of Acceptable Thesis Projects

The key criterion for an acceptable thesis is that it be of publishable quality and magnitude. Feasibility and scientific merit are two major factors to consider when deliberating thesis options. In general, it should be possible to complete the study during the two years of the program.

The thesis project must be able to stand on its own. In particular, the study must have a sufficient sample size to answer a research question. "Pilot" studies are generally not acceptable, but preliminary work that may lead to a larger effort in the future is encouraged, provided the work has adequate scientific merit and statistical power on its own accord. If a study is too small or not adequately designed to answer a question definitively, it will not be publishable in its own right. The student's primary mentor and advisors can provide substantial guidance in the pursuit of an appropriate question for the thesis proposal. The student is encouraged to think big by outlining a set of steps towards the answer to an important clinical issue and then develop one of the initial steps into a thesis project and proposal.

Starting the Thesis "from scratch"

Students should begin the design process for their projects soon after entering the program by considering a range of options for addressing research questions of interest. The initial process is focused on finding and refining a relevant clinical question(s) suitable and appropriate to answer with a research study, which is generally considered to be the specific aim(s) of their project. The coursework introduces the principles of scientific study design early in the curriculum to provide the structural underpinning of the students' discussions with their advisors. In refining the question, students have often changed their research focus as they realize the potential problems and possibilities available to answer questions that they find compelling. Research that has been initiated prior to starting the program will not be acceptable as a thesis. If the research questions have been defined but the protocol is not fully developed and can be modified throughout the year in response to input from all of the resources available to the student in the MTR program, it is likely that an acceptable project can be designed. The project should be of the student's own choosing and related to their research and clinical interests. Many students will have thought about research questions before entering the program, and continuity with prior research activities is expected and encouraged. It is essential for each student to take advantage of the coursework and meetings with their advisors in developing the research plan in order to ensure that the thesis provides the opportunity for academic growth.

The assessment of having met the criteria for successful defense and completion of the program are based on the examiners being able to say the candidate

1. Understands the concept of translational research.

2. Understands how to pose and address testable hypotheses.

3. Has an ability to analyze his /her own data and has the capacity to respond to critique regarding his/her own experiments.

4. Appreciates where his/her own data fits in respect to the scientific field in general and the potential of clinical application.

5. Has an appropriate understanding of the value of his /her results and how they may shape future research questions.

6. Can respond to general and specific questions regarding study design, analytical methodology and ways to asses and respond to flaws and limitations in design and analytic methodology

7. Successfully presents the data during the oral defense and answered questions posed by the committee satisfactorily.

Role of the Primary Mentor in the Master's Thesis

The primary mentor's role is to help the student identify a feasible research question; explore alternative approaches to answering the question; identify content experts to supplement the mentor's expertise; and advise the student on protocol development, student implementation, analysis, and summary for publication. The mentor's role is not to assign a thesis to the student, but rather, the advisor should help the student translate his or her own ideas into a research project. Finally, the mentor is responsible for ensuring that the student formulates and adheres to a timeline to complete the thesis.

Laboratory Research for MTR Students

Candidates for the MTR degree are required to participate in primary laboratory research that provides students with a meaningful experience in translational research. Candidates are expected to formulate a lab proposal, conduct the research in the laboratory, collect data, and analyze it. The purpose of the lab experience is to emphasize the basic components of the translational research experience, to appreciate that the underpinnings of translational research is understanding disease mechanism, and to learn the subtleties of measurement of disease process and the complexity this brings to the area of human research

MTR 999 Laboratory Units

MTR degree candidates are required to complete **two lab rotations** of primary, meaningful laboratory research in a translational research setting. Successful completion of each lab rotation results in the awarding of one credit unit. The purpose of the lab rotation is to emphasize the basic components of the translational research experience, to appreciate that the underpinnings of translational research is understanding disease mechanism, and to learn the subtleties of the measurement of disease process and the complexity this

brings to the area of human research.

The student **formulates a lab proposal**, **conducts the research** in the laboratory, **collects data**, and **analyzes** it. Each lab rotation is meant to provide experience **working in a new environment or learning a new technique**. Examples of lab units include, but are not limited to:

- a traditional wet bench experience to learn how to develop an assay
- a clinical lab rotation learning how to perform and analyze a technique in your specialty
- a rotation in a bioinformatics laboratory
- a rotation in an imaging laboratory.

Process and Registration

Students need to identify a lab mentor who will oversee the lab rotation. The lab mentor and the program mentor must approve the lab proposal prior to registering for a MTR 999 Unit. To get approval, students should complete the **lab proposal form** found on the MTR Canvas webpage, obtain the lab mentor's approval and signature on the form, and then forward the signed form to their program mentor for their final approval. Once approved, students will be **registered for the MTR 999 unit by the ITMAT Administrative Office**. The Lab Rotation approval must be received **prior** to commencing the lab rotation.

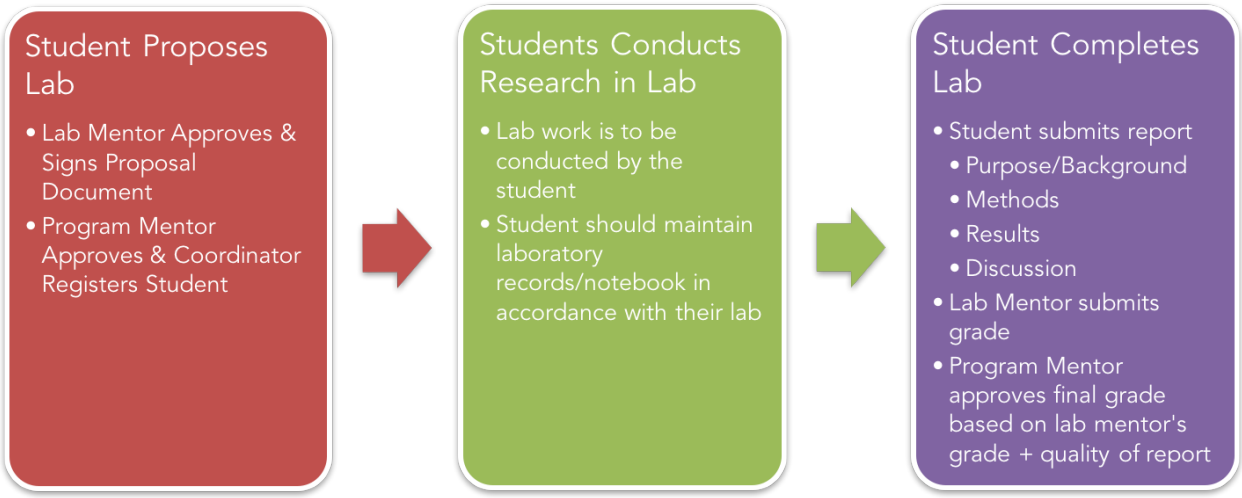
Expectations

During the lab, students are required to document their experiments in a **laboratory notebook** in accordance with the guidelines established in their research laboratory. The complete laboratory notebook ensures research integrity, intellectual property protection and the ability for anyone to recreate the experiment in its entirety. A short NIH webinar on keeping a lab notebook can be found here: https://www.training.nih.gov/OITEtutorials/OITENotebook/Notebook.html.

At the end of the lab, students are required to write **a 1-3 page report** by completing the MTR 999 Lab Report Template (found on the MTR Canvas webpage) that outlines the:

- Purpose of the lab/Background
- Methods
- Results
- Discussion

The quality of the written report should be sufficient for incorporation into the MTR thesis or a publication submission. The lab grade awarded is a composite assessment of the student's lab mentor evaluation of the rotation and the program mentor's evaluation of the final report.



Conduct of the Research

It is common that the student personally conduct all aspects of the thesis project. In circumstances where the amount of work required exceeds what could be reasonably expected of a single investigator, it is appropriate to work with additional researchers in the collection of data and data entry. In such cases, the student is expected to oversee the process and provide sufficient monitoring to ensure that the quality of the data is not compromised. Once the data is collected and properly entered into a computer database, the student is responsible for data cleaning, creating analytic files, and the primary analysis of the data. It is expected that the student will seek the advice of his or her mentors during this process to ensure an efficient and appropriate analysis process.

The Final Product

The writing of the thesis is again, the primary responsibility of the student, with input from his/her mentors including reading and comments on the paper as the process progresses. The final thesis should be in the format of a journal article and should be acceptable for submission to a journal.

When the final thesis is near complete, the student must notify the MTR administration office of their plans to defend. The primary mentor should review the thesis first. Once the mentor's suggestions are incorporated, the thesis must be submitted to the other members of the Mentoring Committee for formal approval. Once the student responds satisfactorily to the comments of all committee members, final approval of the thesis will be conveyed to the MTR Program Office from the primary and program mentors by completion of thesis review form. The student will send an electronic copy of the thesis to the MTR Program Office for distribution to the examining committee. The examiners will be given an

opportunity to express any major flaws that may prevent the student from passing on the day of the defense.

It is expected that all MTR theses will be submitted for publication and a copy of the final paper should be submitted to the MTR Program Office to be included in the student's file.

Procedures for Changing the Thesis

All students in the Master of Science in Translational Research program must develop and complete a thesis project as fulfillment for the degree. This process involves developing a project under the guidance of the student's mentor, receiving feedback from fellow students and faculty, executing the project, and writing up the thesis for approval by the Mentoring Committee.

It is very important to note that changes to the originally proposed thesis project should be extremely rare. The originally proposed thesis project will have been developed with careful guidance from the student's mentor and numerous other faculty and students. As such, the project should be tenable from both a scientific and logistic standpoint. It is only under extremely rare circumstances that a thesis project should need to be changed. Nonetheless, it is recognized that the initially proposed thesis may not always be tenable for reasons of logistics, time, or unforeseeable circumstances. Should it become impossible to complete the originally designed thesis, a student may request to change the project.

The following steps must be taken prior to changing the originally approved thesis topic:

1) The reason for not completing the originally proposed project must be documented in writing and distributed to the student's primary mentor, the programmatic mentor, and the MTR Program Director.
2) The above-mentioned faculty members must all agree that the thesis project is not feasible.
3) The student must then propose an alternate thesis project to their primary mentor, programmatic mentor and Program Director of the MTR program. This project must meet the same requirements as the originally proposed thesis, including writing of a formal protocol under the guidance of the student's mentor (even if the project has already been started), approval of the protocol by the Program Director and mentoring committee, and proper execution and completion of the project.

It is recognized that students will often be working on numerous projects along with their originally proposed thesis project. One of these projects may be used as the student's thesis project only if the project was developed under the guidance of the student's mentor. Projects developed with other faculty members, or developed prior to enrolling in the Master's program, will not qualify for the Master's thesis. Regardless, all of the above-mentioned steps must be taken before the project is acceptable as a thesis.

Grading

The grading system is as follows: A, excellent; B, good; C, fair; D, poor; and F, failure. At the MTR graduate level, the grade of C, while passing, does not constitute satisfactory performance. Letter grades may be modified by a plus (+) or minus (-) sign at the discretion of the course director. The minimum standard for satisfactory work in each course is a B-. The MTR degree program additionally requires that the quality of the students work and their conduct in the program is of an appropriate professional quality to ensure advancement. Failure to meet these requirements may result in a student being placed on probation and/or require a student to withdraw despite a satisfactory grade average.

The mark of I is used to designate "incomplete." A student who fails to complete a course and does not withdraw or change his/her status to auditor within the prescribed period shall receive at the instructor's discretion either a grade of I (incomplete) or F (failure). It is expected, in general, that a student shall complete the work of a course during the term in which that course is taken. The instructor **may permit an extension of time up to one year for the completion** of the course. In such cases, any course which is still incomplete after one calendar year from its official ending must remain as "incomplete" on the student's record and shall not be credited toward a degree.

Academic Standing

The MTR degree program has specific academic standards that are expected of all students. If a student fails to obtain a passing grade for a required course he/she will be placed on academic probation. Students may continue to enroll in other courses while on probation with the permission of the MTR Program Director and input from the course director, as needed. The student must make arrangements with the course director to remediate any grades lower than a B- and these arrangements must be approved by the program director with input from the MTR Advisory Committee as needed.

A remediation will be required that may include one of the following: retake an end of course exam, submit a written assignment as designed by the course instructor, or take another course. This will be at the discretion of the instructor for that course. The grade as entered in SRS may not be changed. Additional remediation may be required based on the judgment of the program director, the student's advisor, the MTR Advisory Committee, and/or the course directors. Any student who receives an unacceptable grade in a course for the second time or fails to meet the remediation plan will be dismissed and will not be eligible for re-admission. The status of any student who is or has previously been on probation and who receives an unacceptable grade for an additional course will be reviewed by the MTR Advisory Committee, the program director, and the student's

mentoring committee. The committee is authorized to dismiss the student or allow the student to remain in the program on a probationary status.

Any student who exhibits unprofessional behavior as determined by the programmatic leadership will be evaluated for probation. Continued unprofessional behavior will be grounds for removal from the program and withdrawal of all associated financial support.

Academic Grievances

Students who have a concern about a matter related to the MTR program, whether it concerns a course, instructor, or mentorship, are encouraged to come to the MTR Program Office (8032 Maloney Bldg/ HUP) to discuss their concern. Alternatively, the student may wish to speak directly with their Programmatic Mentor and/or the MTR Program Director.

Transfer Credit Policy

Twelve course units including completion of two thesis credits are required for the MTR degree. MTR students may request to transfer credit for graduate level courses completed at other schools within the University or from an accredited program. All transfer of credit requests will be considered on a case by case basis.

Transfer credit may not be applied to the two laboratory course units required for the MTR degree. Courses taken on a pass/fail basis will not be considered for transfer credit. Only courses in which the student received a grade of "B" (3.0) or higher will be considered for transfer credit. No course may be counted toward degree requirements if it has been used toward the requirements for more than one other degree.

Requests for transfer credit should be submitted to the MTR Program Director together with a course syllabus for the course under consideration. The director will request a review of the course by a MTR faculty member in that content area for its appropriateness for MTR transfer credit.

Students may request substitution of a core course with a more advanced course in that content area. The process for substitution is the same as that for transfer credit.

Audit Policy

Students who wish to audit a course are expected to designate the audit at the time of registration. Auditing course work is discouraged, as full tuition is charged but no credit is earned toward the MTR degree. If a student wishes to change a course status from credit to audit, s/he must obtain permission from the course instructor *before* the “drop/add” period ends. The audited course will appear on the transcript with the grade of “AUD” and no credit will be earned toward graduation. Students are <u>not</u> permitted to change the course status from graded to audit after the course has ended. *Students funded from ITMAT,*

CTSA KL2 and TL1 awards are not permitted to use these funds to support tuition costs for auditing courses.

Student Conduct

MTR students must comply with the University's Code of Student Conduct and other University policies related to student conduct that appears in The PennBook: Resources, Policies and Procedures Handbook. These include, but are not limited to, policies on sexual harassment, acquaintance rape and sexual violence, appropriate use of electronic resources, open expression, and drug and alcohol usage. Students are also expected to abide by the BGS policies adopted by OMP including the Authorship Policy when publishing their research and BGS Student Expectations including the Code of Academic Integrity. The PennBook, BGS Policies, and a directory of other important University Policies relevant to Graduate Education are available here: http://www.med.upenn.edu/bgs/staff.shtml

Any student who exhibits unprofessional behavior as determined by program leadership will be evaluated for probation. Continued unprofessional behavior will be grounds for removal from the program.

Code of Academic Integrity

The most fundamental value of any academic community is intellectual honesty; accordingly, all academic communities rely upon the integrity of each and every member. Students are responsible not only for adhering to the highest standards of truth and honesty but also for upholding the principles and spirit of the Academic Code. Violations of the Code include but are not limited to the following acts:

A. Cheating: using or attempting to use unauthorized assistance, material or study aids in examinations or any other academic work, or preventing, or attempting to prevent another from using authorized assistance, material, or study aids. Example: using a cheat sheet in a quiz or exam, altering a graded exam and resubmitting it for a better grade, etc.

B. Plagiarism: using the ideas, data or language of another without specific and proper acknowledgment. Example: copying another person's paper, article, or computer work and submitting it for an assignment, cloning someone else's ideas without attribution, failing to use quotation marks where appropriate, etc.

C. Fabrication: submitting contrived or altered information in any academic exercise. Example: making up data for an experiment, fudging data, citing nonexistent articles, contriving sources, etc.

D. Multiple Submission: submitting, without prior permission, any work submitted to fulfill another academic requirement.

E. Misrepresentation of Academic Records: misrepresenting or tampering with or attempting to tamper with any portion of one's own or any other person's transcripts or academic record, either before or after coming to the University of Pennsylvania. Example: forging a change of grade slip, tampering with computer records, falsifying academic information on one's resume, etc.

F. Facilitating Academic Dishonesty: knowingly helping or attempting to help another violate provisions of this Code. Example: working together on a take-home exam, etc.

G. Unfair Advantage: attempting to gain unauthorized advantage over fellow students in an academic exercise. Example: gaining or providing unauthorized access to examination materials, obstructing or interfering with another student's efforts in an academic exercise, lying about a need for an extension for an exam or paper, continuing to write even when time is up during an exam, destroying or keeping library materials for one's own use., etc.

Alleged violations of the BGS Code of Academic Integrity are adjudicated in accordance with the Charter of Biomedical Graduate Studies Student Judicial System. Alleged research ethics violations are handled in accordance with the University's Procedures Regarding Misconduct in Research for Non Faculty Members of the Research Community. If a student is unsure whether his action(s) constitute a violation of the Code of Academic Integrity, then it is that student's responsibility to consult with the instructor to clarify any ambiguities.

Time Limitation

The MTR program is designed as a full-time program. The time to complete the didactics is typically 2 years and the research project may take up to 3 years to complete. The maximum time permitted to complete the MTR degree is 5 years from the date of matriculation.

Registration

Continuous Registration

Continuous registration as a Master's student is required unless a formal leave of absence is granted by the Program Director. A leave of absence will be granted for military duty, medical reasons, and for family leave; this leave is typically for up to one year and "stops the clock" on time to completion. Personal leave for other reasons may be granted for up to one year with the approval of the Program Director, but it does not automatically change the time limit.

Registration Process

The MTR program coordinators are responsible for registering all students for MTR courses. Students can change their course schedule without penalty during the add/drop period.

To register for electives, students must first obtain approval from their MTR Mentoring Committee then contact the course instructor to request permission to enroll. Once the instructor grants permission, then the student must notify the MTR coordinator who will request a "permit" be entered to complete the elective registration.

To register for labs, students must submit the lab proposal to their program mentor. After receiving approval, the proposal and approval must be submitted to the MTR program coordinators by the registration deadline.

To register for the industry internship, students must arrange the experience with Nalaka Gooneratne. Approval by Dr. Gooneratne must be sent to the MTR program coordinators.

To register for independent study, students must submit a proposal to their MTR program mentor. After receiving approval, the proposal and approval must be submitted to the MTR program coordinators before the registration deadline.

Students are strongly encouraged to verify course registration, tuition bills and grades through the student portal: http://pennintouch.apps.upenn.edu

Students may refer to the Penn Three-Year Academic Calendar to find out registration dates and add/drop periods on the Registrar's website http://www.upenn.edu/registrar/.

Information on course offerings (e.g. timetables, classrooms, and course descriptions) can also be found on the Registrar's website. For the most up-to-date information on MTR courses visit the MTR website at http://www.itmat.upenn.edu/itmat/mtr/

For specific MTR registration deadlines, contact the MTR program coordinators.

Leave of Absence

A student who wishes to take a leave of absence must submit a written request to the MTR Program Office for initial approval and then it will be forwarded to the Associate Dean in the Office of Masters Program for final approval. The granting of a leave of absence does not automatically change the time limit for the degree.

ADMINISTRATIVE REQUIREMENTS

Throughout the program, students will be required to keep track of and follow through on all administrative requirements for the MTR degree. Below is a summarized list of the requirements:

1) Graduation application – In order to be considered for conferral of the degree students must complete an online graduation application approximately two months prior to the expected conferral date. The graduation application initiates an academic audit that, assuming all requirements are met, places the student with the next graduation cohort. The MTR degree is conferred by the University of Pennsylvania Perelman School of Medicine and is granted in May, August and December of each year.

2) Course evaluations – students are required to complete an evaluation for every MTR course. Students will receive an email notification and website link to the online evaluation at the end of each term. Grades will not be released until evaluations are complete.

3) MTR Surveys – students are required to complete an online evaluation of the MTR program each year. You will receive an email with a survey link from the MTR Coordinator. Graduating students are required to complete an exit survey evaluating the program and their mentors. Thesis grades will not be released until the evaluations are complete.

Research Regulations Compliance

Because much of the research conducted by our students involves clinical data, it is essential that all studies comply with various research regulations. These policies are designed to protect patient and human subject privacy.

UNIVERSITY OF PENNSYLVANIA SYSTEMS

PennCard

PennCard is the official identification card of the University of Pennsylvania and is required for all students. The PennCard Center is located on the 2nd floor of the Penn Bookstore at 3601 Walnut Street. A valid government issued photo I.D. will be required in order to pick up your new PennCard. The Office can be reached at http://www.upenn.edu/penncard**.**

PennKey

Your PennKey name and password gives you access to PennNet, a Penn e-mail account, and many other essential services managed through the MTR Program. All students are required to have a current, active PennKey and password.

Penn InTouch

Penn InTouch provides secure web access to view current billing information, course registration and schedules, academic records, student health insurance, etc. Access to this site requires login with PennKey and password: http://pennintouch.apps.upenn.edu

The PennPortal

The PennPortal webpage bundles together links to important information for students. Access the PennPortal at www.upenn.edu/penn_portal/

Canvas

Canvas is the online course site system used for the majority of MTR courses and by the University. Individual pages are set up for each MTR Course and can be accessed with PennKey and Password.

Log in at https://canvas.upenn.edu

Support: canvas@pobox.upenn.edu

Description of Fees

The MTR tuition is calculated based on course unit plus general and technical fees. Tuition for non-MTR courses vary by department and students should contact the individual department to verify tuition cost. For current tuition rates, visit http://www.itmat.upenn.edu/mtr-tuition.html

General Fee: The amount of the general fee is based on the number of course units taken. The general fee enables the University to maintain essential facilities such as the library system, museums and institutes, special laboratories, the Student Health Service, Athletics, and Career Services, all of which provide benefits to students both before and after graduation.

Technical Fee: Students are charged a technical fee for computing services such as access to computer labs and use of email accounts.

Clinical Fee: Full-time students are required either to pay a separate Clinical Fee for access to the Student Health Service or to enroll in a health insurance plan that provides a capitated payment to the Student Health Service (i.e., the Penn Student Insurance Plan or a private plan that provides and equivalent capitated payment). A review of the Penn Student Insurance Plan can be found at the following website: http://www.vpul.upenn.edu/shs/shi.html

Translational Therapeutics

The translational therapeutics track focuses on discovery of new treatments in an academic setting and transfer of this technology to industry for implementation in clinical practice. There are three main components to this curriculum: a core didactic class in Therapeutics Development (MTR 620); an internship in industry; and a thesis project with a focus in translational therapeutics. The goal of the track is to enhance training in commercialization of academic technology.

http://www.itmat.upenn.edu/mtr-tt.html

Entrepreneurial Science

The track in Entrepreneurial Science offers trainees the opportunity to translate biomedical research into innovative solutions and to develop approaches to commercialization. Graduates of the program are expected to have a more robust entrepreneurial mindset coupled with tangible skills to bring biomedical research to market. The program is designed to support a trainee as they acquire skills in key aspects of: 1) Needs assessment, 2) Idea development, 3) Scientific methodology, and 4) Approaches to commercialization. The program is directed by Nalaka Gooneratne, M.D., M.Sc.

http://www.itmat.upenn.edu/mtr-entsci.html

Biomedical Informatics

The MTR Biomedical Informatics track aims to train a new generation of translational scientists in informatics approaches. The rapidly expanding field of biomedical informatics defines how we compare and evaluate healthcare data to both understand and introduce improvements to care (biomedical informatics), as well as the use of healthcare data to conduct discovery-based investigation of biological systems (bioinformatics). Our goal in introducing the biomedical informatics track within the MTR program is to not only produce translational scientists who are customers and collaborators with informaticians, but to empower these scientists to leverage informatics approaches to develop and test their own hypotheses.

http://www.itmat.upenn.edu/MTRBiomedicalInformatics.html

JOINT DEGREE PROGRAMS

Potential applicants for the joint-degree are Medical, Dental, Veterinary and Nursing students. The following joint-degree programs are offered or are in development in conjunction with MTR:

(1) MD-MTR

(3) MSN/PhD-MTR

(3) VMD-MTR

(4) DMD-MTR

Students interested in pursuing a joint degree program are encouraged to discuss their interests with the MTR Program Director, Emma Meagher, M.D.

MD-MTR Curriculum and Program Structure

Students will complete three years of the MD curriculum before beginning full time study in the MTR program in July at the end of year 3. (Students who are interested in the program early in their time as medical students may begin exploring the possibilities for their research project before beginning full time course work.

The July 1 start date for full time MTR coursework means that MD-MTR students will have only six months (from January through June) of year 3 to complete step 1 of the boards and take the electives and "Sub-Is" they need for residency application. Faculty advising and close communication with the Registrar, Helene Weinberg about scheduling issues are absolutely essential given the compressed time frame. Students considering the MD-MTR program should start planning as early as possible in their first or second year of medical school to make the best use of their time. All of year 4 and the fall of year 5 will be devoted to full time work toward the MTR degree, during which time students are not registered for the MD. The spring of year 5 will be devoted to completing the final requirements for both degrees.

The MD-MTR requirements are similar to those of the free-standing MTR degree option.

6 core courses

1. MTR 600 Introductory Biostatistics
2. MTR 601 Scientific Writing I - Review Writing
3. MTR 602 Proposal Development
4. MTR 603 Disease Measurement
5. MTR 604 Scientific and Ethical Conduct
6. MTR 605 Scientific Writing II - Manuscript Writing

2 elective courses

2 laboratory experiences

2 credits for research project and thesis

SAMPLE STUDY PLAN – MD-MTR

Year	Fall	Spring	Summer
1	MD curriculum (Modules 1,3,6)	MD curriculum (Modules 2,3,6)	
2	MD curriculum (Modules 2,3,6)	MD curriculum (Modules 4,6)	MD curriculum (Modules 4,6)
3	MD curriculum (Modules 4,6)	Boards 1 and MD curriculum (Module 5)	MTR 601 (1.0 c.u.)
4	MTR 600 (1.0 c.u.) MTR 602 (1.0 c.u.) MTR 603 (1.0 c.u.)	MTR 604 (1.0 c.u.) MTR 605 (1.0 c.u.) Elective 1 (1.0 c.u.)	MTR Research
5	MTR 999 (1.0 c.u.) MTR 999 (1.0 c.u.) Elective 2 (1.0 c.u.)	MD curriculum (Module 5) MTR 607 (1.0 c.u.) MTR 608 (1.0 c.u.)	

(MTR courses in red)

Overview of finances

TL1 grant provides financial support. Students enrolled in the MTR program are only charged 7 semesters of medical school tuition – this will make the MD/MTR degree cost neutral for most TL1 funded students enrolled in the MTR. Contact the Admin/Financial Director, Lorri Schieri and/or Helene Weinberg in PSOM for details.

The **MTR Leadership Committee** is charged with: 1) providing career guidance to prospective MD-MTR students, including MD students who are interested in translational research but are undecided about the MTR program; 2) providing advice and counseling to students enrolled in the MD-MTR joint-degree program; and 3) screening applications to the MD-MTR program and make recommendations to the MTR admissions committee.

For more information about MD-MTR contact:

Emma Meagher, MD
Director, MTR Program
8032 Maloney Bldg.
215-662-2174
emma@upenn.edu

Helene Weinberg
Registrar
PSOM Registrar's Office
JMEC, 6th Floor
215-898-4646
hweinber@mail.med.upenn.edu

Amy Nothelfer
Associate Director, PSOM Combined Degree and Physician Scholar Programs
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Jean Fox
Financial Aid Manager
PSOM Admissions and Financial Aid Office
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215-898-9118
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DMD-MTR Curriculum and Program Structure

Students interested in the DMD-MTR combined degree will apply in the fall of their first year of dental school through the dental school's combined degree committee in consultation with the Proposal Evaluation Committee. Accepted students will begin coursework for the MTR program in the Summer following Year 1 of dental school, at which time they will also complete a 4 week intense lab orientation in the laboratory of their chosen mentor. Students will then follow the plan of study outlined in the grid below. After completing all MTR coursework, students will take a refresher course for the dental school prior to returning to the DMD curriculum for years 4 and 5. Students will also continue their MTR research resulting in a Thesis Defense in the spring of year 5 of the combined degree program.

This plan of study allows 6 semesters of time dedicated to MTR coursework.

The DMD-MTR requirements are as follows:

6 core courses:

1. MTR 600 Introductory Biostatistics
2. MTR 601 Scientific Writing 1 – Review Writing
3. MTR 602 Proposal Development
4. MTR 603 Disease Measurement
5. MTR 604 Scientific and Ethical Conduct
6. MTR 605 Scientific Writing II – Manuscript Writing

2 Elective Courses (Cross-Reference with DMD Curriculum)

1. DMD 520: Microbiology
2. DMD 625: Pharmacology

2 Laboratory Experiences

2 credits for research project and thesis

DMD-MTR Sample Study Plan

(MTR courses in red)

YEAR	FALL	SPRING	SUMMER
1	DMD curriculum Elective 1: Microbiology DMD 520	DMD curriculum	Summer Session II MTR 601 (1.0) MTR 602 (1.0) DMD-Lab Orientation
2	DMD curriculum Elective 2: Pharmacology DMD 625	DMD curriculum	MTR 999 (1.0) - Lab MTR 999 (1.0) – Lab *MTR Research*
3	MTR 600 (1.0) MTR 603 (1.0) *MTR Research*	MTR 604 (1.0) *MTR Research*	Summer Session I MTR 605 (1.0) *MTR Research*
4	DMD curriculum MTR 607 (1.0) MTR 608 (1.0) *MTR Research*	DMD curriculum *MTR Research*	*MTR Research*
5	DMD curriculum *MTR Research*	DMD curriculum *MTR Thesis Defense*	

MTR ADMINISTRATIVE STRUCTURE

The institutional governance and oversight of the Master of Translational Research Program resides in the School of Medicine (SOM) Office of Master's Programs (OMP) (http://www.med.upenn.edu/masters.shtml) within the Office of the Vice Dean for Research and Research Training. The Academic home for the MTR program is the Institute for Translational Medicine and Therapeutics (ITMAT).

The Participating Schools in the MTR program are the Schools of: Medicine, Veterinary Medicine, Nursing, Bioengineering and Dental Medicine.

The Program Director is responsible for administrative oversight and academic leadership of the program. The Director also serves as a primary academic advisor to MTR students and is the chairperson of the Advisory Committee and the Selection Committee. The current Program Director is Emma Meagher, MD.

The MTR Curriculum Committee serves generally to advise the program leadership on all matters related to implementation and evaluation of the MTR program and other related activities. The curriculum committee is responsible for formal decision-making on academic aspects of the MTR degree program. The committee is primarily composed of course directors and program mentors who evaluate existing curriculum and implement modifications. Specific responsibilities of this committee include establishing criteria for membership in the MTR program, monitoring the work of the standing committees, recruiting faculty for the program, and developing liaisons with appropriate Penn centers and institutes.

The MTR Selection Committee meets to identify new MTR students and award funding. The selection committee is responsible for reviewing all applications to the degree programs and associated funding mechanisms. The members interview applicants and recommend acceptance on the basis of a uniform set of criteria related to the applicant, project, mentoring, and resources.