

CLINICAL AND TRANSLATIONAL SCIENCES, DOCTOR OF PHILOSOPHY (PH.D.) WITH A CONCENTRATION IN CANCER AND MOLECULAR MEDICINE

Program goal

The doctoral program in clinical and translational sciences offers a general curriculum, an interdisciplinary concentration in psychiatric, behavioral and statistical genetics and a concentration in cancer and molecular medicine.

Students who pursue the doctoral program in clinical and translational sciences will be grounded in a relative substantive area and be prepared to integrate data from multiple disciplines, have strong communication and computational skills and be sufficiently flexible to easily move among different projects and research venues.

Student learning outcomes

Students who complete the program should achieve the following core competencies:

1. Understand, integrate and apply relevant discipline-specific biomedical concepts and theoretical frameworks in research, written and oral communication
2. Comprehend, assess and apply appropriate theories and/or experiments to address issues in the literature, research and in oral communication
3. Comprehend and assess context, methodology and data of scientific articles
4. Comprehend what is being measured, theoretical knowledge on how measurement occurs, be able to compare outcome to homologous types of data
5. Be able to define, identify and express weaknesses in research or content as an effort for further investigation or suitable explanation
6. Plan, incorporate and use appropriate terminology for orally imparting research findings and theories
7. Use writing as a vehicle to impart or explain research findings and theories in a discipline- or audience-specific manner

VCU Graduate Bulletin, VCU Graduate School and general academic policies and regulations for all graduate students in all graduate programs

The VCU Graduate Bulletin website documents the official admission and academic rules and regulations that govern graduate education for all graduate programs at the university. These policies are established by the graduate faculty of the university through their elected representatives to the University Graduate Council.

It is the responsibility of all graduate students, both on- and off-campus, to be familiar with the VCU Graduate Bulletin as well as the Graduate School website (<http://www.graduate.vcu.edu/>) and academic regulations in individual school and department publications and

on program websites. However, in all cases, the official policies and procedures of the University Graduate Council, as published on the VCU Graduate Bulletin and Graduate School websites, take precedence over individual program policies and guidelines.

Visit the **academic regulations section for additional information on academic regulations for graduate students.** (<http://bulletin.vcu.edu/academic-regs/>)

Degree candidacy requirements

A graduate student admitted to a program or concentration requiring a final research project, work of art, thesis or dissertation, must qualify for continuing master's or doctoral status according to the degree candidacy requirements of the student's graduate program. Admission to degree candidacy, if applicable, is a formal statement by the graduate student's faculty regarding the student's academic achievements and the student's readiness to proceed to the final research phase of the degree program.

Graduate students and program directors should refer to the following degree candidacy policy as published in the VCU Graduate Bulletin for complete information and instructions.

Visit the **academic regulations section for additional information on degree candidacy requirements.** (<http://bulletin.vcu.edu/academic-regs/grad/candidacy/>)

Graduation requirements

As graduate students approach the end of their academic programs and the final semester of matriculation, they must make formal application to graduate. No degrees will be conferred until the application to graduate has been finalized.

Graduate students and program directors should refer to the following graduation requirements as published in the Graduate Bulletin for a complete list of instructions and a graduation checklist.

Visit the **academic regulations section for additional information on graduation requirements.** (<http://bulletin.vcu.edu/academic-regs/grad/graduation-info/>)

Apply online today. (<https://www.vcu.edu/admissions/apply/graduate/>)

Admission requirements

Degree:	Semester(s) of entry:	Deadline dates:	Test requirements:
Ph.D.	Fall (preferred); rolling admissions	Applications received by Jan 10 receive priority	TOEFL if relevant

In addition to the general admission requirements of the VCU Graduate School (<http://bulletin.vcu.edu/graduate/study/admission-graduate-study/admission-requirements/>) all applicants must provide the following:

1. A statement of purpose for application to the program. The statement of purpose should address the following items in two to five pages:
 - a. Reasons the applicant wishes to pursue a Ph.D. in Clinical and Translational Sciences
 - b. Background experience relevant to pursuing a Ph.D.
 - c. Research interests and potential faculty mentors with whom the individual may want to work
 - d. Description of the applicant's career goals

2. Transcripts for each college/university attended
3. Resume or curriculum vitae
4. International applicants must also provide, to the VCU Global Education Office, scores from the Test of English as a Foreign Language or International English Language Testing System.

Degree requirements

All students are expected to be actively engaged in research throughout the duration of the Ph.D. program. Students are generally admitted under a mentorship model, meaning that they will begin research under the supervision of faculty advisers to whom their research interests most closely align. Other didactic experiences include participation in workshops and scientific meetings of relevance to the student's research area.

The curriculum provides a strong grounding in fundamental concepts while emphasizing aspects of research design and technology that are broadly applicable across disciplines in industrial, government and academic settings. A series of elective courses will then provide an advanced base of knowledge focused on a student's areas of interest.

In addition to general VCU Graduate School graduation requirements (<http://bulletin.vcu.edu/academic-regs/grad/graduation-info/>), students are required to meet the following:

1. Credit hour requirements: Students are required to complete course work in core and elective courses and to conduct significant research. In order to earn the Ph.D., students must complete a minimum of 54 credit hours: 32 from core and elective courses as well as 22 from directed and dissertation research that provide a sound foundation in clinical and translational research principles. Students will also participate in seminar and workshop experiences that place them in the midst of the research process from theoretically based hypothesis generation through grant writing, study conduction, and, ultimately, data analysis and manuscript preparation. This program also includes a rigorous interdisciplinary research component comprising directed research and dissertation hours.
2. Transfer and M.S. credit hours: Graduate-level course work completed prior to matriculation into the program, including course work taken in another program at VCU or at another institution, shall be evaluated to determine whether it can be used to fulfill degree requirements of this program. Transfer of credit hours will be limited to those allowed by the university. A minimum grade of B is required for credit hours to transfer.
3. Grade requirements: Degree applicants must achieve an overall GPA of 3.0 (B) with a grade of C in no more than two courses per the VCU Graduate Bulletin. The GPA for graduation shall be based on all graduate courses attempted after acceptance into the program. Students who receive a grade lower than a B in any of the required core courses will be subject to remedial action as determined by their advisory committee in conjunction with the program director to ensure that there is adequate mastery of the material. All remedial action must be undertaken and completed to the committee's satisfaction before the student is eligible to begin their qualifying exams.
4. Research advisers and committee: The director of the Wright Center education program or the director's designee will assist the student with initial course selection and provide advice concerning the program. All students should select their doctoral co-advisers and finalize the composition of their research advisory committee prior to the end of the second semester of study.
5. The student's co-advisers shall provide each student enrolled in the doctoral program with individualized recommendations regarding course work selection, workshop experiences and the direction of their research. It is essential that each student be comprehensively assessed in the area of their methodological and research background. Recommendations will be made to ensure that each student has acquired the needed substantive research background necessary for doctoral-level work. Thus, the total credit hours required for graduation will be determined on a case-by-case basis by the individual student's research advisory committee.
6. The committee will consist of a minimum of five members, all of whom must be members of the VCU graduate faculty. Note: Individuals who are not already graduate faculty members must apply to the dean of the Graduate School for temporary affiliate membership. The composition of the research advisory committee shall be such that the significant areas of the student's research focus are represented. To foster the interdisciplinary intent of this degree program, at least one member of the committee shall be from a department other than those of the student's co-advisers. Final approval of each student's advisory committee membership shall rest with the Wright Center education program committee.
7. Admission to candidacy for the Ph.D. Before admission to candidacy for the Ph.D., students must have:
 - a. Completed all required course work (as noted above, through a comprehensive screening process students will have been evaluated to assure that they have grounding in a relevant substantive content area and have taken the needed course work in statistics, methodology and research so that they are able to pursue doctoral-level research)
 - b. Successfully completed an oral examination
8. Oral examination: Upon successful completion of all required didactic course work, not including seminars and workshops and submission and acceptance of a research proposal, students shall take an oral examination administered by the student's research advisory committee. The exam shall be based on a defense of the student's proposed dissertation research project, which shall be constructed in the format of an NIH (or other sponsor as approved by the student's advisory committee) grant proposal and all other subject areas deemed appropriate by the committee. All advisory committee members must vote on the student's performance as either Pass or Fail. A student may pass the exam with no more than one negative vote. Upon successful completion of the oral examination, the student is officially entered into candidacy and permitted to refine their proposed dissertation research and submit it for final committee approval before initiating the project (see below). An unsuccessful oral examination shall require re-examination within a time period determined by the committee. Only one oral re-examination is permitted.
9. Dissertation research/proposal: Students must propose and conduct a substantial original clinical and/or translational investigation under the supervision of the research adviser(s) and advisory committee. The student can refine the research proposal which served as the foundation of their oral examination in consultation with the research advisers and advisory committee or propose a new novel research proposal. Once the student has received the committee's approval, they can initiate their dissertation research.
10. Dissertation research project: The research project should represent a significant contribution to the body of knowledge in its field and should be deemed publishable in refereed journals. The emphasis of the research conducted by students in this program shall be on clinical and translational interdisciplinary research, incorporating two

or more disciplines as well as a systems approach. This emphasis will be fostered by the requirement of having at least one faculty member on the research advisory committee from a department, school or college different from that of the research advisers, thereby exposing students to different perspectives on the same problem and assisting students in developing multidisciplinary approaches to their research.

11. Dissertation defense: Students shall prepare a written dissertation describing the completed research using a format approved by the VCU Graduate School. An oral defense of the dissertation, under the direction of the research advisory committee and open to all faculty members, shall be scheduled to examine the student's research, dissertation documentation and underlying fundamental knowledge across the disciplines encompassed by the student's research. An announcement of the oral defense, including the candidate's name, dissertation title and the day, place and time of the defense, shall be made at least 10 working days in advance of the defense. Following the defense, all committee members shall vote on the acceptability of the dissertation. A student may pass the oral defense, signifying that the research advisory committee has accepted the dissertation, with no more than one negative vote. Upon successful completion of the defense and dissertation, the student may apply for graduation from Virginia Commonwealth University with the degree of Doctor of Philosophy in Clinical and Translational Sciences.

Research advisers and committee

Each student in the program will have both a research and a clinical mentor (these could be the same or different faculty members). This team-based mentoring approach will facilitate the translational aspects of the Ph.D. students' projects and may actually serve to stimulate new translational projects and collaborations at VCU. The research mentors in the program will be chosen based on demonstrated expertise in the area of the student's research, excellent mentoring skills and research funding to support the Ph.D. student. Clinical mentors will be chosen based on clinical expertise and mentoring excellence. Through the clinical mentor, the trainee will have opportunities to be exposed to clinical practice, including clinics and surgeries, clinical laboratories, the complexities of clinical trials, and other clinical activities. Both the research and clinical mentor will be on the dissertation committee, which would comprise a total of five faculty members. The students' mentors and dissertation committee will advise the students as they prepare career development plans in the second year in the program. The career development plan will be required because translational science is by definition an interdisciplinary and novel career path for students.

Qualifying examination

Students in good academic standing who have completed all of their required academic core course work will prepare for the qualifying exam. The qualifying exam will have two parts — a written proposal and an oral defense of the proposal — and for Ph.D. students, should be completed by summer of the second year or fall of the third year. M.D./Ph.D. students are encouraged to complete this process by the end of their second year in the Ph.D. program.

The qualifying exam is administered by the student's dissertation committee and focuses on scientific communication skills and an understanding of the interdisciplinary nature of contemporary scientific research. The written grant proposal is generally in the format of the research strategy for an NIH F30/F31 grant, although if the student plans to submit a grant to a different sponsor, that format may be used. The topic of the grant proposal should be developed by the student in

consultation with their dissertation adviser and committee; however, once the aims of the proposal are agreed upon, the rest of the written proposal must be the student's own work, without editing by the adviser. The proposal should include information on the general purpose of the research, background information on the research topic (including a review of the relevant literature), a rationale for the project, a statement of the hypotheses to be investigated or research questions to be answered, and proposed methods and statistical analyses.

The grant proposal and evaluation form should be submitted to the student's dissertation adviser at least three weeks prior to the planned date for the oral exam. The dissertation adviser is responsible for distributing the grant proposal and critique/evaluation form to the committee and for obtaining the critiques from the committee members. The evaluation form is provided by the program. When the dissertation committee reviews the written proposal, they will list the strengths and weaknesses of it and score the proposal on the evaluation form. If the proposal has an average score better than 4 (on the scale of 1-9, where 1 is best), then the student will advance to the oral defense of the proposal with the dissertation committee. If the average score is 4-9, then the student will revise the written proposal based on the critiques. The committee will work with the student to make revisions within approximately two weeks, and the proposal will be resubmitted to the dissertation committee for scoring.

After the student's written proposal has been accepted by the dissertation committee, they will present the proposal orally to the committee and answer questions about it from the committee. The purpose of the oral defense of the proposal is to allow the student's dissertation committee to evaluate the student's command of the material and to give the committee an opportunity to ask questions and provide feedback regarding the proposed work. At the end of the oral defense, each dissertation committee member will recommend that the student either passes or fails the qualifying exam. In order for the student to successfully complete their qualifying exam, they must have no more than one negative vote from the committee members. Unsuccessful completion of the qualifying exam will require re-examination within a period of time determined by the committee and the program director. The content of the re-examination will also be determined by the committee and the program director on an individual basis. In most cases this would involve a revision of the grant proposal. Only one reattempt to pass the qualifying exams is permitted. Students who do not pass the written or oral portions of the qualifying exams after their second attempt will be dismissed from the program. Upon successful completion of the oral examination, the student is officially entered into candidacy for the Ph.D. and permitted to refine the proposed dissertation research and submit for final committee approval before initiating the project (see below).

Admission to Ph.D. candidacy

Students will have written and oral qualifying examinations, based on writing a grant proposal describing their proposed dissertation research and orally defending the proposal with their dissertation committee. Before admission to candidacy for the Ph.D., students must have (1) completed all required course work as described above and (2) successfully completed a qualifying exam.

Publication requirement

A student appearing for the final defense in the Wright Center for Clinical and Translational Research's doctoral program must provide evidence of a minimum of one first-author manuscript accepted for publication in an archival journal. The publication must be based on the student's

research conducted during training in the Ph.D. program and approved by the student's dissertation committee. Review articles or other works not representing original research are encouraged but will not count toward the minimum publication requirement.

Additional manuscript(s) accepted for publication are highly encouraged. These additional publications can be review articles or represent original research, and participation as a middle author on any type of publication is also encouraged. The stated publication policy represents the minimum requirement across the Wright Center; the student's dissertation committee and/or individual development plan may specify reasonable additions to the publication requirement to confirm readiness for the final defense.

Dissertation proposal defense

Students in good standing who have completed all required course work and the qualifying exam continue their dissertation research and have regular meetings with their dissertation committee (at least annually). Students are eligible to defend their dissertation upon approval by their dissertation committee. Students shall prepare a written dissertation describing the completed research using a format approved by the VCU Graduate School. An oral defense of the dissertation, under the direction of the dissertation committee and open to all faculty members, shall be scheduled to examine the student's research, dissertation documentation and underlying fundamental knowledge across the disciplines encompassed by the student's research. An announcement of the oral defense, including the candidate's name, dissertation title, and the day, place and time of the defense, shall be made at least 10 working days in advance of the defense.

Following the defense, all committee members shall vote on the acceptability of the dissertation. A student may pass the oral defense, signifying that the research advisory committee has accepted the dissertation, with no more than one negative vote. Upon successful completion of the defense and dissertation, the student may apply for graduation from VCU with the degree of Doctor of Philosophy in Clinical and Translational Sciences.

Time limit

All requirements for the Ph.D. must be completed within eight years from the date of admission to the degree program.

Concentration in cancer and molecular medicine

The concentration in cancer and molecular medicine is a translational and interdisciplinary Ph.D. curriculum in the Wright Center for Clinical and Translational Research. The goal of the program is to train students to perform translational research in cancer and molecular medicine. This requires a background and the necessary vocabulary to communicate with both scientists and clinicians and the research skills to be able to bridge bench science and clinical science. The marriage of cancer and molecular medicine blends established cancer biology with an emerging field, molecular medicine. The CaMM concentration serves as an educational program for Ph.D. as well as M.D./Ph.D. students encompassing the research objectives of the VCU Massey Cancer Center, the VCU Institute of Molecular Medicine and the Wright Center.

In addition to the core courses, elective courses will be recommended to Ph.D. students based on their research. Students will develop an individualized curriculum with the guidance of the program director based on their research interests and career goals. By the end of the first semester, each student will develop a complete curriculum plan to be

approved by the program director. This will be reviewed by the student's dissertation committee in the second fall semester.

Curriculum requirements

Course	Title	Hours
Required courses		
ANAT 620	Scientific Writing and Grantsmanship	2
BIOS 543	Graduate Research Methods I	3
or STAT 543	Statistical Methods I	
CCTR 520	Fundamentals of Research Regulation	2
CCTR 630	Design Implications in Clinical Trials	3
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	2
OVPR 601	Scientific Integrity	1
or OVPR 602	Responsible Scientific Conduct	
or OVPR 603	Responsible Conduct of Research	
Electives		
Select 12 credit hours of elective courses (chosen with approval of dissertation committee). Examples of potential electives include but are not limited to:		12
BIOC 503	Biochemistry, Cell and Molecular Biology	
BIOC 504	Biochemistry, Cell and Molecular Biology	
BIOC 605	Molecular Biology	
BIOS 691	Special Topics in Biostatistics	
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	
SBHD 692	Special Topics	
Research		
CCTR 697	Directed Research in Clinical and Translational Sciences ¹	22
Total Hours		54

¹

Course must be taken for a minimum of 22 credits.

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

M.D.-Ph.D. opportunity

The M.D.-Ph.D. program allows students to pursue both the M.D. and Ph.D. degrees using a coordinated program of study and apply a limited

number of M.D. requirements toward fulfillment of requirements for the Ph.D. See the dual degree program page (<http://bulletin.vcu.edu/graduate/dual-degree-ops/md-clintransci-phd/>) for additional details.

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(<https://cctr.vcu.edu/education-and-training/phd-program/>)