

**Ph.D. in Translational Biology, Medicine, and Health (TBMH)
Plan of Study for VTCSOM Medical Students**

TBMH 5105 - Professional Development and Ethics (2 semesters, 4 credits)
TBMH 5204 – Seminar in TBMH (4 semesters, 4 credits)
TBMH 5304 - Research Experience in TBMH (2 semesters, 6 credits)
TBMH 5404 – Scientific Logic and Analysis (1 credit)
TBMH 7994 - Research and Dissertation (62 credits)
TBMH 50XX – TBMH Focus Area Elective (4 credits)
XXXXNNNN - Quantitative Elective (3 credits)
MED TRANSFER (16 credits, Replaces TBMH 5004, TBMH 5054, TBMH 5034)

TOTAL: 100 Credits

Requirements & Procedures

Application Process: Medical students wishing to pursue a PhD with the TBMH program must begin the application process by March of their M2 year.

Qualifying Examination: A qualifying examination is required and serves to evaluate the student's mastery of fundamental knowledge from their coursework, assess their ability to evaluate literature in the biomedical and health sciences, and to diagnose deficiencies. The examination must be taken prior to entrance into the Ph.D. program. The qualifying exam may be substituted by a passing score on the Step 1 exam. If the student elects for the Step 1 exam to substitute for the qualifying examination, the Step 1 exam must be completed by May 1st during their second year to be eligible to apply for the PhD.

Dissertation Advisor: Ph.D. students must identify a dissertation advisor prior to admission to the graduate program. The advisor must be a participating TBMH faculty member with an appointment in the Faculty of Health Sciences (FHS) to serve as the student's advisor and supervise the student's research. If appropriate and acceptable to the dissertation advisor, the student may opt to take on a clinical co-mentor.

Focus Area: Students must also select their area of concentration from one of six Focus Areas upon entering the program: Cancer, Tissue Engineering and Reparative Medicine, Public Health and Implementation Science, Immunity and Infectious Disease, Metabolic and Cardiovascular Science, or Neuroscience. This selection should be based on their research focus area, and dissertation advisor recommendation.

Student Advisory Committee: Prior to submitting a program of study and no later than the end of the second academic semester of study, each student must form an Advisory Committee. The Advisory Committee is composed of the dissertation advisor and a minimum of three (3) other faculty members. According to the VT Graduate School guidelines, the dissertation advisor must serve as the chair. The committee must include faculty from at least three (3)

different departments, including one faculty member representing a different stage of the translational research spectrum relative to the dissertation advisor's research. It is highly encouraged for the student to have one TBMH faculty member from outside their focus area. The Advisory Committee must meet at least twice annually to assess student progress and submit a copy of their progress letter to the Academic Progress Committee.

Plan of Study: The Plan of Study outlines the specific courses to be taken by the student in the fulfillment of the degree, and should be completed no later than the end of the second academic semester of study. The Plan of Study must be approved by the student's Advisory Committee prior to submission to TBMH and the Graduate School.

Degree Requirements: Candidates are eligible for graduation upon successful completion of all core, elective, and research credits, as well as successful oral defense of a written dissertation. A cumulative GPA of 3.0 is required for all coursework, and no grade below a B is allowed for any core course. Courses where a grade below a B is received must be retaken.

Individual Development Plans: In addition to the Program of Study, each student will develop an Individual Development Plan in their Professional Development course, which will evolve over time in consultation with their dissertation Advisor and Advisory Committee. Specifically, students will utilize a free online tool (<http://myidp.sciencecareers.org/>), endorsed by FASEM and AAS, for setting strategic goals each year, exploring career possibilities, and setting goals to prepare each student for their intended career path. Goals could include publications, fellowship submission, attendance at professional meetings, patents, clinical activities, professional activities, research project goals, or networking.

Advancement to Ph.D. Candidacy: In order to advance to Ph.D. candidacy, students must have completed all required coursework, and must take a written and oral Preliminary Examination, administered by the student's Advisory Committee. For the written component, the student will prepare his/her dissertation research proposal in the format of an NIH F31 predoctoral fellowship proposal. The oral examination will cover the proposed research plan, including the student's knowledge of the literature, the feasibility and originality of the proposed work, and all course material. A student who fails will be allowed only one additional attempt to retake the exam one semester later. The student's Advisory Committee must approve the research topic and plan in order for the student to continue in his or her research studies.

Dissertation Defense: Upon completing all other degree requirements, and at a minimum of six months after the preliminary examination, students will prepare a written dissertation describing the completed research. The dissertation will be approved by the student's dissertation advisor and provided to each of the committee members at least two weeks prior to the oral examination (dissertation defense). Upon successful completion of the dissertation and public defense, students may apply for graduation from Virginia Tech with the Doctor of Philosophy in Translational Biology, Medicine and Health.

Time to Completion: It is expected that students will take 3 full years of leave* from medical school, and complete the degree within six (6) semesters, depending on the student's background interest.

Maintenance of Clinical Skills: VTCSOM students will be required to attend periodic clinical activities (selected by the Senior Dean for Academic Affairs) for maintenance of hands-on clinical skills while they are on leave from medical school. These activities will be a programmatic expectation, and will not be taken for a grade.

Seminars: Seminar attendance is required in the first two years, but will not be required for a grade the following semesters. However, it is a programmatic expectation that students will attend scientific seminars while enrolled in the program, particularly the Medical Scholars Lecture series in Fall (4 seminars) and Spring (4 seminars).

Grant Submissions: If interested and approved by the student's dissertation advisor, an MD+PhD student may apply for an [NIH F30 predoctoral fellowship](#). To be considered a competitive applicant, the student must be a full-time TBMH PhD student for one academic year and enroll in TBMH Grant Writing (TBMH 5094) prior to fellowship submission.

**Note – A leave of absence from the Virginia Tech Carilion School of Medicine is required to pursue a full-time Ph.D. Therefore, all VTCSOM students wishing to pursue a Ph.D. must receive approval from the VTCSOM Dean of Students prior to beginning the application process.*

TBMH Course Descriptions:

TBMH 5105 Professional Development and Ethics (4 cr.)

Ethical standards of science and ethical issues in translational, biomedical and health research. Responsible conduct of biomedical and health research. Collaborative research strategies. Impact of translational science on national and global issues.

TBMH 5204 – Seminar in TBMH (4 cr.)

Weekly scientific research presentations from local and invited visiting scholars on current topics related to the biomedical, translational, and health sciences. Emerging technological and methodological trends. Recent conceptual advances, their relevance across specializations, and broader societal impact.

TBMH 5304 Research Experience in TBMH (6 cr.)

Research experience in biomedical, translational, and health sciences. Experimental design and methods, techniques and procedures, lab safety, data analysis and presentation. May be repeated for up to 15 credits.

TBMH 5404 – Scientific Logic and Analysis (1 cr.)

Scientific logic, hypothesis testing, study design, and evaluation of evidence in biomedical, translational, and health science research. Critical evaluation and discussion of primary research studies. Analysis of contemporary research problems and controversies, research design and methodology, and interdisciplinary scientific approaches in translational biology, medicine, and health research. Effective peer-review and its role in science.

TBMH 7994 Research and Dissertation (62 cr.)

Independent dissertation research.

TBMH 50XX – Focus Area Elective (4 cr.)

Students are expected to take a Focus Area Elective of their choice and at their advisor's discretion to enhance their familiarity with the content as a biomedical researcher.

Courses waived through TRANSFER credit

TBMH 5004 Fundamentals of Translational Biology Medicine, and Health (8 cr.)

Processes underlying human health and disease and the context in which they occur. Normal v. pathological lifespan trajectory of humans and animal models at the molecular, cellular, organ system, organism, group, and social levels. Homeostatic processes throughout the life's stages and the genetic, environmental, behavioral, and social drivers and interactions that lead to pathological outcomes.

TBMH 5054 Fundamentals of Immunity and Infectious Disease (4 cr.)

Comprehensive survey of human immunity, infectious agents and disease across scales: genetic, molecular, cellular, tissue, organism, society. Diagnosis, treatment, and prevention of

infectious and immune diseases. Social and economic aspects of infectious disease and immunity.

TBMH 5034 Fundamentals of Public Health and Implementation Science (4 cr.)

Analysis of research and strategies for translating major medical and health discoveries into effective treatment delivery with measurable outcomes at the individual, health systems, and population levels. Theories of health implementation, research design and methodology, health messaging, human behavior change, health care decision making, health literacy and disparities, community-based participatory research, patient-centered research, and health economics and policy. Research new approaches to improve health outcomes, health care quality, and costs related to recent therapeutic or preventative discoveries.

VTCSOM Courses that replace TBMH 5004

MED 9061. Block I: Functional Biology of Cells and Tissues (2 cr.)

Topics for this course include:

Molecules, Genes, Chromosomes, Proteins, Cells, Tissues, Metabolism, Transcription, Translation, Musculoskeletal System, Early Development, Pharmacodynamics, and Pharmacokinetics

MED 9062. Block II: Human Body I (2 cr.)

Topics for this course include:

Immunology, Cardiovascular, Respiratory, and the Autonomic Nervous System

MED 9063. Block III: Human Body II (2 cr.)

Topics for this course include:

GI Tract, Liver and Biliary, Renal, Endocrine, and Reproduction

MED 9064. Block IV: Biology of the Nervous System (2 cr.)

Topics for this course include:

Central Nervous System, Peripheral Nervous System, Special Sensory Structures

VTCSOM Courses that replace TBMH 5054

MED 9071. Block V: Fundamentals of Pathobiology (2 cr.)

Topics for this course include:

Cells and Tissues, Necrosis, Neoplasia, Inflammation, Genetic Disorders, Immunological Diseases, Infection, Microbiology, Virology, Skin Disorders, Pharmacology, Therapeutics

MED 9072. Block VI: Pathobiology of the Human Body I (2 cr.)

Topics for this course include:

Hematology, Bleeding Disorders, White Cell Disorders, Vascular Diseases, Heart, Pulmonary, ENT, Lymph Nodes and Spleen, Microbiology, Virology, Pharmacology, Therapeutics

VTCSOM Courses that replace TBMH 5034

MED 9073. Block VII: Issues in Medicine & Culture – A Course in Medical Humanities (2 cr.)

Topics for this course include:

Pain, Cancer Treatment, Death, Disability and Modern Life, and Empathy

MED 9074. Block VIII: Public Health and Medicine (2 cr.)

Topics for this course include:

Integration of Public Health and Medicine - Public Health in the 21st Century, Social Determinants of Health, Environmental Determinants of Health, Epidemiology in Action – Outbreak Investigation, The Affordable Care Act and What It Means for Practicing Physicians, and Group Presentations

Ph.D. in TBMH for MD Students – Timeline to Degree

Transfer Credits				
Course Number	Course Name	Credit Hours	Core	Graded Hours
TBMH 5004	Fundamentals of Translational Biology, Medicine, and Health	8	8	8
TBMH 5054	Fundamentals of Immunity and Infectious Disease	4	0	4
TBMH 5034	Fundamentals of Public Health and Implementation Science	4	0	4
TOTALS		16	8	16

Year 1 - Fall				
Course Number	Course Name	Credit Hours	Core	Graded Hours
TBMH 5105	Professional Development and Ethics	2	2	2
TBMH 5204	Seminar in TBMH	1	1	1
TBMH 5304	Research Experience in TBMH	3	3	3
TBMH 7994	Research and Dissertation	8	0	0
TOTALS		14	6	6

Year 1 - Spring				
Course Number	Course Name	Credit Hours	Core	Graded Hours
TBMH 5105	Professional Development and Ethics	2	2	2
TBMH 5204	Seminar in TBMH	1	1	1

TBMH 5304	Research Experience in TBMH	3	3	3
TBMH 7994	Research and Dissertation	4	0	0
TBMH 50XX	Focus Area Elective	4	4	4
<i>TBMH 5094*</i>	<i>Grant Writing</i>	<i>(3)</i>		<i>(3)</i>
TOTALS		14	10	10

**Required course if student would to submit an NIH F30 predoctoral fellowship*

Year 2 - Fall				
Course Number	Course Name	Credit Hours	Core	Graded Hours
TBMH 5204	Seminar in TBMH	1	1	1
TBMH 5404	Scientific Logic and Analysis	1	1	1
TBMH 7994	Research and Dissertation	11	0	0
TOTALS		13	2	2

Year 2 - Spring				
Course Number	Course Name	Credit Hours	Core	Graded Hours
TBMH 5204	Seminar in TBMH	1	1	1
TBMH 7994	Research and Dissertation	12	0	0
TOTALS		13	1	1

Year 3 - Fall				
Course Number	Course Name	Credit Hours	Core	Graded Hours
TBD	Quantitative Elective	3	3	3
TBMH 7994	Research and Dissertation	12	0	0
TOTALS		15	3	3

Year 3 - Spring				
Course Number	Course Name	Credit Hours	Core	Graded Hours
TBMH 7994	Research and Dissertation	15	0	0
TOTALS		15	0	0

TOTAL HOURS: 100

