

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 biomedical biobehavioral concepts and theoretical frameworks to research
2. Comprehend, select and apply the appropriate study design to address specific health issues
3. Critically review the scientific literature by applying sound research knowledge and principles to the review
4. Apply data collection processes and information technology to create, maintain and secure databases and other information
5. Apply ethical principles to study design, data collection and dissemination
6. Devise an analysis plan (statistical methodology) and analyze data using methods appropriate for the study design and type of data to be obtained
7. Identify, interpret and implement relevant laws, regulations and policies related to specific studies and/or programs
8. Plan, incorporate and use appropriate methods for the dissemination and adoption of clinical research findings
9. Manage as a clinical translational research team leader the fiscal, personnel, facilities, regulatory assets and scientific integrity of a funded clinical research program
10. Use knowledge and skills related to leadership, team-building, negotiation, conflict resolution, group process and principles of ethical decision-making to manage a research team and build transdisciplinary collaboration
11. Identify and coordinate institutional resources needed to carry out theoretically based and scientifically sound high-quality funded research
12. Effectively communicate specialist-to-specialist
13. Effectively communicate specialist knowledge to nonspecialists and laypersons

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 Graduate study section for additional information on academic regulations for graduate students. (<http://bulletin.vcu.edu/graduate/study/general-academic-regulations-graduate-students>)

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 Graduate study section for additional information on degree candidacy requirements. (<http://bulletin.vcu.edu/graduate/study/general-academic-regulations-graduate-students/degree-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 Graduate study section for additional information on graduation requirements. (<http://bulletin.vcu.edu/graduate/study/general-academic-regulations-graduate-students/graduation-requirements>)

Apply online at graduate.admissions.vcu.edu (<http://www.graduate.admissions.vcu.edu>).

Admission requirements

Degree:	Semester(s) of entry:	Deadline dates:	Test requirements:
Ph.D.	Fall (preferred); rolling admissions	Applications received by Jan 10 receive priority	GRE, 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 document should be 1.5 or double-spaced with one-inch margins, in a font height no smaller than 11 points. The statement of purpose should cover the following issues in two to five pages:
 - a. Why the applicant wishes to pursue a Ph.D. in the Clinical and Translational Sciences with a concentration in cancer and molecular medicine
 - b. Background experience relevant to pursuing a Ph.D. in the concentration in cancer and molecular medicine
 - c. Research interests and potential faculty mentors with whom the individual would want to work
 - d. Description of the applicant's career goals
2. Scores from the Graduate Record Examination (GRE). Applicants **must** score at the 75th percentile or above in all sections of the GRE.
3. 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 the weekly seminar series (both at the VIPBG and in external departments) as well as 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/graduate/study/general-academic-regulations-graduate-students/graduation-requirements>), 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 core and elective courses as well as 22 in 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 CCTR 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 master's or 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 master's or 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. Particularly in the case of those pursuing the Ph.D., 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 school other than those of the student's co-advisers. Final approval of each student's advisory committee membership shall rest with the CCTR 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 grant submission 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 advisers 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. The proposal, which shall be constructed in the format of an NIH grant submission, 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. 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 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 research expertise in the area of cancer or molecular medicine, 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. The clinical activities are expected to consist of approximately one hour/week on average for Ph.D. students, but would be more intensive for M.D./Ph.D. students, in keeping with the existing requirements for that program. Both the research and clinical mentor would be on the thesis committee, which would comprise a total of five faculty members, at least three of whom are CMM faculty members. For M.D./Ph.D. students, their clinical mentors will be the same faculty member serving as their Foundations of Clinical Medicine preceptors. The students' mentors and thesis 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 spend the summer after the second year preparing for the qualifying exam. The qualifying exam will consist of writing a review paper of no more than 30 double-spaced pages, excluding references. In keeping with the interdisciplinary nature of the program, the review paper must demonstrate mastery across the core areas represented in CCM. The topic of the review paper should be developed by students in consultation with their advisers. The title of the review paper, along with a short abstract (no longer than one single-spaced page) describing the proposed content should be submitted to the concentration program director by June 15 for review by the qualifying exam committee. The QEC will review the proposal to ensure that the topic of the review paper is appropriate in that it allows the student to demonstrate command of the literature and interdisciplinary breadth. The committee will make decisions about adequacy of the review paper and, if necessary, work with the student to make revisions within approximately 14 days. Once the topic has been approved by the QEC, the student may begin writing. The review paper must be the student's own work. Drafts may not be reviewed by the student's adviser or other faculty, fellows or students. The final review paper must be submitted to the advisory committee by Aug. 1.

An oral examination of the paper administered by the student's advisory committee and the QEC must be scheduled to take place approximately two weeks after submission to evaluate the student's command of the material and to give the committee opportunity to ask questions and provide feedback. A pass/fail decision will be made at that time. 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 program director on an individual basis. In some cases this could involve a revision of the review paper or particular sections; in other cases, it may involve a repeat of the entire process including selection of a new topic and submission of a new review paper and/or repeat of the oral defense. Only one reattempt to pass qualifying exams is permitted. Students who do not pass their qualifying exams upon their second attempt will be dismissed from the program. Upon successful completion of the oral examination, the student is then officially entered into candidacy for the Ph.D. and

permitted to refine their proposed dissertation research and submit it 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 thesis research and orally defending the proposal with their thesis 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.

Dissertation proposal defense

Students who have completed the qualifying exam and the second year project are eligible to propose and defend their dissertation. The proposal should be constructed in the format of an NIH grant submission. The proposal must consist of an original research idea generated by the student in consultation with their adviser. The dissertation proposal defense should generally be completed during the fall semester of the third year. 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 with a concentration in cancer and molecular medicine.

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 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 CMM 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 CCTR.

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 thesis committee in the second fall semester.

Curriculum requirements

Required courses

BIOS 543	Graduate Research Methods I	3
or STAT 543	Statistical Methods I	
BIOS 571	Clinical Trials	3
CCTR 520	Fundamentals of Research Regulation	2
CCTR 690	Research Seminar in Clinical and Translational Sciences	8
CCTR 692	Special Topics in Translational Research	3
CCTR 801	Clinical Practicum	1
CCTR 802	Research Practicum I	1
IBMS 680	Proposal Preparation	1
OVPR 601	Scientific Integrity	1
or OVPR 602	Responsible Scientific Conduct	
or OVPR 603	Responsible Conduct of Research	
PHIS 691	Special Topics in Physiology	1
Total Hours		24

Electives

Select 12 credit hours of the following (chosen with approval of research advisory committee): 12

BIOC 605	Molecular Biology	
BIOC 503	Biochemistry, Cell and Molecular Biology	
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EPID 620	Cancer Epidemiology	
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 625	Cell Signaling and Growth Control	
Total Hours		12

Research

CCTR 697	Directed Research in Clinical and Translational Sciences	1-15
CCTR 898	Dissertation Research in Clinical and Translational Sciences	1-10

Total graduate credit hours required (minimum) 54

Graduate program director

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