RESEARCH MENTOR HANDBOOK

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Research Mentor Handbook

Introduction

Welcome and **thank you** for agreeing to serve as a research mentor for the VTC medical students. This handbook is designed to give guidelines to mentors and to their students to facilitate successfully completion of the Research Domain at Virginia Tech Carilion School of Medicine.

A recent report, "Scientific Foundations for Future Physicians," from the Association of American Medical Colleges (AAMC) and the Howard Hughes Medical Institute (2009) emphasizes the importance of the science of medicine for selecting and educating tomorrow's doctors and for improving healthcare delivery. A key element of the science of medicine is the discovery process itself, including the scientific reasoning process, understanding how data are obtained and evaluated, assessing the validity of medical and scientific claims and practicing evidence-based medicine. Putting what's best for the patient as the top priority often requires weighing competing claims from the medical literature, from colleagues, from industry as well as from the patients themselves and their families. The AAMC (2008) encouraged being aware of the potential conflicts in evaluating such claims and making decisions based on evidence. Thus, to meet these challenges and in light of our vision and our mission to provide an educational experience and to develop physician thought leaders grounded in inquiry, research, and discovery, VTCSOM has developed a program where students learn these values and competencies through participating in original medical research under the mentorship of accomplished scientists and physicians.

The Research Value Domain is incorporated throughout all four years of the curriculum with the goal of developing scientist physicians. Scientist physicians are medical practitioners whose main focus is patient care but who bring the perspective, knowledge and analytical skills of a scientist to all aspects of the practice of allopathic medicine. To train scientist physicians, the VTCSOM curriculum immerses students in the language, culture and practice of research. This begins in the classroom setting during Year 1, where original medical scientific literature is used to expose students to both seminal and contemporary research related directly to the topics that are explored in the Basic Science Domain as well as to introduce them to real-world challenges and limitations of modern medicine that require ongoing inquiry. Fundamental research principles (the scientific method, the ethical and regulatory issues associated with human and animal research, successful scientific collaboration, inferential reasoning) and contemporary tools of medical research (biostatistics, epidemiology) are introduced in the context of real medical scientific literature, allowing students to experience how these concepts are applied in actual research. Students have in-class presentations from faculty members describing on-going research (Research Live!) as well as a formal Medical Scholars seminar series that integrates the Research and Basic Science Domains from highly accomplished scientist physicians who are conducting research on topics that the students study in their first year. This immersion in the language of research fosters life-long learning.

By actively participating in research under the guidance of a skilled mentor, VTCSOM students learn by doing research. At the conclusion of Year 1, students have developed a **<u>hypothesis-driven</u>** research project in conjunction with their mentor, and the students' participation in the Research Value domain becomes predominantly self-directed. Blocks of time are subsequently designated for the student to be **<u>fully engaged</u>** in their research project in each year of the curriculum. In addition to these scheduled research times, students are also expected to maintain an active research effort during intervening periods over the entire four years. This approach will prepare the student for the practice of evidence-based medicine where they will be required to integrate patient care with the discovery process on a daily basis. Interested students may also pursue a Masters or Ph.D. degree after Year 2 or 3.

The culmination of the Research Domain is a publishable-quality manuscript that may either stand alone or may be integrated into a larger body of ongoing work from the mentor's research program. To graduate, students must submit their manuscript **<u>for approval</u>** to an evaluation committee and make a formal oral presentation on their work. In addition, the student's work is submitted to an appropriate medical or scientific forum for presentation. The VTCSOM Medical

Student Research symposium provides a venue for the VTCSOM community to learn about the accomplishments of each year's graduating class, in both poster and oral format. The Research Domain activities during Year 4 thus provide the students the opportunity to demonstrate their successful mastery of both the language and practice of research as future scientist physicians.

Research Opportunities for VTCSOM students

The **Virginia Tech Carilion School of Medicine** (VTCSOM) is a public-private partnership between Carilion Clinic and Virginia Tech. VTCSOM students are encouraged to explore research project possibilities at both institutions. Access to researchers at the Virginia Tech Carilion Research Institute, Carilion Clinic and Virginia Tech provides a broad range of topics and research modalities to accommodate many particular student research interests. A brief description of the facilities and programs at each institution is provided below.

Virginia Tech (VT) has a number of outstanding programs that integrate well with medical research. These include programs in veterinary medicine, biomedical engineering, computational biology, bioinformatics, biology, biochemistry, and nutrition, foods and exercise and psychology. It also has a highly interdisciplinary program in translational biology, medicine and health (TBMH) that has focus areas in neuroscience, metabolic and cardiovascular science, infectious disease and immunity, health implementation science, and cancer. VT has joint degree programs and affiliation relationships with the Wake Forest University School of Medicine and Georgetown University. The institution is ranked 44th in university research expenditures (NSF report, FY2011) in the United States and generated $504 million for research programs in fiscal year 2015.

Carilion Clinic (CC) is an integrated physician-hospital network in Virginia, anchored by Carilion Roanoke Memorial Hospital, which includes a new children's hospital, an advanced heart treatment center, and floors designed for women's care. Overall, Carilion provides services for the metropolitan Roanoke population of 250,000 and has a referral area of one million people. Carilion Roanoke Memorial Hospital, the inpatient clinical training site, is licensed for 765 beds, and there are six additional hospitals in the system. The system also includes the Jefferson College of Health Sciences which offers students degrees in 21 programs in a variety of healthcare fields, including nursing, physician assistant, occupational therapy, and physical therapy. Carilion has been involved in graduate medical education for over 60 years, and currently employs 230 residents and fellows training in 23 ACGME-accredited programs.

Virginia Tech Carilion Research Institute (VTCRI), opened in 2010, is managed by Virginia Tech in close collaboration with Carilion Clinic and has its own building adjacent to the VTCSOM. Research conducted by VTCRI scientists is aimed at understanding health and disease at a variety of levels from molecular to cellular to organ systems to whole organism (including humans) to behavior to social interactions, education and policy, and to the development of innovative diagnostic tools, treatments and therapies that contribute to the prevention and solving of existing and emerging problems in contemporary medicine. Some of the critical platform technologies at the VTCRI include interactive functional human brain imaging, optical imaging, electrophysiology, molecular genetics, informatics, cryo-electron microscopy, ultrasound technology development, sophisticated human behavioral testing and deep phenotyping as well as educational research technologies and platforms to study individual children and whole populations. Primary research focus areas at the VTCRI include developmental and translational neurobiology, addiction and substance abuse, health behavioral science, cognitive and computational neuroscience, cardiovascular science, regenerative medicine and wound healing, immunology, cancer biology, neurorehabilitation and human development.

To facilitate the coordination of research efforts across these institutions, the Executive Director of the VTCRI also serves as the Senior Dean for Research at VTCSOM and as the Vice President for Health Sciences to effectively integrate research programs between the VTCSOM, Carilion Clinic and VT, thereby providing continuity for the various constituents.

In addition to research opportunities at the institutions listed above that have a direct relationship with VTCSOM, students may explore possible research projects at outside institutions, in **rare situations.** This is not generally encouraged due to the requirement that the student be actively engaged in research throughout the four years of their medical curriculum, and

successfully maintaining an active research project off-site is challenging, particularly during Years 3 and 4. However, if an outside mentor is approved **after consultation** with the Senior Dean for Research and Assistant Dean for Research, an **on-site** VTCSOM faculty member must be identified to serve as **co-mentor**. If a student chooses to pursue research outside one of the core institutions, it is critical that potential difficulties in doing research off-site be discussed with the Senior Dean for Research and Assistant Dean for Research prior to any commitments on the part of the student to the potential mentor. After this discussion, the student should prepare a brief proposal that summarizes the proposed project and outlines what the student's responsibilities will be. The proposal should be accompanied by the proposed mentor's curriculum vitae (CV), as well as a commitment letter from this mentor. This proposal will be reviewed for approval by a committee composed of the Senior Dean for Research, the Senior Dean for Academic Affairs, the Assistant Dean for Research, the Assistant Director of Research Education, and the on-site co-mentor.

VTCSOM Research Curriculum

The research curriculum at VTCSOM is a four-year program.

Year 1 (Blocks I – IV): During the first year, students receive classroom-based research instruction designed to equip them with the tools needed to pursue one of the many types of medical research possible in our school, in our hospital, at VTCRI and at Virginia Tech. This core curriculum includes topics such as:

- the scientific method
- learning to develop appropriate research questions and hypotheses
- working with scientific literature and databases
- experimental design
- the protection of human and animal research subjects
- defining translational research
- biostatistics
- epidemiology
- scientific collaboration
- scientific misconduct

VTCSOM has defined 10 core competencies and 60 objectives that will be addressed throughout Year 1 (see **Appendix 1**). These are detailed on the course website within Blackboard. During Year 1, VTCSOM students will spend 4 hours each week on classroom research instruction in the form of lectures, problems, and experiential learning activities, as well as Research Live! or Medical Scholar Seminar presentations,

The portion of the first-year curriculum entitled **"Research Live!"** consists of presentations from faculty from Virginia Tech, Carilion Clinic and the Virginia Tech Carilion Research Institute who are eager to highlight research opportunities available to VTC students under their guidance. These presentations allow students to not only interact with potential mentors but also to become adept at listening to scientific lectures on a variety of topics central to the biomedical, behavioral and health sciences. Research Live! presentations begin during the first week of medical school and continue weekly until the end of January. Research Live! introduces students to approximately 50 VTCSOM faculty researchers who have expressed an active interest in mentoring medical students on research projects.

The Timothy A. Johnson, PhD Medical Scholar Seminar series provides students the opportunity to learn about ongoing research programs from nationally and internationally prominent physicians from other leading institutions who are actively engaged in research. As part of this exposure, students participate in Methods in Logic (MIL) sessions where they present research publications of the visiting scholars prior to the Scholars' visit to VTC under the guidance of expert faculty facilitators. The scientific approaches used, as well as the conceptualization, experimental design and inferential processes are particularly emphasized in MIL. Students also have the opportunity to meet the visiting scholar in small groups to facilitate further interactions and discussion as well as to provide networking opportunities in the national biomedical research community. The eight visiting scholars (two per block) represent a range of career paths including M.D.s in clinical practice who carry out research and M.D./Ph.D.s who have active research programs in addition to clinical practices. Research instruction, MIL, Medical Scholar Seminars, and "Research Live!" occur in three 80-minute sessions each week during Year 1.

By **March 1 of Year 1** (prior to the beginning of Block IV), students are expected to have identified a mentor. Students are responsible for engaging faculty members of interest in substantive discussions about the nature and scope of the project being proposed by the mentor. Students are encouraged to consider projects in all areas of research, including

basic, translational and clinical research, population-based and policy research, as long as the health-related research is original, scientifically sound and rigorous, and '**hypothesis-driven**'. The hypothesis to be tested may be one originated by the student or may build on a hypothesis generated as part of an ongoing project of the mentor and her/his team. Moreover, the students may participate in discovery-based research that includes the exploration and analysis of existing databases, as long as this type of research meets the criteria above, and the student and mentor generate a hypothesis to be evaluated in the framework of the existing database(s) to be studied.

The student and potential mentor should discuss the nature of the mentoring provided by the faculty member, including other members of the mentor's team who may contribute to the student's mentoring program. After the potential mentor and student have agreed upon expectations such as time commitment required to complete the research, skills to be acquired, and frequency and type of interactions with the mentor and colleagues, the mentor and student will complete the **Research Mentor Selection Form (due at the end of Block III)**, acknowledging their agreement.

In **Block IV** of Year 1, students prepare a structured abstract, a research oral presentation and a written prospectus that outlines the background and justification for their planned project with a literature review, a statement of the specific aims and hypothesis to be tested in their project, a detailed description of the methods to be employed, along with any preliminary results the student may have collected, a description of expected outcomes, and potential pitfalls and strategies for dealing with them. The oral presentation and prospectus are prepared in close consultation with the mentor, and the student's efforts are evaluated by members of the Research Domain evaluation team. The prospectus serves as the final assessment for Block IV, in lieu of a final exam.

Following Block IV, a **3-week M1 Research** Block is built into the VTCSOM schedule for a preliminary launch of the research effort by the student between Years 1 and 2. During the M1 Research Block, the expectation is that students will be <u>fully engaged in activities directly related to the approved Research Domain project</u>. The project is the primary responsibility for the student during this period. The project can be carried out in any appropriate venue such as a lab, a clinic, another institution, a school or in a community setting. <u>It is not acceptable during this period for the student to be on vacation</u> or to be in a location for activities other than those directly required for full engagement, working on the research project. Appropriate planning by the student with approval of the mentor is necessary to optimize the designated research time, including obtaining the necessary approvals, protocols, subjects, lab materials and supplies, access to databases, etc. Students also are expected to avail themselves of opportunities to interact regularly with their mentor through lab meetings, individual meetings, team discussions of clinical research activities, as appropriate and necessary. In some cases, students may spend some of this three-week period at other sites requiring special facilities, access to clinical populations, databases, etc. as pre-arranged and mutually agreed upon by the mentor and student. At the end of the M1 Research block, students summarize their progress using the Progress Report Form (See **Appendix 2)** and submit to their mentor for formal summative feedback and evaluation of student performance. Once this progress report is signed by the mentors, students upload the report on Blackboard by the last Friday of the block. While the **three-week period is mandatory**, students who are interested may spend up to 4 additional weeks working on their research project (the following 4 week vacation period), although this is strictly voluntary and is not part of the official curriculum.

Year 2 (Blocks V-VII and Research Block)

During the second year, students communicate with their mentors throughout each block; this includes having at least 2 meetings per block to ensure that adequate progress is being made. The expectation is that students will spend a minimum of **4.5 hours per week** engaged in these activities (see Sample Weekly Schedule, **Appendix 3**), and this level of time commitment is reflected in the course schedule that students receive each block. Students may also choose to spend additional time, such as the Special Studies week after each block (if they are not required to remediate), as well as unstructured time throughout each week working on their research projects, although this is voluntary as previously

arranged with their mentors. Student work during this time can include a range of activities necessary for advancing their research project, including developing specific aims and a proposed calendar, literature reviews, advanced study of a methodology or technique required for the project, or collection of initial datasets. At the end of each block, students summarize their progress using the Progress Report Form (See **Appendix 2)** and submit to their mentor for formal summative feedback and evaluation of student performance. Once this progress report is signed by the mentors, students upload the report on Blackboard by Thursday of Exam Week.

At the end of Block VIII in Year 2, students should be prepared to perform the major parts of the experimentation and/or data collection during the M2 Research Block.

During the M2 Research Block (eight to nine weeks following Block VIII in the spring of Year 2), the students are <u>fully engaged</u> in carrying out the major portion of the experimentation/data acquisition phase of their research projects, consistent with the agreed-upon program and time commitment previously arranged with their mentor in order to successfully fulfill the project's goals. This block is to be devoted to the research project; <u>it is not to be used for any other activities, including vacation time.</u>

During late spring/early summer of Year 2, students are required to take the USMLE Step 1 board exam. A six-week period of time is devoted exclusively to exam preparation.   This intensive study period and exam can be scheduled before or after the Research block. Most students opt to conduct the Research Block prior to the Step 1 exam, but interested students are encouraged to discuss the possibility of taking the Step 1 exam prior the Research Block with the approval of the Dean of Student Affairs and the Assistant Dean for Research.

At the end of the Research Block, students will <u>orally present their progress</u> to their mentor, co-mentor(s), and a VTCSOM faculty evaluation team selected by the Senior Dean for Research and Assistant Dean for Research based on appropriate expertise and availability. The oral presentation will briefly describe the overall research question and its significance, state the hypothesis(es) being tested, and focus predominantly on progress that has been made, with a detailed description of results obtained to date. The presentation should conclude with a detailed timeline that outlines the remaining items to be done during Years 3 and 4 and whether additional research rotations are planned. The evaluation team will determine whether the oral presentation represents satisfactory progress or whether changes need to be made to the research plan or student's schedule to ensure successful completion of the Research Domain curriculum component prior to graduation. If needed, students will be scheduled for a second oral presentation or another form of follow-up with the evaluation team during Year 3.

Optional Research Year

Students also have the option of taking a year between Years 2 and 3 to devote to full-time research with their mentor. This research must be approved by the Research Domain.   The "research year" must be planned well in advance of Year 3; discussion about this particular option should be initiated shortly after identifying a research mentor. During the research year, the student will be enrolled in a Master's degree program at Virginia Tech with approvals from the VT program director and VT graduate school to accept the student's first two years of the VTCSOM curriculum as satisfying the program's necessary course requirements. In addition, the successful completion of the student's proposed research project must be deemed satisfactory to fulfill the thesis requirement for the Master's degree program. During this period, the student will be on a leave of absence from the VTCSOM and will be considered a graduate student at Virginia Tech. The student may receive financial support through various funds available to the mentor (e.g., research grants, university or clinic funds, the VTCSOM, an extramural funding agency, or some combination of these sources). This financial support is expected to meet the standard for any other graduate student at Virginia Tech, and must be approved by the VT graduate school. After completing the requirements for the M.S., such students would return to the VTCSOM curriculum.

Years 3 and 4

During Year 3, all students have a required 4-week research rotation. Additional elective time, up to 4 weeks, may be used for a research elective. Decisions regarding this additional 4-week period must be in consultation with the student's research mentor, the Assistant Dean for Clinical Science (Years 3& 4) and the Associate Dean for Student Affairs. In Year 4, all students have a required 2-week rotation. Additional 2-week or 4-week rotations may be required and can be added to Year 4, and decisions for how the students choose to schedule those weeks will be in consultation with the student's research mentor, Assistant Dean for Clinical Science (Years 3 &4), the Associate Dean for Student Affairs, the Senior Dean for Research, and the Assistant Dean for Research. At the end of any Year 3 or Year 4 rotation, students summarize their progress using the Progress Report Form and submit to their mentor for formal summative feedback and evaluation of student performance. Once this progress report is signed by the mentor, students upload the report on Blackboard by the last Friday of the rotation. Data collection and analysis should be largely finished prior to the beginning of Year 4.

Completion of Student Research Projects

- Completion of Manuscript and Oral Presentation

  At the end of Year 3, each student will prepare a draft written report of *publication quality* that may stand alone or may be incorporated into a larger body of work for future submission for publication by the mentor(s) and other colleagues. The format will be provided by the Research Domain and will follow the format of a manuscript for publication in a professional peer-reviewed journal. The report should include an introduction explaining the background and significance of the research question, a detailed methods section, a description of the results that includes figures and/or tables, and a discussion explaining what was learned, caveats in interpretation, and a summary of next steps, as well as appropriate scholarly literature citations.

  Each student will turn in their draft manuscript and deliver an oral presentation on their research project's outcome to the Research Domain Evaluation Committee (members selected by the Senior Dean for Research and Assistant Dean for Research based on appropriate expertise and availability) prior to the beginning of Year 4 and 10 days before the scheduled oral presentation. Copies of the draft manuscript will be provided to the Evaluation Committee members at this time, in preparation for the oral presentation.

  The Year 4 oral presentation is 15 minutes, with another 15 minutes for questions and discussion. Each student's mentor and co-mentor(s) are required to attend if at all possible. The Evaluation Committee evaluates the presentation, and each presentation is attended by either the Senior Dean for Research, the Assistant Dean for Research or the Assistant Director of Research Education. The written research report and the oral presentation will be evaluated as satisfactory or unsatisfactory based on how successfully the project addressed the proposed hypothesis and how well the student demonstrates understanding of the methodology, analysis, and future directions of the project. If the written report and/or the oral presentation are deemed unsatisfactory by a majority of the Evaluation Committee, the student is given feedback as to what areas need to be improved. The student will address the committee's concerns over the course of Year 4 and resubmit the written report and/or present the project again before March 1 of Year 4.

- Medical Student Research Symposium

  Each student is also expected to attend and present a poster on the outcome of their research project at the VTCSOM Medical Student Research Symposium held in the spring of Year 4.

- Conference submission

Each student is also required to <u>submit</u> an abstract of their project for presentation at an external meeting (local, state, regional or national) as a poster or oral presentation before graduation. Some funds from the VTCSOM may be provided to help defray travel costs for meetings. In order to access these funds, the student's abstract must be accepted for presentation at the conference. In addition, the student must present the project originally approved by the Research Domain and they must serve as first author. This allows students the opportunity to present their work at a professional forum appropriate for the standards of the discipline associated with their research topic and to gain experience in interacting with other colleagues in that field from a variety of institutions.

Research in Translation Medicine Certificate from Virginia Tech Graduate School

The Year 1 and Year 2 Research Domain curriculum serves as the core of the requirements for a Certificate in Research in Translational Medicine (RTM) offered by Virginia Tech. All VTCSOM students are dual-enrolled in the VT Graduate School during Years 1 and 2, and upon successful completion of the Year 1 and 2 Research Domain curriculum, earn the RTM certificate. This will be included on their CV and residency application.

Research supply money

VTCSOM provides (pending board approval each year) money to support the research being conducted by each medical student during Years 2, 3, and 4 (currently $1000 per year, fiscal year begins in July). Allowable expenses include equipment, supplies, consumables and/or services that <u>are necessary for and will be used to conduct</u> the student's research project. Purchases can range from supplies such as chemicals, reagents, software, subject recruitment incentives, or equipment parts to services such as statistical consulting or DNA sequencing. <u>Money cannot be used for capital equipment purchases or expenses associated with travel.</u>

Purchases should be evaluated and approved by the mentor as necessary and appropriate for a particular student's research project. For projects in which mentors are primarily based at Carilion Clinic, purchases are reimbursable or can be initiated through VTCSOM. For projects in which mentors are primarily based at Virginia Tech, purchases can be made using the standard lab purchasing process by applying funds from the student's money; direct reimbursement of student out-of-pocket expenditures is not possible from Virginia Tech.

Research travel money

There is travel money (<u>up to $1,600</u>) available for students to <u>present their Research-Domain approved research study</u> at ONE scientific meeting. Travel can be either reimbursed or can be arranged prior to the conference to limit out-of-pocket expenses. Students who plan to take advantage of this travel funding need to complete a <u>VTCSOM Student Time Away Request Form</u> and a Research Time Away <u>Request Addendum</u>. <u>Once a student has acquired the necessary signatures</u>, the forms should be submitted to the Research Domain manager.

This is independent from and in addition to the process described in the Student Handbook regarding requests for professional time away through the Associate Dean for Student Affairs, so students should refer to the Student Travel policy in the VTCSOM Student Handbook.

Other research support

To support our medical student researchers and their mentors, VTCSOM offers several services. VTCSOM partners with Carilion Clinic to provide on-site office hours with representatives of the Carilion Clinic Institutional Review Board and with the Health Analytics Research Team (HART).

IRB representatives are available to assist with and to help expedite the IRB application/approval process. Students performing human subjects-based research are HIGHLY encouraged to take ownership of their project's application process, as it will provide an invaluable learning experience.

The Carilion Clinic HART can answer questions about and assist with data extraction and merging from the electronic medical record, health databases, and other "big data" sets. Carilion Clinic HART can also provide access to and support for REDCap, a web-based electronic data capture application. Members of the HART should be consulted in the earliest stages of project planning and study design, to ensure feasibility, availability and efficiency of data collection.

Biostatistical support for VTCSOM student projects is available during office hours offered both by members of the Carilion Clinic HART and by biostatistics VTCSOM faculty members, with the expectation that biostatistical analyses are largely performed by each student for their own study, with appropriate guidance and consultation.

Finally, a part-time clinical research coordinator is available for assignment to projects identified as needing such assistance by the Research Domain office. If the student and mentor feel their project will benefit from such assistance, they are required to request this from the Research Domain faculty.

Letters of Distinction for the Research Domain

Students are eligible to receive recognition for outstanding performance in the Research Domain through the VTCSOM Letters of Distinction mechanism (see VTCSOM Student Handbook for more information). Letters of Distinction in all domains are awarded at the end of Year 2 and again during Year 4. Below are the criteria for receiving this recognition in Research Domain.

Academic Performance in the Research Curriculum: Students will be selected based on both their academic performance in the Year 1 course and on information about the students' commitment, productivity and work ethic, creativity and reasoning on their research project provided by their research mentors. (Up to 8 Awards at the end of Year 2)

Research Scholarship:

During their final year of study, students will submit a written publication-quality manuscript and present their research orally to an evaluation committee composed of experts and accomplished researchers, scientists and clinicians selected by the Senior Dean for Research and Assistant Dean for Research, who also oversee the evaluation process. Immediately following the oral presentation, the evaluating committee will consider whether to recommend the student to be placed in the finalist group for consideration for a Research Domain Letter of Distinction in the category of "Research Scholarship". Recommendations will be made based on the overall quality, significance, relevance, innovation, thoroughness, rigor and clarity of the student's findings as presented in the written document, as well as their understanding, ability to effectively communicate, and respond to questions during the oral presentation. Final selections for up to eight (8) letters of distinction in this category will be made by an ad hoc committee assembled and overseen by the Senior Dean for Research. Some or all of the students selected will present their work as a formal 15-minute oral presentation at the annual VTCSOM Medical Student Research Symposium to which all 4 classes of medical students, the students' mentors, VTCSOM faculty, and the community will be invited. (Up to 8 Awards throughout Year 4)

Research Productivity:

Students will be asked to catalog the following:

1) Any formally presented papers or abstracts at official meetings

2) Any papers published, in press or officially accepted for publication

3) Any grants submitted or awarded on which they are listed as primary or co-principal investigator or key personnel. (Include the granting agency, grant title, grant status, period and their role on the grant indicated)

4) Any official recognition received for their primary research project activities (e.g., foundation or funding agency awards or fellowships)

5) Any disclosures or patents, based partly or wholly on their research where they are officially listed as contributing to the disclosure.

6) Any "supplementary research activities" (scholarly activities in which they are involved that are not a result of their Research Domain project).

An ad hoc committee assembled and overseen by the Senior Dean for Research will select up to eight (8) students to receive recognition in this category. (Up to 8 awards throughout Year 4)

<u>Selection Committee:</u>

The Research Distinction ad hoc committee will be formed to review all documents submitted and generate a list of the top eight most distinguished students in the categories of Research Scholarship and Research Productivity. The committee will be co-chaired by the Senior Dean for Research and the Assistant Dean for Research, who will select three other members. Their recommendations will be forwarded by the Senior Dean for Research to the Associate Dean for Student Affairs.

Highlights of the Research Domain Curriculum and Project Requirements

The Research Domain provides an opportunity to learn and carry out the fundamental principles and application of research for VTCSOM students. It begins in Year 1 using lectures, problems, and experiential learning activities. During their first year, students also are exposed to researchers and potential research projects in a series called "Research Live."

- Each student is required to complete a scholarly research project in order to graduate.
- The project may be in the realm of basic, translational, clinical, population-based, or policy science, as long as it is health-related, original, scientifically sound and hypothesis-driven. The project may involve discovery-based research that includes the analysis of existing databases.
- The hypothesis(es) to be tested may be originated by the student or may build on those generated as part of an on-going project of the mentor.
- Students are guided in their project by a mentor and co-mentors, with yearly input from Research Domain faculty.
- Students are responsible for identifying and engaging potential mentors in discussions about the proposed project.
- The project, mentor and committee are selected before the beginning of Block IV.
- The committee provides regular feedback to the student on her/his progress - specific timelines and target goals are established to help ensure continuous progress.
- Before undertaking the project, there should be agreement between the mentor and the student as to the expectations for the student to complete the proposed project in terms of time committed, skills to acquire, interactions with the mentor and colleagues and the final product to be completed as well as the nature of the mentoring provided by the faculty member including specification of other members of the mentor's team who may contribute to the student's mentoring program.
- In Block IV, students prepare a *research prospectus* with a brief introduction and statement of the question to be addressed with a short literature review, statement of specific aims and specific hypothesis(es) to be tested, methods to be employed along with any preliminary results the student <u>may</u> have collected, a description of expected outcomes and potential pitfalls and strategies for dealing with them. The prospectus is evaluated and approved by the mentor and a faculty evaluation team.
- Between Years 1 and 2, the student spends three weeks <u>fully engaged</u> in the implementation of their research project. Students may spend up to the following additional 4 weeks working on their research project.
- During <u>each block</u> of Year 2, students should communicate regularly with their mentors and have at least 2 meetings to ensure that adequate progress is being made. Mentors evaluate their student's performance at the end of each block to verify satisfactory performance.
- In the M2 Research block, the students are <u>fully engaged</u> in carrying out the major portion of the experimentation/data acquisition phase of their research projects, consistent with the agreed-upon program and time commitment previously arranged with their mentor in order to successfully fulfill the project's goals. Other than necessary preparation time for the USMLE Step 1 exam, this block is not to be used for any other activities, including vacation time. An oral presentation describing research progress to a committee of evaluators is scheduled during this block.
- Students have a 4-week rotation in Year 3 and a 2-week rotation in Year 4 for completing their research and may also utilize elective periods for additional research during Years 3 and 4.
- Successful completion of the research project is based on: i) a written report of *publication quality* that may stand alone or be incorporated into a larger body of work for future submission for publication by the mentor(s) and other colleagues; ii) presentation of the project orally to a committee of evaluators; iii) submission of the research to an appropriate professional venue for presentation as a poster <u>or</u> platform talk; and iv) presentation of a poster detailing the outcome of their research project at a VTCSOM symposium to be held in the spring of Year 4.

- The written report should be in the VTCSOM-approved format, resembling a manuscript for publication in a professional peer-reviewed journal suitable to the field of study. The report should include: an introduction explaining the background and significance of the research question, a detailed methods section, result figures and tables, and a discussion explaining what was learned, caveats in interpretation, and a summary of next steps, as well as appropriate scholarly literature citations.

Summary of Time Available In VTCSOM Curriculum for Individual Research Projects

When?	Time
Summer Research Experience (3 weeks between Years 1 & 2)	120 hours
Blocks V-VIII (4.5 hours/week for each 6-week block)	108 hours
Research Block (8 weeks, 40 hours/week)	320 hours
Year 3 Research Rotation (4 weeks)	160 hours
(students may elect 2 to 4 additional research weeks during Year 3)	80 to 160 hours **(optional)***
Year 4 Research Rotation (2 weeks)	80 hours
(students may elect up to 8 research weeks during Year 4)	320 **(optional)***
Total (including optional hours)	1268 hours

* must be in consultation with the student's clinical advisor and the Associate Dean for Student Affairs

Role of Mentor and Co-Mentor

What does it mean to be a mentor? By agreeing to be a research mentor for a medical student, faculty are committing to 3 years of research supervision. As mentors, faculty will help identify an original 'hypothesis-driven' project that is expected to significantly improve, delineate or expand our knowledge and understanding of a relevant, health-related issue. We anticipate that the research project proposed will have been vetted by the mentor to ensure a balance between scientific rigor and realistic expectations of a medical student with variable levels of time allotted over the course of a 3-year program. Since we are interested in teaching the research process and not focused on a particular research outcome, we have some flexibility in making the project 'interest-driven' as well as 'hypothesis-driven'. Projects, therefore, may come from a variety of settings (wet labs, computational labs, clinics, community settings, schools, etc.). Importantly, the scope of the project defined by the medical student and the mentor will serve as the backdrop for us to achieve our instructional objective – *developing physicians with enhanced research skills (scientist physicians).*

Mentors will <u>*assist*</u> the student in

- understanding the scope and nature of the work to be performed
- establishing testable hypotheses related to the work as well as suitable specific aims and study designs to test them
- obtaining the skills and methodologies necessary to perform the investigational components of the studies
- performing experimental studies
- interpreting the experimental results obtained
- preparing, editing and submitting a summary document of publishable quality, preparing a formal oral presentation of the student's work and preparing an abstract for submission for consideration at an appropriate meeting

What will my weekly time commitment be? In general, mentors will be expected to have a regularly scheduled one-on-one meeting (at least 2 per block during Year 2) with their medical students during Years 2-4 of their medical education. During the first months, when training and instruction is expected to be more intense, meetings may be more frequent.   In addition, mentors may want to have more comprehensive meetings with the student during designated research blocks or near the due dates for block progress reports. Mentors are encouraged to include students in other meetings that occur as part of their scholarly activities such as lab meetings, meetings with clinical coordinators, research teams, journal clubs, attendance at grand rounds, visiting colleagues' presentations, etc. Mentors are also encouraged to clearly communicate their expectations regarding expectation of attendance and participation at such meetings, keeping in mind the classroom and clinical obligations required of the students by the medical school curriculum. Students are expected to follow through on the agreed-upon expectations in a professional manner and to fully engage in the research process as one of the four equally important components of their curriculum at VTCSOM.

How will I evaluate the student's progress? Mentors will be expected to evaluate their mentees each block. Your signature (electronic or in pen) on each block progress report (See **Appendix 2)** documents that you have given the student formative feedback about their performance during the block.   During the M1 Research block (3 weeks at the end of Year 1) and the M2 Research block (8 weeks at the end of Year 2), mentors and students should develop measurable objectives prior to beginning work in order to ensure that both student and mentor expectations are reasonable and in agreement. This will ensure adequate progress during these critical research periods. Students should then be evaluated on whether or not they achieved these objectives.

Students are expected to provide their mentors with completed progress report forms in a timely fashion. Students should be sure that mentors are available during the days prior to the evaluations to ensure completion. Mentors are expected to

submit their evaluations (via the progress report form) to either the student or the medical school promptly at the end of each grading period, because students must pass each domain (of which Research is one of four) to pass the entire block. If mentors do not provide a signed evaluation approving the student's progress for that block, the student will receive a grade of "incomplete" for that block. If such an "incomplete" is not satisfactorily addressed before the end of the next block, it may convert to an unsatisfactory grade. If a mentor determines that a student's performance warrants an "unsatisfactory" evaluation, the student will work with the mentor to remediate the grade during Special Studies Week. If the student does not successfully remediate, he/she will receive an "unsatisfactory" grade for that block, will be placed on academic probation, and will need to remediate that grade prior to advancing on to the next year. If a student receives a second grade of unsatisfactory in any of the value domains while on academic probation, they will be referred to the Medical Student Performance and Promotions Committee (MSPPC) for a hearing to determine if the student will be permitted to continue her/his studies at VTCSOM. More details regarding this process can be found in the Student Handbook.

What does it mean to be a co-mentor? In addition to the mentor, each medical student is encouraged to identify co-mentors, who, along with the mentor, help guide the student's research endeavors. Co-mentors deliver additional levels of insight and expertise to the student's research experience and collaborate with the principal mentor in designing, monitoring and evaluating the research performed by the student. Co-mentors should meet with the student periodically during the year as part of the mentoring team that will evaluate and assess the progress of the research. Periodic discussions between the mentor and the co-mentors to assess the student's progress will be very important to help the students meet required goals.

Can I mentor and/or co-mentor more than one student? Absolutely.

Who funds this research? Students do not receive stipends for their research work since the activity is part of their educational curriculum. Research groups are therefore not expected to identify stipend, tuition or health funds to support a medical student working on a project. Participating research groups are expected, however, to use research reserves as *in-kind* support for funding the work being performed by the medical student. Mentors are not compensated for their involvement, however, since those efforts are viewed as *in-kind* as well.

There is currently $1000 per student in each of Years 2, 3, and 4 to purchase supplies necessary to conduct research (see details in above section). This money is either transferred to the faculty member's institutional accounts or is reimbursable through VTCSOM. Funds may not be used for capital equipment purchases or travel.

Will the students have to publish to graduate? Students are expected to produce a manuscript judged by the evaluation committee to be of "publishable quality." It is expected that the mentor and the student will both want a manuscript to be submitted, but publication, as such, is not required for graduation. It is recognized that, with the limited time available and the many other competing demands on the students' time, the contributions of the student may not always be able to stand alone as the basis of a publishable manuscript in the particular discipline, however, contributions should at least represent a component of a larger study that may be ongoing in the mentor's research group. As such, it should be written in the larger context of the greater study and when the timing is appropriate, the student's contribution could be applied to a larger publication of which they may be a co-author. Students should also submit their work to at least one external, appropriate state, regional or national association or professional scientific or medical society to present it in either posters and/or platform presentation format.

Will students be trained to be physician-scientists? That is not our intended primary goal, although for those with that interest, they will be well-prepared to obtain additional training to build on their strong research experiences. We are primarily committed to developing a cadre of *scientist physicians* who make ongoing scientific contributions in their

respective fields, either at the bench, at the bedside or in their practice of medicine that, in the aggregate, exceeds prior efforts to merge medicine with research. We do expect the graduates of this program to be highly sophisticated and knowledgeable consumers of biomedical information and effective advocates for their patients who can discern and communicate valid medical information and claims on behalf of their patients. We have recently established a course of study that will lead to an MS in Translational Biology, Medicine, and Health with the addition of select coursework, an academic thesis and qualifying examination. Our hope is that highly motivated students will take advantage of this offering to be completed during one additional year out after the successful completion of their second year to concentrate fully on their research project to complete the Master's degree. In addition, an MPH option, also requiring an additional year of study, is available; if the student's Research Domain project aligns appropriately, it may contribute to the Capstone in Public Health requirement for this degree. Qualified student in good standing who would like to obtain the PhD degree as well as the MD degree may do so with permission of the Dean by extending their time from the TBMH MS program to complete a PhD level dissertation.

What are the benefits for me of having a medical student join my research team? The medical student, first and foremost, will be a bright, intellectually curious, motivated and hard-working addition to your team. That individual will be the driving force to complete a project of mutual design and move your team's research efforts forward. The student will be working against a defined timeline and eager to learn from you, your collaborators and the other students you interface with in your research. The student is aware of the defining requirement to produce a scholarly work of publishable quality and, indeed, will receive maximum benefit from the research performed (e.g., competitive residency match) with tangible evidence of accomplishment.

Important contacts if you have questions;

Senior Dean for Research – Michael Friedlander, PhD

Senior Dean for Academic Affairs – Rick Vari, PhD

Assistant Dean for Research – Leslie LaConte, PhD

Assistant Director of Research Education – Jennifer Vaughn, MD, MSPH

Manager, Research Domain – Lauren Harris, MS, MEd

Last modified, 7/28/17

Appendix 1: Research Domain Core Competencies

Research Domain core competencies that graduates will demonstrate are listed below. Individual objectives associated with each core competency can be found for each block in Blackboard.

1. **Scientific Method:** Graduates will be able to identify, understand and apply the scientific method in both basic and clinical science settings.
2. **Thinking Like a Scientist Physician:** Graduates will be able to frame questions using the tools and language of the scientist physician.
3. **Basic, Translational, Clinical and Population-based Research:** Graduates will be able to describe the research continuum that translates scientific discoveries into clinical applications.
4. **The Protection of Human Subjects in Research:** Graduates will be able to identify the ethical foundations of human research and apply the associated regulatory principles and procedures.
5. **The Use and Protection of Animal Subjects in Research:** Graduates will be able to identify the ethical foundations of animal research and apply the associated regulatory principles and procedures.
6. **Biostatistics:** Graduates will be able to identify, define and apply the basic tools of biostatistical analysis.
7. **Epidemiology:** Graduates will be able to define basic epidemiologic concepts and describe general epidemiologic domains.
8. **Keys to Successful Collaboration:** Graduates will be able to understand and apply the components of collaborative research.
9. **Introduction to Medical Literature:** Graduates will have advanced competencies in literature search, citation, report type and sources
10. **Medical Research and Scientific Misconduct:** Graduates will be able to interpret and apply legal principles to medical research in clinical and basic science domains.

Appendix 2: Sample Progress Report form.

Research
VTC | Virginia Tech Carilion
School of Medicine

Block V Research Report - 2017
(Due by Thursday, August 17, 2017 at 5pm)

Student Name:

Mentor: Co-Mentor 1:   Co-Mentor 2:

Working Title of Research Project:

Instructions for Students: This form should be completed at the end of the block to report progress on your Research Project. In this narrative, you should <u>outline the achievements</u> *you made and* <u>any obstacles you encountered</u>. *Include* <u>documentation supporting your progress</u> *(preliminary data, draft surveys, draft protocols, documentation of meetings with support services such as LISA or OSP). Specifically address progress you have made on* <u>the specific aims</u> *you outlined in your prospectus. The report should conclude with an* <u>updated research timeline</u> *and **a brief (1/2 page) description of what you and your mentor plan for you to accomplish during the next block**.*

*When completed, you should meet with your mentor, discuss your progress, problems and plans, solicit approval of your progress report, and submit a signed copy electronically **via Blackboard**.*

Part I. Progress Report on Block Activity: *(Use as much space as you need.)*

Approval of Research Mentor

How many hours a week did your student spend toward Research during this Block? _____ hrs/week

I provided Formative Feedback regarding this Research Project during this block to _____ (student name)

The student has accurately described their research activities during the past block. ☐ yes   ☐ no

Based on their progress for this block, I recommend a grade of: ☐ Satisfactory   ☐ Not Satisfactory.

Mentor Comments (Please provide any feedback on the student's progress):

_____   _____
Mentor's Signature   Date

Mentor's Name (Print)_____

Appendix 3: Year 1 and 2 Weekly Schedule

Sample Weekly Schedule for Year 1 (slight variations each week. Current schedules can be downloaded from Blackboard).

	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
8-9	Basic Science	Basic Science	Basic Science	Anatomy Lab	Patient Case-based Learning
9-10	Basic Science	Basic Science	Patient Case-based Learning	Anatomy Lab	
10-11	Patient Case-based Learning	Basic Science		Anatomy Lab	
11-12					Patient Wrap-up
12-1	Lunch	Lunch	Lunch	Lunch	Lunch
1-2:20	Research Domain		Research Domain		Research Live! or Medical Scholar Seminar
2:30-3:30	Interprofessionalism		Clinical Science		Clinical Science
3:30-5					

Sample Weekly Schedule for Year 2 (Varies somewhat each week. Current schedules can be downloaded from Blackboard). Students are allotted **4.5 hours per week during Blocks V through VIII** to dedicate to research. Students and mentors are encouraged to work together to accommodate both class and mentor schedules. Times shown below for Research Independent Study are examples.

	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
8-9	Basic Science	Basic Science	Basic Science	Basic Science	Patient Case-based Learning
9-10	Basic Science	Basic Science	Patient Case-based Learning	Basic Science	
10-11	Patient Case-based Learning	Basic Science		Basic Science	
11-12					Lunch
12-1	Lunch	Lunch	Lunch	Lunch	Patient Wrap-Up
1-2	Clinical Science				Clinical Science
2-3			Interprofessionalism		
3-4					Research Independent Study
4-5	Research Independent Study		Research Independent Study		