

# MEDICINE, DOCTOR OF (M.D.)/ CLINICAL AND TRANSLATIONAL SCIENCES, DOCTOR OF (PH.D.) [DUAL DEGREE]

Graduate study in clinical and translational research in the C. Kenneth and Dianne Wright Center for Clinical and Translational Research is a highly individualized undertaking and required course work represents only one component. Each student's program is tailored to meet his or her particular interests, with the primary emphasis on developing research skills and the capacity for independent scholarship and with the recognition that career goals for many M.D.-Ph.D. physician-scientists are distinct from those of most Ph.D. trainees.

## Program goals

The objectives of this dual degree program are:

- Students in the M.D.-Ph.D. program in clinical and translational sciences will acquire the foundational skills to allow them, after further clinical specialty and postdoctoral research training, to become independent physician-scientists with the necessary research skills to bridge bench science with clinical science. Program graduates ultimately pursue careers in academic medicine, pharmaceutical industry, research institutes and government agencies as clinicians, scientists, educators and administrators.
- Students will gain a progressive mastery of concepts in clinical and translational sciences and discipline-specific biomedicine, an understanding of theoretical frameworks in research, an ability to synthesize information and apply foundational concepts to identify key areas for innovative investigation and experimentation, and the knowledge to design, execute and interpret experiments and publish studies that address the questions identified.
- Students will develop skills in various means of communicating core knowledge in the field and the details of experimental design, results and interpretation to a variety of potential audiences.

Among the many benefits offered by participation in the dual-degree program are the following:

- Students will have the foundation and training in clinical and translational sciences and in medicine to conduct basic and translational research that will enable them to take bedside observations to the bench and the results of bench research to the bedside to advance both the underlying science and patient health.
- Students have the opportunity to participate in clinical research during the M4 year.
- Students with M.D.-Ph.D. training are highly competitive for positions in leading physician-scientist clinical training programs, faculty positions in academic medical centers, and are well-positioned to ultimately take on leadership roles in academic medicine, industry and government.
- Tuition, fees and a stipend are provided throughout both the medical and graduate phases of training.

The diplomas for this dual degree program are awarded simultaneously upon completion of the requirements for both degrees.

## Student learning outcomes

The student learning outcomes described on the clinical and translational sciences Ph.D. program page (<http://bulletin.vcu.edu/graduate/office-research/center-clinical-translational-research/clinical-translational-sciences-phd-concentration-cancer-molecular-medicine/>) also apply to M.D.-Ph.D. students.

## Admission requirements

To be considered for the VCU M.D.-Ph.D. program, prospective students must apply to the medical school through the American Medical College Application Service (<https://students-residents.aamc.org/applying-medical-school/applying-medical-school-process/applying-medical-school-amcas/>). Please designate "Combined Graduate/Medical Degree" on your AMCAS application. The deadline for application to the program for admission in the fall semester is listed on the AMCAS web site.

In rare situations when resources allow, students matriculated in the medical school class may be considered for admission to the M.D.-Ph.D. program, usually near the start of the M1 academic year. For additional details, see the M.D.-Ph.D. dual degree opportunities page (<http://bulletin.vcu.edu/professional-studies/medicine/md-phd-opportunities/>).

## Degree requirements

The dual degree program is designed to allow students to complete the first two years of medical school and the USMLE Step 1 examination (M1, M2) before undertaking graduate training (G1 and subsequent years). After successfully defending the Ph.D. dissertation, students complete the remaining clinical years (M3, M4) of medical training. Nevertheless, important aspects of dual degree training are integrated across the program. These include M.D.-Ph.D.-specific graduate courses taken during M1 and M2 that supplement the medical curriculum and emphasize research and translational aspects of M.D. course topics and required M3 clinical rotations integrated into the graduate phase. Opportunities for research experience begin prior to entering the graduate phase (pre-matriculation and summers after M1 and M2), when students spend time working in several faculty laboratories of their choice. These laboratory rotations enable students to examine faculty research projects, experimental approaches and laboratory environments, and to select an area for specialization. After completing M2, students are required to take the USMLE Step 1 exam, followed by one or two required M3 clinical rotations lasting six to eight weeks in total. They then transition into graduate studies.

During the first year of graduate training (G1), students take graduate courses selected to optimize their training and devote time to independent research under the guidance of a faculty adviser. During G2 and subsequent years, most effort is devoted to independent research, as part of the course requirements are satisfied by the M1 and M2 M.D. curriculum (see below). On satisfactory completion of course work, students must pass written and oral comprehensive examinations to qualify for degree candidacy. Candidacy examinations for the dual M.D.-Ph.D. are normally completed during G2. Following admission to candidacy, each student must conduct a substantial original research project, prepare a written dissertation, present their work in a seminar and defend it successfully in an oral examination. Department-sponsored seminars and other activities give students opportunities to discuss their research interests with visiting scientists and to present their research both internally and at national professional meetings.

**The Ph.D. component of training in clinical and translational sciences for M.D.-Ph.D. students normally takes at least four years to**

**complete.** Courses taken during the M1 and M2 years of medical school satisfy elective graduate program courses. M.D.-Ph.D. students, if eligible under NIH rules, are required to prepare and submit an NIH F30 predoctoral training grant application, which is usually based on the dissertation proposal defended during the comprehensive examinations. Students also are encouraged to submit predoctoral training grant applications to other funding sources. Acceptance of a peer-reviewed first-author (or co-first-author) manuscript in a scientific journal indexed in PubMed or Web of Science that is based on experimental research conducted during Ph.D. training (rather than a review, commentary, case note or similar publication) is required of all M.D.-Ph.D. students prior to returning to the M3 phase of medical school.

In addition to completing VCU School of Medicine requirements for the M.D. degree and the general VCU Graduate School graduation requirements (<http://bulletin.vcu.edu/academic-regs/grad/graduation-info/>), students must complete a minimum of 54 credit hours for the Ph.D., including directed research.

## Curriculum requirements for the M.D.

Based on the equivalent knowledge acquired by successfully completing MEDI 100, MEDI 150, MEDI 200 and MEDI 250 during the M1 and M2 years, 12 elective credits are satisfied. Courses taken to satisfy Ph.D. requirements do not satisfy M.D. requirements.

Course	Title	Hours
<b>M1 year</b>		
Fall semester (MEDI 100): 20 weeks		
	Orientation to Medical School	
	Practice of Clinical Medical Bootcamp	
	Molecular Basis of Health and Disease	
	Principles of Physiology	
	Principles of Autonomics and Pharmacology	
	Immunity and Infection	
	Foundations of Disease	
	Practice of Clinical Medicine	
	Patient, Physician and Society	
	Population Health and Evidence Based Medicine	
	Ultrasound	
	Diagnostic Reasoning	
Spring semester (MEDI 150): 21 weeks		
	Marrow and Movement	
	Gastrointestinal	
	Endocrine	
	Reproduction	
	Practice of Clinical Medicine	
	Patient, Physician and Society	
	Population Health and Evidence Based Medicine	
	Ultrasound	
	Diagnostic Reasoning	
<b>M2 year</b>		
Fall semester (MEDI 200): 22 weeks		
	Cardiovascular	
	Pulmonary	
	Renal	
	Mind, Brain and Behavior	

	Practice of Clinical Medicine	
	Patient, Physician and Society	
	Population Health and Evidence Based Medicine	
	Ultrasound	
	Diagnostic Reasoning	
Spring semester (MEDI 250): 12 weeks		
	Step 1 Study	
<b>M3 year</b>		
Fall and spring semesters (MEDI 300): 50 weeks		
	M3 Transitions to Clerkships Workshops	
	Internal Medicine Clerkship	
	Surgery Clerkship	
	OB/GYN Clerkship	
	Pediatrics Clerkship	
	Family Medicine Clerkship	
	Neurology Clerkship	
	Psychiatry Clerkship	
	Ambulatory Clerkship	
	Foundational Career Exploratory Elective (FE)	
	Patient, Physician and Society	
	Population Health	
<b>M4 year</b>		
Fall and spring semesters (MEDI 400): 49 weeks		
	Two acting internships, one ward and one critical care (four weeks each)	
	Step 2 Clinical Knowledge and Clinical Skills exams	
	Five specialty electives (four weeks each)	
	Up to five non-clinical electives (four weeks each)	
	Population Health	
	Interprofessional Critical Care Simulations	
	M4 Capstone Course	

## Curriculum requirements for the Ph.D.

Based on the equivalent knowledge acquired by successfully completing MEDI 100, MEDI 150, MEDI 200 and MEDI 250 during the M1 and M2 years, 12 elective credits are satisfied. Students are required to take additional credits of M.D.-Ph.D.-specific courses listed below.

Course	Title	Hours
<b>Required core courses</b>		
ANAT 620	Scientific Writing and Grantsmanship	2
CCTR 520	Fundamentals of Research Regulation	2
CCTR 631	Adaptive Clinical Trials	1
CCTR 640	Team Science: Theories and Practice	2
CCTR 690	Research Seminar in Clinical and Translational Sciences (one-credit course repeated for four credits)	4
CCTR 801	Clinical Practicum (one-credit course repeated for two credits)	2
<b>Additional required courses</b>		
BIOS 543 or STAT 543	Graduate Research Methods I Statistical Methods I	3
IBMS 624	Research Reproducibility and Transparency	1

CCTR 630 or BIOS 571	Design Implications in Clinical Trials Clinical Trials	3
IBMS 651	M.D.-Ph.D. Journal Club (one-credit course, required fall and spring semester of M1)	2
IBMS 652	M.D.-Ph.D. Science and Disease	1
IBMS 653	M.D.-Ph.D. Research Seminar (0.5 credit course, required fall and spring of M1, fall of M2, and during G phase except in semester of defense)	2
IBMS 697	M.D.-Ph.D. Directed Research	6
OVPR 601 or OVPR 602 or OVPR 603	Scientific Integrity Responsible Scientific Conduct Responsible Conduct of Research	1

**Electives**

Select 12 credit hours of the following (satisfied by M1/M2 curriculum): 12

BIOC 503	Biochemistry, Cell and Molecular Biology
BIOC 504	Biochemistry, Cell and Molecular Biology
BIOC 605	Molecular Biology
EPID 650	Epidemiologic Methods for Research
EPID 651	Intermediate Epidemiologic Methods for Research
EPID 652	Advanced Epidemiologic Methods and Data Analysis
HGEN 614	Pathogenesis of Human Genetic Disease
MICR 684	Molecular Biology of Cancer
PHTX 606	Introduction to Pharmacology of Therapeutic Agents

**Research**

CCTR 697	Directed Research in Clinical and Translational Sciences (six credits are satisfied by IBMS 697) <sup>1</sup>	22
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Total Hours 54

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Course must be taken for a minimum of 22 credits.

**The minimum number of graduate credit hours required for this degree is 54.**

**Plan of study timeline**

The dual-degree program blends medical and graduate training supplemented with M.D.-Ph.D.-specific course work and opportunities during the medical (M) and graduate (G) phases of the curriculum that culminates in the simultaneous awarding of the M.D. and Ph.D. degrees. The timeline of medical and graduate training is as follows:

**Year 1 (M1): Mostly preclinical medical course work, some research**

- Preclinical medical courses
- M.D.-Ph.D. Journal Club (two semesters)

- M.D.-Ph.D. Seminar (two semesters)
- Research rotations (and pre-matriculation research opportunity)

**Year 2 (M2): Mostly preclinical medical course work, some research and clinical rotation**

- Preclinical medical courses
- M.D.-Ph.D. Science and Disease (one semester)
- M.D.-Ph.D. Seminar (one semester)
- Research rotations
- Preparation for USMLE Step 1
- Required M3 clinical rotation(s) (one or two, lasting six to eight weeks total)

**Year 3 (G1): Graduate course work and research, some clinical experiences**

- Graduate program course work
- M.D.-Ph.D. Seminar (two semesters)
- Directed research (begin dissertation research)
- Opportunities for clinical experience

**Years 4-5 (G2-G3) and additional year if needed: Primarily research, some clinical experiences**

- Ph.D. Qualifying Examination, admission to candidacy
- Submit NIH F30 fellowship application
- Directed research (completion of dissertation research)
- Graduate program course work
- M.D.-Ph.D. Seminar
- Required M3 ambulatory care rotation
- Publication of peer-reviewed first-author paper
- Dissertation defense

**Years 6-7: M3-M4: Completion of clinical training, clinical research experience**

- Clinical rotations
- Clinical and non-clinical elective
- Preparation for USMLE Step 2
- M4 Clinical research capstone project

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**Program website:** [ctr.vcu.edu](https://ctr.vcu.edu) (<https://ctr.vcu.edu/>)