



Academic Catalog
2017–2018

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VAIGS ACADEMIC CATALOG

INTRODUCTION

Van Andel Institute (VAI) was founded by Jay and Betty Van Andel in 1996 with a vision to improve and enhance the lives of current and future generations through biomedical research and science education. VAI comprises the Van Andel Education Institute (VAEI) and the Van Andel Research Institute (VARI). Each organization has a charitable trust agreement with the State of Michigan. Van Andel Institute Graduate School (VAIGS) is a part of VARI and is incorporated in the State of Michigan with authority to grant Ph.D. and M.S. degrees.

VAIGS is supported by VAI, VAEI and VARI. VAI administrative offices provide finance, information technology, human resource, facilities support, fundraising (through grants and private philanthropy) and public awareness services. VARI, a biomedical research organization, has a mission to improve human health with current projects focused on cancer, Parkinson's disease, bone biology, cardiac regeneration, and epigenetics. VARI conducts research in cellular and molecular biology and genetics to identify and understand the function of genes and their protein products and the ways to apply this knowledge to diagnosis and therapy (translational research). VAEI provides complementary education through programs that enhance science education for K-12 students through improved conceptual models, classroom methods, summer camps, and professional development for teachers.

Mission

The mission of VAIGS is to prepare biomedical research scholars through an intense problem-focused graduate program in cell and molecular genetics, with emphasis on translation of this knowledge and technology to improve human health and well-being. We fulfill this mission by:

- Guiding doctoral students to think and act like research leaders through innovative, problem-based learning
- Developing both laboratory research and leadership skills
- Integrating doctoral students into the professional networks and culture of science.

The educational goals of VAIGS include general goals common to higher education and the scientific research community, and specific goals that distinguish the VAIGS graduate program. VAIGS graduates will know current biomedical science, its historical context, and clinical medicine related to genetics. They will be prepared to conduct original research: design appropriate experiments, be expert in techniques of the life sciences, and

think scientifically and analytically. They will be able to translate basic science to address problems of health and society; work collegially; communicate effectively verbally, in writing, and graphically; and practice the highest ethical and professional standards. VAIGS expects to develop graduates who are creative and confident in exploring new areas and techniques in biomedical research.

Philosophy

The fundamental philosophy underlying the VAIGS graduate program is that the students should act and think like scientists, and thus the activities undertaken by students should prepare them for the work they will do as professional scientists. Our goal is to foster their development as scholars whose work is to generate new knowledge, to conserve and critique the knowledge already gained within the field, and to apply the skills of the discipline to transform the world around us. We anticipate our graduates will be the future stewards of the discipline as they embark on careers as scientists.

Every Ph.D. is inherently a research degree. VAIGS students will be engaged in scientific research from matriculation to graduation. The core curriculum has been shaped by a problem-based learning (PBL) structure to reflect the way scientists conduct research. This approach gives students the responsibility for their development and supports the growth of the intellectual skills and tools to ask and answer original research questions. Through this approach, we expect that our students will master the core concepts of genetics, cell biology, biochemistry, bioinformatics, and pathobiology. To achieve this goal, they will also learn how to find key information when they need it; to digest the quality and relevance of that information; to place that information into a coherent conceptual framework; and to make use of that information to tackle a new scientific problem or test a novel hypothesis.

Although the central tasks of a professional scientist are to design, execute and interpret experiments, other responsibilities and roles are also important. These include writing and reviewing grant proposals and manuscripts of research publications, managing the financial support of a research program, and selecting and supervising a laboratory research team. VAIGS prepares its students for these roles through classroom activities, seminars, and periodic workshops.

Science is a human endeavor that occurs within a complex and fascinating intellectual community. VAIGS seeks to foster the effective integration of our students into that community. Students learn how to work effectively in a local research team and with external collaborators. Students will also learn how to effectively communicate in written and oral form and how to critically evaluate the work of others. Students are encouraged

(and supported) to attend a national or international scientific conference or workshop each year, beginning in the summer of their first year.

VAIGS promotes a culture of freedom and creativity that encourages individuals to achieve their research goals with excellence and integrity. That culture includes an emphasis on effective mentoring. The mentoring team includes the Thesis Adviser, other VAIGS faculty, and external advisory committee members, whose objective is to develop in VAIGS students both essential research skills and effective mentoring skills.

The VAIGS graduate program and curriculum is continually evaluated and revised. This process is appropriate for scientific education because it mimics the daily work of scientists: asking questions, gathering and analyzing data, applying the new results to previous paradigms, and integrating the new with the old in order to establish a better model and to improve outcomes.

Core Competencies

The VAIGS *core competencies* are the foundational learning goals for the graduate program in cell and molecular biology. These were compiled to explicitly illuminate the path to becoming an independent scientist. These core competencies are evaluated each year by both students and Thesis Advisors. The core competencies focus on the following areas:

Knowledge:

- Describe key concepts in biomedical science
- Place core concepts in the relevant clinical context
- Know scientific literature relevant to the research area

Research:

- Define sound rationale/ identify gap in knowledge
- Frame an appropriate hypothesis
- Apply creative and appropriate experimental design
- Use controls appropriately
- Execute experiments with technical skill
- Demonstrate critical analysis and thinking
- Integrate results into relevant model

Communication:

- Speak effectively
- Write effectively
- Communicate to diverse audiences

Ethical/Professional Practice:

- Manage data with scientific integrity
- Engage in best authorship practices
- Address ethical problems in scientific research
- Comply with safety and regulatory standards in laboratory activities
- Display appropriate lab citizenship
- Work collegially and effectively as a team/ collaborator

ACADEMIC PROGRAM

VAIGS offers admission to a single doctoral program leading to the Ph.D. degree in cell and molecular genetics.

VAIGS is also authorized to confer master’s degrees in cell and molecular genetics, but does not admit students explicitly for the master’s degree. Master’s degrees may be conferred upon students who elect not to complete the doctoral degree, with the approval of the Dean.

Graduation Requirements for a Ph.D. Degree

The essence of a Ph.D. degree is the conduct of original and significant research relevant to that field. The research is described in a dissertation comprising published or publishable accounts of the work conducted by the student. The preparation and defense of the dissertation is the principal requirement for the Ph.D. degree. This research is conducted under the supervision of a faculty member serving as the Thesis Adviser, with additional guidance and encouragement from a Thesis Advisory Committee.

Courses help provide the foundation and context for the conduct of this research. For VAIGS, course requirements include a set of core courses, typically completed in the first year, with additional and elective courses in the subsequent years. VAIGS requires a **minimum of 80** credit hours and a minimum **grade point average (GPA) of 3.0 for a Ph.D. degree.**

A comprehensive examination, typically taken in the second year, evaluates the student’s foundation in knowledge and research skills to determine whether further pursuit of the doctoral degree should be recommended.

Course Requirements for a Ph.D. Degree

The following courses are required for the Ph.D. degree. A complete course list and course descriptions are found in a subsequent section of this catalog.

Strategic Approaches to Biomedical Research (SABR) and exam Four two-credit courses and a one-credit final examination are offered in each of the first two semesters. Each course and exam carries an independent course number.	<i>2 semesters, 18 credits</i>
Historical Perspectives in Molecular Biology	<i>1 semester, 2 credits</i>
Translational Research	<i>1 semester, 2 credits</i>
Responsible and Effective Conduct of Research	<i>1 semester, 1 credit</i>
Technical Writing	<i>1 semester, 1 credit</i>
Journal Club	<i>4 semesters, 4 credits</i>
Research in Progress (RIP)	<i>4 semesters, 4 credits</i>
VARI Seminar Series	<i>2 semesters, 2 credits</i>
Additional Professional Development courses	<i>7 total credits, minimum</i>
Special Topics Courses One- or two-credit courses provide advanced study on a focused topic in basic or clinical research, typically taken in years two through four. Topics reflect particular needs of the students and interests of the faculty member who leads the course.	<i>6 credits</i>
Laboratory Rotations Three rotations of seven weeks duration, completed during the first two semesters; two credits for each rotation.	<i>minimum 3 rotations, 6 credits</i>
Precandidacy Research Dissertation research conducted after selecting a thesis adviser and prior to successful completion of the Comprehensive Exam.	<i>typically 3 semesters, 3-6 credits/semester</i>
Thesis Research	<i>minimum 27 credits</i>

Thesis Research

Thesis Adviser

Thesis Adviser selections are made after three laboratory rotations have been completed (typically in February of the first year). Regular faculty members of VAIGS who hold a terminal degree and are appointed as head of a VARI laboratory may serve as Thesis Adviser for a VAIGS doctoral student. The student may request assistance from the Academic Adviser in selecting a Thesis Adviser. After a mutual agreement is reached between the student and the Thesis Adviser, the student must notify the Dean in writing for approval and recording. The student will then share their decision with any other faculty member in whose laboratory the student had rotated.

The relationship with the Thesis Adviser is central for a successful research project, intellectual development, and the completion of the graduate degree. The student and Thesis Adviser should strive to create a productive and ethical research environment with suitable rapport. The laboratory should engage in research of specific interest to the student and should have an atmosphere conducive to student development and training.

Thesis Advisory Committee (TAC)

Assignment of TAC members: By May of the first year, and after consulting with the Thesis Adviser and student, the Dean will appoint a TAC. The TAC will consist of at least four members including the Thesis Adviser, two VAIGS faculty, and one outside expert on the thesis proposal topic. Additional members (internal or external) may be appointed if a specific benefit can be anticipated from their participation.

Prior to each TAC meeting, the student will complete the Student Progress Report Form. Members of the TAC Committee will add their comments and recommendations on the form, and each member will sign the form indicating their approval. The signed form will then be turned in to the Enrollment and Records Administrator (ERA) for the student's records.

TAC Meeting Frequency: To monitor and support student progress toward completion of their degree, students must meet with the TAC for:

- a. **Annual Summary, and**
- b. **Progress Report**

meetings on a semi-annual basis (i.e., every six months) until their dissertation defense. Students who do not fulfill this expectation may be subject to academic probation.

The initial TAC Meeting will typically take place in September of the second year. The TAC will review the initial thesis proposal to gauge whether the scope and focus of the project are appropriate for a doctoral dissertation. At this meeting the student will present a 3 to 5 page description of their project. With the advice and input of the TAC, the student will outline a set of research objectives to be met in the next year.

Following this, the Annual Summary meetings will take place around the anniversary of a successful comprehensive exam. Students will present the TAC with both a written Annual Summary of her/his research and a formal oral presentation. The TAC will advise the student on her/his progress toward fulfilling the requirements of the program.

The Progress Report meeting will evaluate progress toward the degree and provide continuing advice on the dissertation research project. Progress Report meetings convene approximately six months after each Annual Summary meeting (typically near the beginning of each academic year). Students will present the TAC with a brief report outlining the progress that has been made toward achieving the objectives established at prior TAC meetings. If adequate progress toward the objectives has been met, a new set of objectives for the next year will be established. If the TAC finds inadequate progress toward the objectives, they will provide recommendations with a new set of objectives. The schedule and order of these meetings should be established at the time of the first TAC Meeting.

TAC Responsibilities: The TAC provides both advice on and supervision of the thesis research conducted by a student. After the TAC reviews the initial thesis proposal to gauge whether the scope and focus of the project are appropriate for a doctoral dissertation, the TAC will meet with the student and Thesis Adviser on a semi-annual basis to evaluate progress toward the degree and to provide continuing advice on the dissertation research project. The two VAIGS Faculty members of the TAC will participate in the comprehensive examination. All members of the TAC will participate in the dissertation defense. TAC members may be asked to provide letters of

recommendation when the student pursues subsequent positions or applies for a predoctoral fellowship.

Student Responsibilities: Following the approval of a Thesis Adviser, the student and Thesis Adviser will explore topics for the student's thesis research. As stated above, the student will submit a 3-5 page written thesis proposal to the TAC. With the advice and input of the TAC, the student will outline a set of research objectives to be met in the next year. The student will then follow through on Annual Summary and Progress Report Meetings.

VAIGS Responsibilities: Transcripts and grade reports will be provided to students at the completion of each semester via the VAIGS Student Portal. The Student Performance Review Committee will evaluate overall yearly progress based on academics, research, conferences and workshops, papers, and presentations in addition to the reports submitted by the student's TAC. Based on evaluation by the Student Performance Review Committee, the Dean will provide a letter, to each student, summarizing his/her progress and status in the program.

Comprehensive Examination

The goal of the Comprehensive Exam (also known as the Ph.D. candidacy exam or preliminary exam) is to evaluate the student's potential and ability to explicitly identify and define a specific, testable hypothesis. This will be based on evaluating the relevant literature, drafting a testable and important hypothesis, proposing critical experiments to rule out or prove the hypothesis, and interpreting the experimental outcome. The student will be expected to demonstrate his/her knowledge of basic concepts as well as current and relevant scientific literature.

The Comprehensive Exam is typically taken in February or March of the second year. Exceptions may be made for students who have experienced a leave of absence or comparable changes to their academic program. The implementation of the Comprehensive Exam is described in detail in the *Guidelines for the Comprehensive Examination*. Another document, *Preparing for the Comprehensive Examination*, is intended to help students effectively anticipate and prepare for this exam (See addendum). A brief summary is provided here.

The exam will have three principal components:

1. A written proposal of the thesis research project prepared in the style of a National Institutes of Health (NIH) grant application;
2. A research proposal on a topic in an area different than the student's chosen field of research; and
3. An oral defense of the two written proposals together with an examination on the underlying concepts, principles, and research skills.

Comprehensive Exam Committee

After consulting with the Thesis Adviser and student, the Dean will appoint a Comprehensive Exam Committee. The Comprehensive Exam Committee will comprise four members including two VARI members of the TAC, one VAIGS faculty member not on the TAC, and one outside expert on the non-thesis proposal topic. The Thesis Adviser may attend but does not participate in the examination. The exam will be chaired by a member of the Comprehensive Examination Organizing Committee, who also does not vote on the examination.

Comprehensive Exam Outcomes

Passing the Comprehensive Exam requires satisfactory completion of all three principal components, based on a majority vote of the examining committee. The Comprehensive Exam Committee will decide on one of three possible outcomes:

Pass: No further work is required on the Comprehensive Exam. The Comprehensive Exam Committee may make recommendations for areas in which improvement should be sought or expected.

Failure with opportunity to remediate: If the Comprehensive Exam Committee identifies weaknesses in a limited number of areas and believes that these deficiencies can be corrected with specific actions, the student may be offered the opportunity to remediate those portions of the Comprehensive Exam. The Comprehensive Exam Committee will define explicitly the conditions for remediation. The remediation should be completed within **three months** of the initial examination date. If the remediation efforts are deemed satisfactory, the student will have passed the Comprehensive Exam. If the remediation efforts are deemed unsatisfactory, the student will have failed the Comprehensive Exam and the student will be asked to leave the doctoral program.

Failure: If the student fails one or more components of the Comprehensive Exam, with deficiencies beyond the scope deemed remediable within three months, the student will not be offered the opportunity to remediate, and will be asked to leave the doctoral program.

Upon successful completion of both the written and oral exams, the student will work full-time in the laboratory on his/her thesis project. The student must submit a predoctoral grant application to an external agency, to be considered for funding (typically as a predoctoral fellowship), within one year from the date of his/her Comprehensive Exam. To document completion of this requirement, the student should submit to the ERA both a .pdf copy of the submitted proposal and the VAI transmittal sheet for that proposal.

Dissertation Preparation and Defense

Dissertation Scope and Preparation

A key requirement for the degree of Doctor of Philosophy (Ph.D.) is the submission and successful defense of a dissertation. The dissertation is a compilation of a student's research on an original and significant question in the field.

The dissertation submitted for the Ph.D. degree must be based on original research that makes a significant contribution to our understanding of cell, molecular, or genetic biology relevant to human disease. The design, execution and presentation of the dissertation research must demonstrate that the candidate can perform independent research of a quality consistent with that published in refereed journals of the relevant disciplines. In most circumstances, it is expected that substantial portions of the thesis research will have been published or submitted for publication. The thesis and oral defense should provide clear evidence of the candidate's capacity to function as a professional scientist, including a broad knowledge of the research topic; ability to draft hypotheses and design effective tests of those hypotheses; ability to execute experiments accurately; ability to interpret results critically; and ability to communicate the research project effectively. Elements for the student evaluation can include, but are not limited to, a polished presentation that clearly communicates the science; a clear

statement of well-grounded hypothesis and logical specific aims; the potential clinical significance and beneficiaries of the proposed research; evidence of effective experimental design and proficient execution; appropriate data-gathering and analysis; logical and insightful derivation of experimental conclusions that address the hypothesis; adjustments in experimental design (if any) with clear rationale; insightful discussion of the work in the context of the field; and the future direction or application of this research.

Students are required to prepare a detailed written dissertation conforming to VAIGS requirements as outlined in the Dissertation Preparation Manual. Prior to preparing the dissertation, each graduate student must meet with his/her TAC to discuss future career plans and obtain permission to begin writing the thesis.

Dissertation Defense Committee (DDC)

When the student, Thesis Adviser and TAC agree that the student is ready to prepare and defend the dissertation, a DDC will be formed to evaluate the graduate student's doctoral dissertation.

The DDC will consist of all members of the TAC, including the Thesis Adviser (in a non-voting capacity); two additional VAIGS faculty members; and the external member of the TAC, all of whom have provided ongoing advice to the student throughout his/her thesis project. In addition, the DDC will include one additional external reviewer. The DDC will be chaired by a member of the Comprehensive Exam Organizing Committee.

The Thesis Adviser will attend the dissertation defense as a non-voting member and does not question the student during the dissertation defense. The Thesis Adviser may answer questions of the DDC for clarification. The Thesis Adviser has a vested interest in the success of the student in that the Thesis Adviser's research is logically intertwined.

External review strengthens the quality of the doctoral degree and the graduate program as a whole. The additional external reviewer, who is not a member of the TAC, provides an independent assessment of the research. The additional external reviewer further validates the independent nature of the student's work. The TAC will nominate independent investigators as external reviewers who have the appropriate expertise and who have no

conflict of interest with the student's or Thesis Adviser's current research. Recommendations will be submitted to the Dean for selection of a single independent external reviewer as a fourth voting member of the DDC.

A member of the VAIGS Comprehensive Examination Organizing Committee (CEOC) will act as DDC chair and will ensure adherence to VAIGS standards and policies, monitor for potential conflicts of interest, and enhance consistency between different DDCs. The DDC chair will not vote on the outcome of the examination.

Conflict of interest is created when scientific or personal relationships between the student and/or advisers significantly skew the ability to have unbiased scientific objectivity during the evaluation process. DDC members should be evaluated for collaborations or interactions with the Thesis Adviser such that the degree of collaboration does not introduce a conflict of interest which may provide an unfair or disfavored advantage for the student. The degree of conflict must be determined and approved by the Dean.

Dissertation Defense

The student will deliver a written dissertation to all members of the DDC **at least two weeks prior** to the defense date. The dissertation defense will consist of an oral presentation and an oral examination. The oral presentation is an open public seminar. The student will prepare and deliver a 40-45 minute presentation of the dissertation research and then field questions from the audience. The oral examination is closed and is conducted by the DDC following the presentation.

Defense Outcomes

Following the examination, the DDC will convene in private to discuss the student's dissertation, oral presentation, and performance in the oral examination. After deliberation, the DDC will make a recommendation to the Dean of whether or not to grant the Ph.D. degree. A simple majority vote (at least three votes) from the four voting members of the DDC will be required to recommend to the Dean to grant the student a Ph.D. degree.

The DDC may require additional revisions or amendments to the written dissertation. **Such requirements must be completed before the Ph.D. degree is conferred.** The DDC chair will provide in writing, to the VAIGS Dean, a concise summary of the required changes as approved by the

DDC. The DDC Chair and the Thesis Adviser together will monitor the accomplishment of these revisions and will certify to the Dean when the revisions have been accepted.

Following completion of document editing by the student and after final acceptance by DDC and the Format Reviewer, the student is required to submit the final document as a single .pdf file to the VAIGS ERA. Electronic dissertations and theses will be deposited at ProQuest for online curation.

Details for the preparation of the electronic and hard-copy documents will be included in the guidelines for formatting theses and dissertations. The Graduate School will pay the binding costs for up to two printed color copies, one for the bound copy for VAIGS and one for the student. The student is responsible for costs of other bound copies for their own use or for their thesis adviser.

Typical Program of Study for a Ph.D. Degree

The list and diagram that follows illustrate the typical academic plan for a VAIGS doctoral student. Students enrolled in the graduate program are expected to complete the requirements for the Ph.D. degree within five years. In most cases students will complete all coursework by the end of year 4.

Year One

Fall semester (late-August to mid-December – 16 weeks)

- Strategic Approaches to Biomedical Research courses, exam (9 credits)
- Historical Perspectives in Molecular Biology (2 credits)
- 2 Laboratory Rotations (2 credits each - 4 credits)
- Research in Progress (1 credit)
- Journal Club (1 credit)
- VARI Seminar Series (1 credit)

Winter semester (January to May – 16 weeks + 1 week for thesis integration)

- Strategic Approaches to Biomedical Research courses, exam (9 credits)
- Translational Research (2 credits)
- Responsible and Effective Conduct of Research (1 credit)
- 1 Laboratory Rotation (2 credits)
- Select a Research Adviser at the end of 3rd Rotation
- Research in Progress (1 credit)

- Journal Club (1 credit)
- VARI Seminar Series (1 credit)

Summer semester (mid-May to mid-August – 14 weeks)

- Precandidacy Research (6 credits)
- Technical Writing (1 credit)

Year Two

- Initial Thesis Advisory Committee meeting (August / September)
- Thesis Research (Precandidacy and Doctoral Candidate) (up to 6 credits/semester)
- Comprehensive Exam (February)
- Journal Club (1 credit)
- Research in Progress (1 credit)
- Additional Professional Development courses (1 or 2 credits each)
- Special Topics Course(s) (1 or 2 credits each)

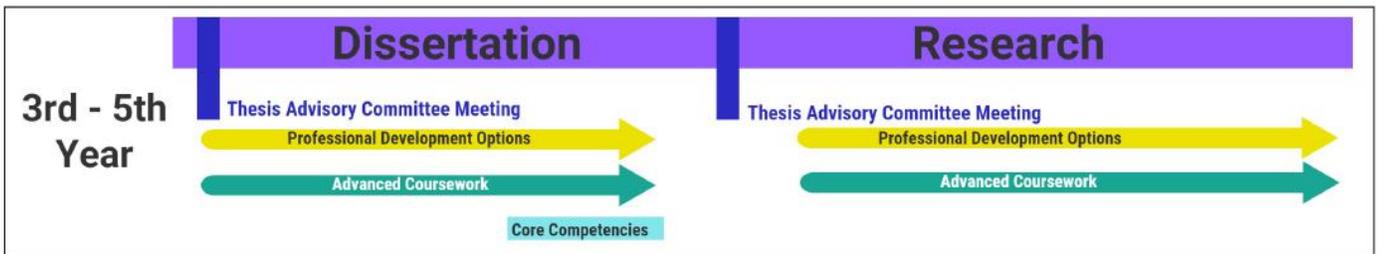
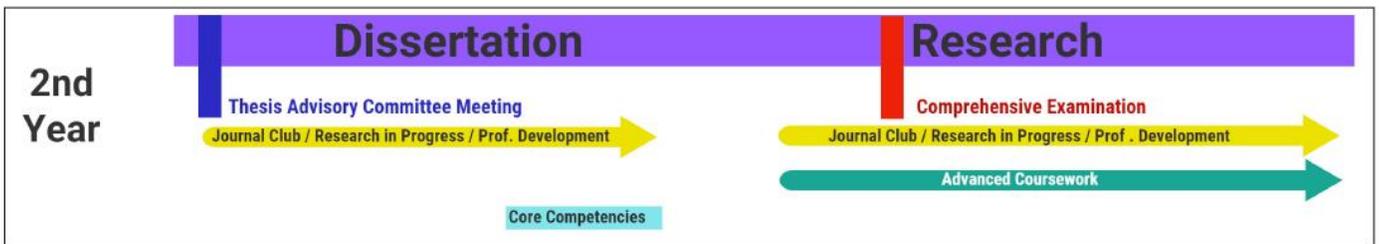
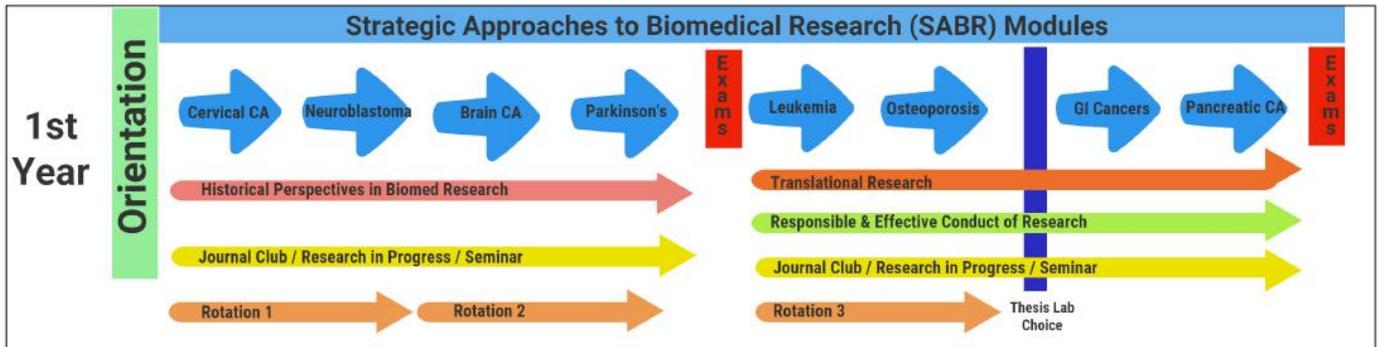
Year Three and Year Four

- Doctoral Candidate Thesis Research (up to 6 credits / semester)
- Teaching opportunity, if desired
- Semi-annual meetings with Thesis Advisory Committee
- Additional Professional Development courses (1 or 2 credits each)
- Special Topics Course(s) (1 or 2 credits each)

Year Five

- Doctoral Candidate Thesis Research (up to 6 credits / semester)
- Final Thesis Advisory Committee meeting(s)
- Dissertation Preparation
- Dissertation Defense

VAIGS Curriculum Overview



Graduation Requirements for a M.S. Degree

The VAIGS charter from the State of Michigan authorizes VAIGS to confer both doctoral and master's degrees. VAIGS recruits, admits, and enrolls students exclusively for the doctoral program. VAIGS does not recruit, admit or enroll students whose primary objective is a master's degree. Nonetheless master's degrees may be conferred upon students who, for various reasons and circumstances, elect not to complete the doctoral degree. This decision to pursue a master's degree rather than the Ph.D. must be approved in writing by the student's Thesis Adviser and by the Dean.

The requirements for the master's degree includes all of the core course requirements defined for the Ph.D. program, including successful completion of the comprehensive exam, except that the number of credits for Special Topics and seminar-style courses and thesis research are reduced. VAIGS requires a minimum of **60 credits**, and a minimum average grade point average (GPA) of **3.0, for a master's degree**.

A thesis providing evidence of the student's competence to perform research in the relevant discipline is required. The thesis research is conducted under the supervision of a faculty member serving as the Thesis Adviser, with additional guidance and encouragement from a Thesis Advisory Committee.

Course Requirements for a M.S. Degree

The following courses are required for the M.S. degree. A complete course list and course descriptions are found in other sections of this catalog.

Strategic Approaches to Biomedical Research (SABR) and exam Four two-credit courses and a one-credit final examination are offered in each of the first two semesters. Each course and exam carries an independent course number.	<i>2 semesters, 18 credits</i>
Historical Perspectives in Molecular Biology	<i>1 semester, 2 credits</i>
Translational Research	<i>1 semester, 2 credits</i>
Responsible and Effective Conduct of Research	<i>1 semester, 1 credit</i>
Journal Club	<i>4 semesters, 4 credits</i>
Research in Progress (RIP)	<i>4 semesters, 4 credits</i>

VARI Seminar Series *2 semesters, 2 credits*

Technical Writing *1 semester, 1 credit*

Additional Professional Development courses *3 credits*

Special Topics Courses *4 credits*

One- or two-credit courses providing advanced study on a focused topic in basic or clinical research, typically taken after completion of the first year. Topics reflect particular needs of the students and interests of the faculty member who lead the course.

Laboratory Rotations *minimum 3 rotations, 6 credits*

Three rotations of seven weeks duration, completed during the first two semesters; two credits for each rotation.

Precandidacy Research *up to 6 credits / semester*

Thesis Research *up to 6 credits / semester*

Thesis Research

Students who receive a MS degree from VAIGS will conduct thesis research under the supervision of a VAIGS faculty member serving as Thesis Adviser. The roles of the Thesis Adviser and TAC are the same as those defined for the Ph.D. student. Students will be expected to meet semi-annually with their TAC, for both Annual Summary and Progress Report meetings. The reports from these meetings will be submitted to the ERA to be included in the student's academic record.

Comprehensive Examination

The goal of the Comprehensive Exam is to evaluate the student's potential and ability to explicitly identify and define a specific testable hypothesis. Students who receive a MS degree from VAIGS must have passed the Comprehensive Examination based on the same criteria and standards as applied to Ph.D. students. The scope and format of the Comprehensive Examination are described above and in documents cited there.

Thesis Preparation and Defense

Thesis Scope and Preparation

A key requirement for the master's degree is the submission and successful defense of a thesis in which is compiled the evidence of a student's competence to conduct research in cell and molecular genetics. The thesis submitted for the MS degree is smaller in scope than is a dissertation for the Ph.D. degree, and represents a body of work appropriate for at least one publishable paper. In most circumstances, it is expected that substantial portions of the thesis will be or will have been published or submitted for publication. The thesis and the oral defense should provide clear evidence of the candidate's capacity to function as a professional scientist, including broad knowledge of the research topic; ability to draft research questions, hypotheses and design effective tests of those hypotheses; ability to execute experiments accurately; ability to interpret results critically; and ability to communicate the research project effectively.

The master's thesis should conform to VAIGS requirements as outlined in the Thesis and Dissertation Preparation Manual. Prior to preparing the thesis, the student must meet with her/his TAC to confirm that the progress is sufficient to justify writing the thesis.

Thesis Defense Committee (TDC)

When the student, Thesis Adviser, and TAC agree that the student is ready to prepare and defend the thesis, a TDC will be formed to evaluate the graduate student's master's thesis.

The TDC will consist of all members of the TAC, including the Thesis Adviser (in a non-voting capacity); two additional VAIGS faculty members; and the external member of the TAC, all of whom have provided ongoing advice to the student throughout their thesis project. The Thesis Adviser will attend the thesis defense as a non-voting member and does not question the student during the examination. The Thesis Adviser may answer questions of the TDC for clarification. A member of the VAIGS Comprehensive Examination Organizing Committee (CEOC) will chair the TDC.

Thesis Defense

The student will deliver the written thesis to all members of the TDC **at least two weeks prior** to the scheduled defense date. The thesis defense

will consist of a 40-45 minute oral presentation and an oral examination. The oral presentation may be open to public or not, at the discretion of the candidate and Thesis Adviser. The oral examination will be administered by the TDC and will be closed to the public. The closed examination will be chaired by the Dean's Representative. Based on the reading of the thesis, the oral presentation, and the oral examination, the TDC may require additional revisions or refinements to the written thesis. **Any such requirements must be completed prior to the conferral of the master's degree.** Upon completion of the defense, the TDC will make a recommendation to the Dean of whether or not to grant the master's degree. A simple majority (at least two votes from the three voting members of the TDC) in favor of a successful thesis defense will be required to recommend to the Dean to grant the candidate a master's degree.

The successful candidate must provide to the ERA a copy of the completed and final version of the thesis in both electronic form (as a single .pdf file) and in bound paper form. Details for the preparation of the electronic and hard-copy documents will be included in the guidelines for formatting theses and dissertations.

Physician-Scientist Training Programs

VAIGS offers several innovative opportunities for training physician-scientists who will be well-positioned to combine clinical and research training in the pursuit of effective translational research.

M.D.-Ph.D. dual degree program (with Michigan State University or with Western Michigan University)

This program combines medical training through the MSU College of Human Medicine or the WMU Homer Stryker M.D. School of Medicine with research training through VAIGS, culminating in both M.D. and Ph.D. degrees. The first two years the student is in medical school. The following four years, the student is in Ph.D. training which includes all components of the VAIGS program on a somewhat condensed timeline, accompanied by integrated clinical experiences. After completing the doctoral dissertation, students undertake an additional two years in medical school for their clinical clerkships with a continuing integrated research experience. Admission to the dual degree program requires approval of both the cognizant medical school and VAIGS. More information is available on the MSU College of Human Medicine website or at the WMU Homer Stryker M.D. School of Medicine website.

Residency-Ph.D. program (with Grand Rapids Medical Education Partners (GRMEP))

This novel program combines medical residency training (in Internal Medicine, Orthopaedic Surgery, or other specialties) with research training in cell and molecular biology, culminating in a Ph.D. and licensure and board eligibility in the medical specialty. The training program for each participant will be developed on an individual basis depending on prior research experience, time of entry into the program, and requirements of the clinical residency. Typically, participants will complete two years of clinical rotations followed by Ph.D. program coursework and dissertation research. Clinical training and research experience may be intertwined during portions of the training period.

Pediatric Hematology/Oncology Fellowship – Ph.D. program (with GRMEP and Helen DeVos Children’s Hospital)

This program links subspecialty training in pediatric hematology and oncology with research training in cell and molecular genetics. The training program for each participant will include all components of the VAIGS doctoral program, including courses and dissertation research, although the timelines may be adjusted to meet clinical responsibilities of the clinical fellowship. Clinical training and research experience may be intertwined during portions of the training period. Details of the programs combining the VAIGS Ph.D. with medical school or the clinical fellowship and residency training are articulated in memoranda of understanding with the partner organizations. These memoranda are available upon request.

Other Learning Opportunities and Experiences

Community Service

All students are required to perform a minimum of **four hours** of community service per academic year during their time in the program. This can take the form of assisting in the VAI education program, summer intern or incoming graduate student peer mentoring, service at a local school, local hospital, or other medical-related facility, or working at an institutional-sponsored event. The student will provide documentation of community service by updating the Student Progress Report.

Oral Presentations

Training and experience in oral communication of scientific information and research results are important formative activities for VAIGS students. Once they have selected their thesis lab, first year students will present a selected journal article from current scientific literature in a Journal Club session of the Graduate Student Seminar Series. Beginning in the second year after successful completion of their Comprehensive Exam, students will also report on the progress of their dissertation research in the Research in Progress sessions of the Graduate Student Seminar Series. Students will be given training on presentation skills prior to their presentations and will be evaluated by VAIGS faculty and student peers. Research in Progress sessions are coached individually and allow feedback to be provided.

Poster Presentations

Beginning in the second year, all students are required to present a poster at the annual VARI retreat.

Attendance at Scientific Meetings

Students are encouraged and expected to attend a national or international scientific meeting, conference, or workshop each year. First-year students normally attend a conference after the end of the second semester. Advanced students (third year and beyond) are expected to present their work at such a conference. VAIGS will provide financial support up to \$2,000 per student, per academic year (September through August), to attend these events. Students are required to submit a short report to the Senior Administrative Assistant within one week of their return, describing the impact of the conference on their scholarly or professional development. (See policy: [VAIGS Student Travel Allowance](#)).

Host a Student-Sponsored Speaker

Each year, as a group, the graduate students will have the opportunity to invite and host at least one outside seminar speaker of their choice through the VARI Seminar Series. Students are also frequently invited to attend luncheons with many of the outside seminar speakers hosted by VARI. Students are strongly encouraged to take advantage of these opportunities to interact with these distinguished visitors.

Career Development

VAIGS and the Graduate School Association collaborate with VARI Office of Postdoctoral Affairs and the Postdoctoral Association to provide workshops and seminars on career development for successful scientists. These include writing and reviewing manuscripts and grants, financial and project management, and conflict

resolution. Additional workshops, information and activities will be coordinated by the VAIGS Student Affairs Specialist. VAIGS faculty have developed a set of expectations to clarify the transition from Graduate School to postdoctoral fellowship. These expectations will be presented to each senior level student mid-way through the fourth year. A career day will be led each year by the Student Affairs Specialist and a committee of graduate students.

Membership in Scientific Societies and Organizations

All students are encouraged to join a scientific society of their choice. Students may pay for these memberships from their own funds or (at the discretion of their Thesis Adviser) from the laboratory support funds provided by VAIGS.

Teaching Opportunities

Opportunities may be available for teaching classes or courses outside of VAI. Interested students should discuss these opportunities with their Academic or Thesis Adviser. VAIGS has established no formal requirement to participate in outside teaching opportunities. However, VAIGS and/or the graduate student's Thesis Adviser reserves the right to institute such a requirement. A decision as to whether or not a student will utilize these opportunities will be decided on a case-by-case basis, by mutual agreement of the student and Thesis Adviser with final approval by the Dean. The External Activities policy describes the ground rules for such experiences and the process for obtaining approval.

COURSE LIST AND DESCRIPTIONS

Strategic Approaches to Biomedical Research (SABR) *2 semesters, 18 credits*

In a progressive series of four-week modules, students develop research plans to address current hypotheses, questions or problems relevant to human disease. In the course of developing these plans, students learn foundational concepts in biochemistry, cell biology, molecular biology, genetics, bioinformatics, and pathobiology. This “problem-based learning” approach best simulates how professional scientists attack new research problems. Students emerge with a strong foundation in core concepts in the relevant disciplines, an understanding of experimental design principles, and experience in crafting research plans. The Fall and Winter semesters of SABR each comprise four two-credit modules and a one-credit, cumulative final examination. The first module is graded on pass/fail; all other modules and exams are graded on a 4.0 scale.

Historical Perspectives in Molecular Biology *1 semester, 2 credits*

This course examines the historical context of current molecular and cell biology research. Students study classic papers in biomedical research and discuss how the work represented in those papers changed the models or paradigms that prevailed at the time the research was done. Topics include foundations of modern biology, mechanisms of genetic change, analysis of biological macromolecules, gene splicing and rearrangement, disease mechanisms, tumor suppressor genes, and organisms used as important experimental models. This course is graded on a 4.0 scale.

Translational Research *1 semester, 2 credits*

This course reviews the process of moving scientific discovery from the bench through the steps of translation and implementation to the bedside. The process of translational research includes the onerous process of moving a drug target into the clinic and through the organization of clinical trials. Students will review elements of regulation, clinical trial biostatistics, correlative science, and entrepreneurship as they take a project through the steps from discovery to translation. This course is graded on a 4.0 scale.

Responsible and Effective Conduct of Research *1 semester, 1 credit*

This course addresses effective laboratory management practices including protection of human and animal subjects, scientific integrity, conflicts of interest, collaboration, authorship, peer review, data management, mentoring, communication, societal impacts, human resource management, grants and

contracts, and fiscal responsibility. The course provides training and direction on how to recognize, address and prevent ethical dilemmas that arise during the course of conducting scientific research. This course is graded on a 4.0 scale.

Technical Writing

1 semester, 1 credit

Because scientists are successful only when their discoveries are communicated, this course provides a solid technical foundation in written communication. This course is graded on a 4.0 scale.

Journal Club

1 credit per semester

This course is based on bi-weekly GSSS journal club presentations. Students present recently published research papers on topics of general interest and importance to the field of biomedical research. Students will describe logical arguments and determine when arguments have sound foundation; explain experimental approaches (i.e. methods), compare approaches, and provide rationale for the approaches presented in the publication; and challenge the outcomes and paradigms of the published work. Non-presenting students will submit written reflections and evaluations of the papers and talks given by others. This course is graded on pass / fail basis.

Research in Progress (RIP)

1 credit per semester

This course is based on bi-weekly GSSS RIP presentations and weekly VARI RIP's. VARI faculty and VAIGS students will present the current state of their research projects. Non-presenting students will submit written reflections and evaluations of these talks, in which they define the "gap in knowledge" and experimental approach; critique the organization and logic of the presentation; question the presenter in order to better understand the research outcomes; and organize their own presentations better as a result of critiquing the logic of others' talks. This course is graded on pass / fail basis.

VARI Seminar Series

1 credit per semester

This course is based on invited seminars presented by scientists external to VARI. Students attend at least ten seminars per semester and submit a written reflection and evaluation following each seminar. This course is graded on pass / fail basis.

Professional Development Courses

1-2 credits per course

These courses build student skills in communication, laboratory management, and organization. Courses complement the Journal Club, Research in

Progress, and VARI seminar courses. Recent offerings include Grantsmanship, Lab Leadership, and Origins of Cancer Scientific Conference Organization. Enrollment in professional development courses is done by the student submitting a course request via the VAIGS student portal, which is then approved by Thesis Adviser. These courses are graded on a 4.0 scale.

Special Topics Courses

1-2 credits per course

These courses provide advanced study on a focused topic in basic or clinical research, and are typically taken in the second, third, and fourth years. Each course engages students in the study and discussion of the current scientific literature and concepts of the topic selected. Specific content varies with each semester. Each VARI Center is responsible for offering a special topics course to students on a rotating basis (Epigenetics, Fall of even-numbered years; Neurodegenerative Sciences, Winter of odd-numbered years; Cancer and Cell Biology, Fall of odd-numbered years; Core Laboratories, Winter of even-numbered years). Additional courses may also be offered depending on student and faculty interest. Enrollment in special topics courses is done by the student submitting a course request via the VAIGS student portal, which is then approved by Thesis Adviser. These courses are graded on a 4.0 scale.

Laboratory Rotations

minimum 3 rotations, 6 credits

Laboratory rotations in the first year provide early research experiences that are important in the development of students. These laboratory rotations assist students in their choice of a thesis adviser, laboratory, and dissertation project. Students will complete three rotations; in rare circumstances, a fourth rotation may be needed before an appropriate thesis adviser and dissertation laboratory can be selected.

During the orientation for incoming students, faculty will present their research interests to the new matriculates. Students are encouraged to visit the laboratories and become acquainted with faculty, lab managers, research technicians, and other researchers in order to choose. Students shall send their rotation preferences to the Dean, who will confirm that this intention is consistent with the faculty member's plans before confirming the placement.

The activities of the rotation should be planned to give the student a rich and deep understanding of the questions being addressed, the approaches and experimental methods employed, the mentoring and leadership style of the laboratory head, and the relationships with other members of the laboratory team.

Students should expect to spend as much time in the laboratory as their course work will allow (typically 25-30 hours per week). Following each rotation, students will submit a Student Evaluation of Rotation Experience form to the ERA. The rotation mentor (faculty member) will also evaluate the student's performance in the rotation, which will be discussed with the student before being submitted to the ERA. Lab rotations are graded on a 4.0 scale.

Independent Study

credits vary depending on effort

Students may petition the Curriculum Committee for approval of VAIGS academic credit for a course or workshop taken at another institution (whether in-person or online), or for learning experiences at VAIGS / VARI that are not incorporated into existing courses. Dependent upon content, Independent Study courses may fulfill requirements for Special Topics or Professional Development courses. A plan for oversight of the student's activity and performance by a VAIGS faculty member will be included in the proposal. See Independent Study Policy. A recommendation by the Curriculum Committee will be forwarded to the Dean for final approval.

Precandidacy Research

credits vary depending on effort

Students who have selected a thesis adviser but have not yet passed their comprehensive exams will acquire academic credit for their thesis or dissertation research. Students enroll in this course for three to six credits per semester, depending on the number of other credits taken in the given semester. Calculations are conducted by the ERA.

Doctoral Candidacy Research

credits vary depending on effort

Students who have passed their comprehensive exams will acquire academic credit for their thesis or dissertation research. Students enroll in this course for three to six credits per semester, depending on the number of other credits taken in the given semester. Calculations are conducted by the ERA.

ACADEMIC CALENDAR

The following academic calendar pertains to the 2017-2018 academic year. Calendars for previous and future years can be found on the VAIGS SharePoint site.

Fall Semester: August – December 2017 (16 Weeks)

Strategic Approaches to Biomedical Research Problems

- Aug. 29 - Sep. 23: Module 1 = 4 weeks
- Sep. 26 - Oct. 21: Module 2 = 4 weeks
- Oct. 24 – Nov. 18: Module 3 = 4 weeks
- Nov. 21 - Dec. 16: Module 4 = 3.6 weeks

Historical Perspectives in Molecular Biology

- Aug 30 – Dec. 13: 16 weeks

VARI seminars / Journal Club/ Research in Progress

- Aug. 31 - Dec. 16 16 weeks

Laboratory Rotations

- Sep. 6 - Oct. 21: Rotation 1 = 7 weeks
- Oct. 24 – Dec. 9: Rotation 2 = 7 weeks

Exams

- Dec. 20-21 [Winter Break: Dec. 22-Jan. 8]

Winter Semester January–May 2018 (17 Weeks)

Strategic Approaches to Biomedical Research Problems

- Jan. 9 – Feb 3: Module 5 = 4 weeks
- Feb. 6 – Mar 3: Module 6 = 4 weeks
- [Thesis Lab Integration Week: Mar. 6-Mar. 10]
- Mar. 13 – Apr. 7: Module 7 = 4 weeks
- Apr. 10 – May 5: Module 8 = 4 weeks

Responsible and Effective Conduct of Research

- Jan. 10 – May 2: 16 weeks

Translational Research

- Jan. 12 – May 4: 16 weeks

VARI Seminars / Journal Club/ Research in Progress

- Jan. 11- May 5: 17 weeks

Laboratory Rotations

- Jan. 9 – Feb. 24: Rotation 3 = 7 weeks
- Select Thesis Mentor / Laboratory by March 3

Exams

- May 9-10

Summer Semester: May – August, 2018 (14 Weeks)

VARI Scientific Retreat: TBA

ACADEMIC POLICIES

This section provides summaries of key academic policies for VAIGS students. In most cases, complete policy statements and the forms relevant to those policies are available at the [VAIGS SharePoint site](#). Students are also responsible for adhering to all relevant VAI policies, which are available at the VAI SharePoint site.

Admissions

The graduate program is intended for students seeking a Ph.D. in cell and molecular genetics that prepares them for leadership positions in research or clinical laboratories. VAIGS is interested in matriculating persons with excellent academic preparation and performance, competence in skills important to scientific work (e.g., writing and critical thinking), and good moral and ethical character. The program is open to all applicants irrespective of race, gender, ethnic or national origin, religion, or age. International students (non-U.S. citizens or permanent residents) are welcome and encouraged to apply. International students may be admitted to VAIGS under the visiting scholars program (J1 visa) administered through VAI.

Applicants must have earned a Bachelor of Arts or Science (BA or BS) degree or equivalent from an accredited college or university prior to enrolling at VAIGS. The usual preparation is in the natural sciences with a range of courses in chemistry, biochemistry, biology, physics, and mathematics. The Admissions Committee seeks to identify those students with the most promise for superior achievement in our program, using a comprehensive review of all credentials. Consideration is given for each applicant's overall qualifications, as demonstrated by academic record, test scores, research experience, and letters of recommendation.

VAIGS has not established minimum cut-off values for most of the required application materials but the following criteria will be considered. Advanced training in cell biology, molecular biology, genetics, and statistics is strongly recommended. A grade point average of 3.5 or better, during the last two full years of undergraduate study in courses pertinent to the pursuit of a career in science, is also recommended. Applicants with other academic backgrounds may be considered if they perform well on the Graduate Record Examination (GRE) and give appropriate evidence of excellent training, qualifications, and motivation. For applicants seeking admissions to VAIGS as part of a dual degree (M.D. – Ph.D.) program, MCAT scores may be used in lieu of GRE scores. International applicants must exceed TOEFL scores of 220 for the computer based test, 80 for the internet based test, or 560 for the paper based test. The IELTS score must be a 6.5 or above. Applicants

judged to have a deficient academic preparation will be required to successfully complete certain courses before enrolling in courses at VAIGS.

In order to ensure full consideration, the application and supporting documents for admission should be received by December 1 prior to the year the student plans to matriculate. The application packet should include:

- A completed online application
- Official transcripts of academic record received directly from the home institution. International transcripts must be accompanied by WES course by course evaluation with USA GPA equivalent. The cost of the WES evaluation is the responsibility of the applicant.
- Official GRE general exam scores, MCAT scores, TOEFL and/or IELTS scores
- Three letters of reference, including at least two from faculty members who know the applicant and the applicant's academic work and, if applicable, who supervised independent study or research
- A personal statement of purpose indicating area of interest, long-term goals, and research experience
- A personal resume or curriculum vitae
- A sample of scientific or academic writing (e.g., research report)
- A cover letter stating the applicant's interest in the VAI Graduate School

Domestic applicants with the strongest credentials will be interviewed in person, typically during a visit to VAI. International applicants may be interviewed via videoconferencing or Skype communication.

Those application packets completed by the deadline will receive the most thorough and timely consideration. Typically, interviews are scheduled for late January and February. Decisions are generally conveyed to applicants in March.

Credit Hour Allocation and Requirements Policy

VAIGS offers courses on a semester basis, and the credits earned from VAIGS courses are deemed to be semester credits. Each VAIGS course will be allocated a specific number of credits based upon the number of instructional contact hours and study hours required each week per semester. These credit allocations are made by the VAIGS Curriculum Committee upon review of the syllabus and calendar for any proposed course.

For classroom-based courses, including core instructional courses, special topics courses, professional development courses, and graduate seminar courses, one credit

hour is allocated for an expected activity of at least forty-five (45) hours of instructional and study time. Typically, one credit hour will be allocated for a minimum of fifteen (15) instructor-student contact hours per semester along with a minimum expectation of two preparation or study hours for each contact hour. The balance of direct instructional hours and study or preparation time may vary as befits a given course.

For research-based courses, including first year laboratory rotations, pre-candidacy research, and doctoral candidate thesis research, one credit hour is allocated for a minimum of ninety (90) hours devoted to research activities, research-related meetings (with lab members or thesis advisor), and in preparation or study for these research activities and meetings. (See [Credit Hour Allocation and Requirements Policy](#))

Full-Time Student Status

VAIGS students are expected to devote their full professional effort toward the pursuit of the Ph.D.. First year students are considered full-time students if they enroll for at least 12 credits in each of the Fall and Winter semesters. Continuing students who are enrolled for at least six credits during each semester are considered full-time students. (See Enrollment policy)

Some individual academic plans may require blending VAIGS academic activities with other professional development activities (e.g., medical residencies or fellowships). These will be established on a case-by-case basis with the approval of the Dean.

Academic Advising

The aim of VAIGS is that students obtain their doctoral degrees within five years. To facilitate the five year goal, student progress is monitored frequently throughout the program. Progress on fulfillment of requirements will be tracked by the use of the Student Annual Progress Checklist. The Dean serves as the Academic Adviser for all first year students to orient the student to the program and to monitor their progress through the core curriculum and laboratory rotations. Once a Thesis Adviser and TAC have been appointed, the Thesis Adviser serves as the primary academic adviser.

Assessment

Student work is evaluated for progress toward fulfilling the goals of the graduate program and also to assist the student in measuring progress toward fulfilling the graduation requirements. The faculty expect the students to make satisfactory progress and will assist them toward that goal. Satisfactory progress includes passing all courses and completing the graduation requirements on a schedule that aims toward completion of all requirements for the degree within five years. Each student will be provided a

Student Annual Progress Checklist to track his/her progress through the program. Student progress will also be monitored annually by the Student Performance Review Committee of the faculty.

Students are expected to complete their degrees in five years and every effort will be made to assist them in meeting appropriate milestones. Failure to make sufficient progress in the program is grounds for dismissal. Extension beyond five years will be allowed if the Dean determines there are extenuating circumstances (comparable to those defined for employees under the Family Medical Leave Act). Rarely will there be an extension beyond six years.

Students whose native language is not English must show fluency in oral and written English by satisfactory performance in courses, seminars and scientific writing. Failure to achieve fluency by the end of the second year may result in dismissal.

Students will be evaluated in the following ways:

Courses

The instructors assess student performance in courses, provide written evaluation of the work, and evaluate students on a 4.0 grade scale (for most courses) or a Pass/Fail decision (for certain specified courses). A grade of 3.0 or better is considered a passing grade. A grade of 2.5 or below will be considered a failing grade. Only grades of 2.5 in required courses are considered for potential remediation. The accumulation of two failing grades in the graduate program provides grounds for dismissal.

Rotations

Following each laboratory rotation, students will summarize their findings and suggest further directions for the rotation project by writing a short (1-2 page) report using the Student Evaluation of Rotation Experience form. Simultaneously, rotation mentors will complete the Faculty Evaluation of Student Performance (Rotation).

Core Competencies

VAIGS has defined a set of Core Competencies to describe the outcomes expected for successful Ph.D. graduates of this program. The competencies are grouped in four major areas: knowledge, research, translation, and ethical and professional conduct. A rubric describing stages of development for each of the competencies is a useful guide for students to understand those expectations and for monitoring progress in achieving those expectations. The Core Competencies

rubric (available through the SharePoint site) should be used at least once a year by the student and thesis adviser, for formative evaluation of the student's progress and for making plans to address any areas with deficiencies. Anonymous (de-identified) results of the Core Competencies evaluations are also used each year by the VAIGS staff to monitor general program outcomes. Students and faculty are expected to support this essential program review activity.

Comprehensive Exam

The Comprehensive Exam shall be completed in February or March of the second year. The format and potential outcomes for the Comprehensive Exam are defined in a prior section of this catalog and in the Guidelines for Comprehensive Exam.

Research and TAC Reports

Students must meet with their TACs every six months. The student shall provide to the TAC members either a brief research Progress Report or a more comprehensive Annual Summary. Members of the TAC Committee will add their comments and recommendations on the Student Progress Report Form, and each member will sign the form indicating their approval. The signed form will then be turned in to the ERA for the student's records.

Student Performance Review Committee

A standing committee of faculty members will conduct an annual review of the progress of each student. The composition and mandate of this committee is defined in the Faculty Bylaws. This committee will consider course grades, thesis committee reports, oral presentations by the student, and other relevant information. The committee will make recommendations to the Dean regarding continued participation of each student including, where appropriate, recommendations for remediation of any deficiencies. A copy of this report will be provided to the student and her/his Thesis Adviser.

Thesis or Dissertation Defense

Students are required to make a public presentation of their research results and thesis as well as successfully defend the thesis or dissertation before the Thesis or Dissertation Defense Committee. The process for the thesis or dissertation preparation and defense is detailed in prior sections of this catalog.

Transfer of Academic Credit

Transfer of academic credit to another educational institution will be initiated by a request from the participating student and will be executed by the VAIGS ERA based on

articulation agreements established with the external institution. VAIGS offers no guarantee that external institutions will grant academic credit for courses taken under this policy. VAIGS students may take graduate courses offered at other institutions for up to four credit hours toward the VAIGS Ph.D.. (See Transfer Credits for VAIGS Courses Policy)

Remediation

VAIGS students are expected to obtain a 3.0 grade or better (on a 4.0 scale) in each class in order to receive degree credit. Circumstances arise, however, where student performance in isolated areas within a required course does not meet standards for a passing grade (3.0). In these rare cases, remediation may be recommended by the Course Director.

Remediation is restricted to focused areas of insufficient learning or substandard attainment of a small number of learning objectives. Only a grade of 2.5 may be considered for remediation. Opportunity to remediate will be made available by the Course Director when the initial grades are submitted to the ERA. The Remediation Plan will define the nature of the deficiency, the scope of remediation expected, the timing of completion, and signatures indicating understanding and agreement by the student and Course Director. With the outcome of successful remediation (from 2.5 to 3.0) the faculty will submit a grade change form to the ERA. (See [VAIGS Course Remediation Policy](#))

Probation and Dismissal

Making errors is part of the learning process. Errors should generate feedback and lead to corrective actions. The nature of the feedback and corrective actions shall be determined by proportional response to the nature of error, the student's training needs, and the context of these issues. Therefore, processes for probation and dismissal operate on a case-by-case basis as established in the VAIGS Policy for Probation and Dismissal.

When students are not making adequate progress toward completion of courses or graduation requirements, as determined by their Academic or Thesis Adviser, the Student Performance Review Committee, and the Dean, they may be placed on academic probation. Grounds for probation include:

- Accumulation of two failing grades in course work, laboratory rotations, or research
- Failure to move through the program at an appropriate rate (e.g., failure to meet milestones throughout the degree program)
- Failure to meet with TAC in timely manner (approximately every six months)
- Unprofessional behavior (e.g., plagiarism, insubordination, violation of workplace policies)
- Poor performance on the Comprehensive Examination

Students and their Thesis Adviser will be given written notification of probation and written guidelines for removal of the probationary status. Should a student desire to withdraw from the program or take a leave of absence, such action is arranged in consultation with the Academic or Thesis Adviser and Dean. At the time of approval of the withdrawal or leave of absence, the student will be advised regarding the criteria for reinstatement.

Grounds for dismissal include:

- Three (or more) failing grades
- Failure to meet the terms of Student Probation Contract
- Failure to pass the Comprehensive Exam
- Failure to adhere to institutional standards in scientific integrity and research conduct, as defined in the VAI Research Misconduct Policy
- Violation of VAI policies regarding appropriate behavior in the workplace

Honor Code

Scientific work requires honesty and integrity, and the scientific community has strict standards for the conduct of research. Students are governed by the VAI Research Misconduct Policy, which encompasses research and coursework. Students will also be asked to read and sign an honor code governing academic honesty and behavior at VAIGS. Academic dishonesty in coursework or in fulfillment of other requirements will result in failure on that specific requirement and is grounds for dismissal from the graduate program.

Tuition

Tuition for a full academic year (three semesters, including summer) is \$25,000. For individual courses, tuition will be assessed at a rate of \$835 per credit hour. Tuition will be waived for students supported by VAIGS fellowships.

Enrollment of non-VAIGS students in VAIGS courses is permitted under certain conditions defined in the VAIGS Tuition Policy. Such enrollment typically requires full participation in course activities (course auditing is not permitted) and payment of tuition.

Course Auditing

Course Directors design instructional activities according to the number and ability of registered students. Classroom engagement and preparedness are critical for learning in all settings at VAIGS. In keeping with the VAIGS mission to maximize learning of students in

all content areas, auditing is not permitted. All courses will be attended by registered students and instructors, only. (See [VAIGS Course Auditing Policy](#))

Grievance

Student grievances regarding coursework, grading, academic progress, and VAIGS policies or practices should be directed to the Academic or Thesis Adviser, if they cannot be resolved directly with the parties involved. If the grievance is still not resolved, the student should consult the Ombudsman (in most circumstances, the Vice President of Human Resources), who will advise the student and serve as a liaison with the faculty and administration. Unresolved issues or appeals should be presented to the Dean, in writing.

Grievances regarding research should first be directed to the Thesis Adviser. Should further resolution be necessary, the student can appeal to the TAC and the Dean in writing.

Students who experience or observe sexual harassment, racial or ethnic discrimination, or scientific misconduct should raise their grievance using VAI employment policies and procedures.

Outside Employment

Students enrolled in VAIGS are presumed to be devoting their full professional efforts toward the pursuit of their Ph.D.. However, the policy on external activities outlines parameters in which students can participate in outside work (See VAIGS Policy on External Activities). These activities typically must be approved by the thesis adviser and the Dean.

Religious Observance

In accord with the VAI holiday policy, VAIGS holds that basic rights regarding religious preference should be extended to students. Therefore, every reasonable effort will be made to grant students time off to attend worship services or to celebrate holidays consistent with their faith. All requests for time off for observance of religious holidays or worship services should be submitted to the Thesis Adviser or the Dean at least 48 hours in advance. (See [VAIGS Religious Observance Policy](#))

Student Verification for Online Assignments

The Higher Education Opportunity Act of 2008 and the rules issued by the US Department of Education include regulations regarding the verification of the identity of students in distance-education programs. The Higher Learning Commission, which is the accrediting body for VAIGS, requires its member institutions to demonstrate that their policies and practices support these regulations. The Student Verification for Online

Assignments Policy describes VAIGS practices for meeting these regulations. (See Student Verification for Online Assignments Policy)

Non-discrimination and Equal Opportunity Policy (EEO)

Van Andel Institute and/or its affiliated organizations (VAEI and VARI), hereafter collectively called "the Institute", through its responsible managers, recruits, hires, upgrades, trains, and promotes in all job titles without regard to race, color, religion, sex, national origins, age, height, weight, marital status, disability, pregnancy or veteran status except when an accommodation is unavailable or it is a bona fide occupational qualification. The Institute's policy also covers the non-employee relationships with students, including admissions and enrollment, instruction and grading, student services, and financial support. (See Equal Employment Opportunity Policy)

LEGAL STATUS

Authority

VAIGS is incorporated in the State of Michigan and is authorized to award the M.S. and Ph.D. degrees.

Accreditation

Accreditation for VAIGS is governed by the rules and procedures of the Higher Learning Commission. As of November 2013, VAIGS has been granted initial accreditation with the HLC. Further information about the HLC and the accreditation status of VAIGS can be found at www.hlcommission.org.

Governance

The corporate name of the school is Van Andel Institute Graduate School (VAIGS). A Board of Directors appointed by the Van Andel Education Institute (VAEI) Board of Trustees governs the school. The Board of Directors includes persons with distinguished careers in biomedical research, higher education, and clinical training. The VAIGS Board of Directors normally meets twice each year, in the spring and fall. The President and Dean of VAIGS administers the school with advice from faculty committees.

VAIGS Board of Directors

- James B. Fahner, M.D., Chief of Hematology/Oncology at DeVos Children's Hospital.
- Mike Imperiale, Ph.D., Director of the Doctoral Program in Cancer Biology, University of Michigan.
- Peter Jones, Ph.D., D.Sc. Chief Scientific Officer, Van Andel Research Institute
- Pamela Kidd, M.D., Medical Director of the Hematology and Flow Cytometry Laboratories of Spectrum Health and Helen DeVos Children's Hospital (retired)

- Karen Klomparens, Ph.D., Senior Advisor to the Provost, Michigan State University
- Danny Welch, Ph.D., Professor and Chair; Adjunct faculty of Department of Molecular & Integrative Physiology
- Gordon L. Van Harn, Ph.D., Emeritus Provost and Professor of Biology at Calvin College; chair of the Board.

Administration

Dr. Steven J. Triezenberg is the President and Dean of VAIGS. Dr. Julie Davis Turner is the Associate Dean of VAIGS. VAIGS is a wholly owned subsidiary of VAEI, which works in close association with VAI and VARI. VAIGS is strongly and broadly supported by the other partner institutes. The administration of these entities includes the following:

VAI

- David Van Andel, Chief Executive Officer
- Jana Hall, Ph.D., Chief Operations Officer
- Timothy Myers, Vice President and Chief Financial Officer
- Jana Hall, Ph.D., Chief Operating Officer
- Jerry Callahan, Ph.D., Vice President Innovations and Collaborations
- Linda Zarzecki, Vice President of Human Resources

VAEI

- Terra Tarango, Director and Education Officer
- Temple Rosenberger, Associate Director of VAEI Business Development

VARI

- Peter Jones, Ph.D., VARI Chief Scientific Officer and Director of the Center for Epigenetics
- Patrik Brundin, M.D., Ph.D., VARI Associate Director and Director of the Center for Neurodegenerative Sciences
- Bart Williams, Ph.D., Director of the Center for Cancer and Cell Biology
- Scott Jewell, Ph.D., Director of Core Technologies

FACULTY AND STAFF LISTING

The faculty of VAIGS are persons appointed as VARI faculty and laboratory heads. Appointment to VARI as a faculty member typically requires a Ph.D., M.D., or equivalent academic degree, plus a distinguished record of scholarship and contributions to the scientific community. Faculty appointment to VAIGS for non-VARI faculty is made by nomination to the Graduate Program Committee and requires a vote of the full VAIGS faculty.

Adjunct faculty members of VAIGS supplement the permanent faculty. Adjunct faculty members participate in VAIGS as cooperating instructors for VAIGS courses, as members of VAIGS Thesis Advisory or Defense Committees, or as facilitators of professional development programs. Typically, adjunct faculty members are practicing professionals or faculty members from local colleges/universities.

Current VAIGS Faculty

Stephen Baylin, Professor, Center for Epigenetics. M.D. (1968), Duke University, Durham, N.C.

Lena Brundin, Associate Professor, Center for Neurodegenerative Science. Ph.D. (2001) and M.D. (2002), Lund University, Sweden.

Patrik Brundin, VARI Associate Director of Research; Professor and Director of the Center for Neurodegenerative Science; Jay Van Andel Endowed Chair in Parkinson Research. M.D. (1992) and Ph.D. (1988), Lund University, Sweden.

Gerhard Coetzee, Professor, Center for Neurodegenerative Science. Ph.D. 1977) University of Stellenbosch, South Africa.

Carrie R. Graveel, Research Assistant Professor, Center for Cancer and Cell Biology. Ph.D. (2002), University of Wisconsin-Madison.

Patrick Grohar, Professor, Center for Cancer and Cell Biology. Ph.D. (2001), M.D. (2003), Wayne State University.

Brian B. Haab, Professor, Center for Cancer and Cell Biology, Innovation and Integration Program. Ph.D. (1998), University of California, Berkeley.

Galen Hostetter, Associate Director, Pathology and Biorepository Core. M.D. (1993), University of Pennsylvania.

Scott D. Jewell, Professor and Director, Core Technologies. Ph.D. (1993), Ohio State University.

Peter Jones, Distinguished Professor and Director, Center for Epigenetics. Ph.D. (1973), University of London.

Stefan Jovinge, Professor, Center for Epigenetics; Medical Director of Research, Frederik Meijer Heart and Vascular Center. M.D. (1991) and Ph.D. (1997), Karolinska Institute, Sweden.

Jeffrey Kordower, Professor, Center for Neurodegenerative Science. Ph.D. (1984), City University of New York

Viviane Labrie, Assistant Professor, Center for Neurodegenerative Science. Ph.D., University of Toronto.

Peter Laird, Professor, Center for Epigenetics. Ph.D. (1988), University of Amsterdam, Netherlands.

Huilin Li, Professor, Center for Epigenetics. Ph.D. (1994), University of Science and Technology, Beijing, China

Xiaohong Li, Assistant Professor, Center for Cancer and Cell Biology, Program in Skeletal Disease and Tumor Microenvironment. Ph.D. (2000), Chinese Academy of Sciences.

Wei Lü, Assistant Professor, Center for Cancer and Cell Biology, Ph.D. (2010), University of Freiburg, Germany

Jiyan Ma, Professor, Center for Neurodegenerative Science. Ph.D. (1997), University of Illinois, Chicago.

Jeffrey P. MacKeigan, Associate Professor, Center for Cancer and Cell Biology, Innovation and Integration Program. Ph.D. (2002), University of North Carolina.

Karsten Melcher, Associate Professor, Center for Cancer and Cell Biology, Innovation and Integration Program. Ph.D. (1990), Eberhardt-Karls University, Germany.

Cindy Miranti, Adjunct Professor, Ph.D. (1995), Harvard Medical School

Darren Moore, Associate Professor, Center for Neurodegenerative Science. Ph.D. (2001), University of Cambridge.

- David Nadziejka, Instructor, Scientific Editor (VARI). MS (1980), University of Arizona.
- Gerd Pfeifer, Professor, Center for Epigenetics. Ph.D. (1984), Goethe University, Frankfurt, Germany.
- James H. Resau, Adjunct Professor. Ph.D. (1985), University of Maryland.
- Scott Rothbart, Assistant Professor, Center for Epigenetics. Ph.D. (2010), Virginia Commonwealth University.
- Lorenzo Sempere, Assistant Professor, Center for Cancer and Cell Biology, Program in Skeletal Disease and Tumor Microenvironment. Ph.D. (2004), Dartmouth.
- Hui Shen, Assistant Professor, Center for Epigenetics. Ph.D. (2013), University of Southern California.
- Matthew R. Steensma, Assistant Professor, Center for Cancer and Cell Biology, Program in Skeletal Disease and Tumor Microenvironment. M.D. (2002), Wayne State University School of Medicine.
- Piroska Szabo, Associate Professor, Center for Epigenetics. Ph.D. (1992), Jozsef Attila University, Szeged, Hungary.
- Steven J. Triezenberg, President and Dean, VAIGS; Professor, Center for Epigenetics; Ph.D. (1984), University of Michigan.
- Julie Davis Turner, Associate Dean, VAIGS. Ph.D. (2000), University of Pennsylvania.
- Jeremy Van Raamsdonk, Assistant Professor, Center for Neurodegenerative Science. Ph.D. (2005), University of British Columbia.
- George F. Vande Woude, Distinguished Scientific Fellow and Professor, Center for Cancer and Cell Biology, Program in Molecular Oncology and Pre-Clinical Therapeutics. Ph.D. (1964), Rutgers University.
- Bart O. Williams, Director, Center for Cancer and Cell Biology; Professor, Program in Skeletal Disease and Tumor Microenvironment. Ph.D. (1996), Massachusetts Institute of Technology.

Mary Winn, Instructor; Manager, Bioinformatics and Biostatistics Core. Ph.D. (2011), University of California, San Diego.

Ning Wu, Assistant Professor, Center for Cancer and Cell Biology, Innovation and Integration Program. Ph.D. (2002), University of Toronto. H. Eric Xu, Professor, Center for Cancer and Cell Biology, Innovation and Integration Program. Distinguished Director, VARI/SIMM Research Center. Ph.D. (1994), University of Texas Southwestern Medical Center.

Tao Yang, Assistant Professor, Center for Cancer and Cell Biology, Program in Skeletal Disease and Tumor Microenvironment. Ph.D. (2001), Institute of Biochemistry and Cell Biology, Chinese Academy of Sciences (SIBCB, CAS).

Faculty Committees

VAIGS faculty members are involved in the governance of VAIGS through appointed committees as defined in the Faculty Bylaws and described briefly as follows. Committee members will be appointed by the Dean to three-year terms, staggered to ensure continuity of experience.

Admissions Committee

Composed of five faculty members and one graduate student member, this committee oversees the student recruitment process, reviews all applications, and makes recommendations to the Dean.

Comprehensive Examination Organizing Committee

Composed of three faculty members, this committee supervises the preparation and administration of the comprehensive examinations and thesis and dissertation defenses.

Curriculum Committee

This committee oversees the design, implementation and evaluation of the degree requirements, coursework, and grading policies of VAIGS. The committee assesses whether the course offerings provide adequate instruction in the core disciplines for VAIGS. The committee approves special topics courses (graduate seminar courses). The committee comprises four faculty members and one postdoctoral associate or graduate student member, In addition, the Assistant or Associate Dean sits on the committee as an ex officio member.

Graduate Program Committee

This committee recommends policy on graduation requirements, curriculum, admissions, and faculty. This committee also monitors the program and advises the Dean on administrative matters. This committee comprises four faculty members, in addition to the Dean who chairs the Graduate Program Committee as an ex officio member.

Student Performance Review Committee

This committee annually assesses the progress of each student with respect to the requirements for completing the intended degree. This committee comprises three faculty members, in addition to the Dean who chairs the committee as an ex officio member.

Undergraduate and Internship Programs Committee

This committee of four faculty members is responsible for design, implementation, and evaluation of VAIGS programs and related policies whose primary constituents are students enrolled in other educational institutions. These students include those enrolled in high schools, undergraduate colleges or universities, and medical or other professional schools. This may also include students enrolled in masters or doctoral degree programs at other institutions for whom the relationship with VAIGS or VARI is time-limited. The programs within the purview of this committee include internships, guest student relationships, and regional undergraduate research conferences.

Reference to Faculty Bylaws

The Faculty Bylaws of VAIGS describe and define the organization of the Graduate School faculty and the procedures by which faculty fulfill their functions with respect to the Graduate School. The administrative structure of the Graduate School is further defined by the Articles of Incorporation (restated in 2017) and the Bylaws of the Van Andel Institute Graduate School (as amended in 2010). These faculty bylaws shall be in compliance with policies and bylaws of the Van Andel Institute (VAI), the Van Andel Education Institute (VAEI), and the Van Andel Research Institute (VARI). If, in any substantive manner, the VAIGS bylaws conflict with VAI, VAEI or VARI bylaws and policies, the latter shall take precedence.

VAIGS Staff

- Steven J. Triezenberg, Ph.D., President and Dean, VAIGS
- Julie Davis Turner, Ph.D., Associate Dean
- Christy Mayo, Enrollment and Records Administrator II
- Patty Farrell-Cole, Ph.D., Evaluation Specialist

- Nancy Schaperkotter, M.A., Student Affairs Specialist
- Susanne Miller-Schachinger, Executive Assistant
- Kathy Bentley, Senior Administrative Assistant II
- Michelle Love, Administrative Assistant II

AMENDING AND REVISING THIS CATALOG

Any faculty member or graduate student may submit proposals to amend or revise the VAIGS Catalog. Amendments to be considered must be written and circulated to the faculty and graduate students not less than 14 days prior to the faculty meeting at which they are to be voted upon. Amendments must be passed by a majority of the "voting faculty". The VAIGS Catalog should be reviewed and re-approved at periodic intervals no greater than five years.

This document was originally approved by vote of the faculty on Feb. 23, 2007, and has been revised on the following dates: December 14, 2007, June 23, 2009, September 16, 2011, September 14, 2012, August 1, 2013, August 1, 2014, June 25, 2015, June 2016, and July 7, 2017.

ADDENDUM A – GUIDELINES FOR THE COMPREHENSIVE EXAMINATION

PREAMBLE – The Comprehensive Examination is the first true step towards the goal of earning the degree of Doctor of Philosophy. The Ph.D. is the highest academic degree granted and the dissertation is the distinctive mark of doctoral education. Before conducting dissertation research, the applicant should first demonstrate potential and ability to identify and define explicitly a specific testable hypothesis to pursue for her/his dissertation research as a doctoral *candidate*. The candidate will be expected to critically evaluate the relevant literature, present a testable and important hypothesis, and propose critical experiments to test the hypothesis, including a plan to interpret potential outcomes. These qualities will be assessed through a process termed the Comprehensive Examination (sometimes referred to as the Preliminary Examination).

Overview – This document specifies how the Comprehensive Examination will be conducted. Because the prospective candidate will be qualitatively assessed by human judges, the goal is to explicitly describe what is expected and detail how the prospective candidate will be judged.

A. The Comprehensive Exam Committees

A standing committee (the Comprehensive Examination Organizing Committee, or CEOC) of the faculty will oversee the organization and conduct of the Comprehensive Examination process, including these guidelines. A separate Comprehensive Examination Committee will be established for each Ph.D. candidate. The members of each Comprehensive Examination Committee will consist of:

- the Ph.D. candidate's thesis adviser
- two VARI faculty members from the candidate's Thesis Committee
- one VARI faculty member that is not on the Thesis Committee
- one outside expert on the non-thesis proposal topic
- one VARI faculty member from the CEOC

The latter three members will be appointed by the Graduate School Dean with advice from the thesis advisory committee and the CEOC. These appointments shall be made in December prior to the February date of the comprehensive exam.

B. Role of the Comprehensive Exam Committee members.

The Comprehensive Exam Committee will be chaired by the representative from the CEOC. The committee chair will not participate in the evaluation of the candidate, but will assist in identifying and recruiting a suitable outside expert, will be responsible for describing the scoring criteria to all Comprehensive Exam Committee members, will be responsible for

overseeing the proceedings of Part III of the Comprehensive Exam (the Oral Examination), and will ensure that the scores are submitted to the Dean of the Graduate School.

Candidates are responsible for preparing the proposals comprising the written exam and ensuring appropriate documents are presented to the rest of the Committee at the appropriate dates. The proposals should represent the student's individual efforts and abilities. During the preparation of the proposal, students are encouraged to consult with other students, postdoctoral fellows, and faculty for clarification of ideas. Students should not solicit suggestions for the proposal's specific aims nor should they ask anyone else to provide specific experimental design.

The candidate's thesis adviser should offer instruction and advice on proposal planning and writing in general terms, but not participate directly in the preparation of either the written or oral exam. The thesis adviser attends Part III of the Comprehensive Examination (Oral Examination, see below) but refrains from directly participating in the evaluation.

The three VARI faculty members (excluding thesis adviser and CEOC representative) and the one outside expert will score the candidate's Comprehensive Exam using the scoring criteria outlined below. In brief, three sections of the exam will be scored: the thesis proposal, the non-thesis proposal, and the oral defense. Each scoring committee member will evaluate the three sections and give each section a score of either Pass, Remediate, or Fail. Brief comments that support the scoring for each section should be included. The scores of all four evaluating faculty will be summarized by the committee chair in the report submitted to the Dean of the Graduate School.

C. Timeline

Students must take the Comprehensive Examination prior to February 28th of their second year of study. Exceptions will be made only with the approval of the Comprehensive Examination Committee and the Dean of the Graduate School. Prospective candidates are encouraged to consult with advisers (including thesis adviser, Comprehensive Exam Committee members, or the Dean) regarding preparation and planning for this exam.

In order for CEOC to eliminate overlapping areas of examination, the topic for the off-topic proposal must be approved by the Comprehensive Examination Organizing Committee, by December 15. Students will submit the specific aims page of their thesis with two potential off-topics topics. The off-topic proposals should be a brief 1-2 paragraph rationale.

The written thesis and off-topic proposals shall be submitted by email to the student's Comprehensive Examination Committee at least two weeks prior to the

scheduled examination date, with the VAIGS Senior Administrative Assistant and Enrollment and Records Administrator (ERA) copied.

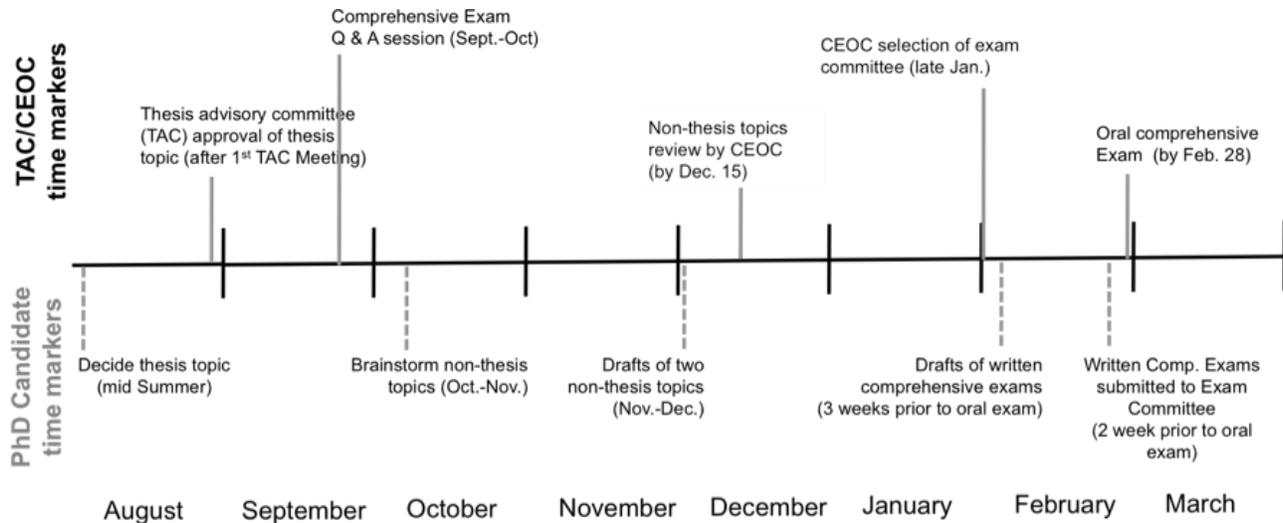


Figure. Timeline for Comprehensive Exam preparation

D. The Examination (three parts):

Part I. Thesis-based Proposal – The first component is a written research proposal that describes the candidate's future thesis work. This proposal shall be prepared in the style of a National Institutes of Health (NIH) pre-doctoral grant application complete with Specific Aims, Research Strategy (Significance, Innovation, Approach), and Bibliography sections. See Appendix 1 for further guidelines about the contents of each section. Students are encouraged to work closely with their thesis adviser to develop specific aims and begin generating preliminary data to support their thesis-based proposal. The written proposal (exclusive of references and figures) should not exceed 10 pages, single-spaced, 11 point font, with 1 inch margins. The students are required to submit their proposals to their Comprehensive Exam Committee two weeks prior to the scheduled comprehensive oral exam date.

Part II. Off-topic (Non-Thesis) Proposal – The second part consists of a written research proposal based on topics NOT directly associated with the candidate's chosen field of research. The candidate will first propose two off-topic proposals by writing a brief 1-2 paragraph description on each, at least three months prior to the anticipated examination date (typically in November of the second year). These off-topic proposals (submission to the Comprehensive Exam Organizing Committee, copy to VAIGS Senior Administrative Assistant, by December 1) must clearly state the hypothesis to be addressed

in the proposal and briefly describe the experimental systems proposed to test the hypothesis. The topic selection must be approved by CEOC, by December 15.

The scope of the project should be such that it could be realistically carried out by a single person, with only part-time technical help, in three years. The off-topic proposal should be written using the same NIH proposal format. The off-topic proposal should not exceed 7 pages, single-spaced, 11 point font, with one inch margins. The off-topic proposal is also due to the Comprehensive Exam Committee two weeks prior to the scheduled comprehensive oral exam date.

Part III. Oral Examination – After the two written proposals for the Comprehensive Exam have been submitted, the third phase involves an oral defense of the two written proposals, together with an examination on related topics. The student should prepare a short formal presentation (approximately 15-20 minutes) to provide a framework for the examination. This presentation should provide an overview of the thesis-based proposal, including the biological context for the work, the central question of the project, a statement of the hypothesis and specific aims, a sketch of the approaches proposed, and a consideration of expected or potential outcomes. The off-topic proposal should also be introduced in like manner (in the second portion of the oral exam). Both presentations should be planned as “chalk talks” without reliance on slides or other presentation media.

During and following the student’s presentation, the committee will pose questions to probe whether the student has a fund of knowledge and critical thinking skills sufficient to conduct the proposed research with a reasonable likelihood of success. Approximately one hour will be devoted to questions on the thesis proposal. That portion will be followed by a period of approximately one-half hour for questions on the off-topic proposal. The goal of the questioning is to define the boundaries of the student’s knowledge, and thus it is likely that eventually questions will be raised to which the student has no ready answer. This may include questions on topics that are related to, but not directly addressed by, the written research proposals. The task of the committee is to decide whether the boundary of knowledge is appropriate for a student at this stage of development. Because “foundational knowledge” is one of the evaluation criteria, the committee’s questions may delve into topic areas that are not directly related to either the thesis or off-topic proposals. The committee has the responsibility to arrive at a consensus as to whether the candidate possesses the foundational knowledge or has the skills to learn the foundational knowledge, which will be critical to his or her thesis work.

At the discretion of the committee, the student will be asked to leave the room for deliberations at the beginning and end of the exam.

E. Scoring Criteria

Evaluation of the student’s performance on the three parts of the Comprehensive Examination will be evaluated using the following criteria. A scoring sheet will be provided to each committee member allowing them to comment on these criteria.

Criterion	Standard
Background, Rationale & Significance	Does the applicant understand the underlying concepts necessary to proceed with proposed research? Has the applicant critically assessed the previously published research?
Preliminary Results	Is there sufficient preliminary data to support the pursuit of the proposed research? Does the applicant critically assess the quality and relevance of the preliminary results?
Theory/Guiding Hypothesis	Has the applicant devised an important and testable overarching hypothesis? Are the specific aims well-defined and relevant for testing that hypothesis?
Research Design	Are the proposed methods appropriate and necessary for testing the hypotheses? Does the applicant understand the conceptual and technical basis of the proposed methods? Are alternative approaches (and their advantages or disadvantages) considered? If new approaches are necessary, is the applicant equipped to develop them? Is the timeline for completion of the work reasonable and appropriate?
Predicted Outcomes	Has the applicant adequately considered experimental outcomes, how they will be interpreted and considered changes in strategy if problems are encountered?
Presentation Clarity	Has the applicant presented a clear working knowledge of the proposed research? Does the applicant respond directly and concisely to questions?
Creativity	Has the applicant identified a new and interesting question? Has the applicant designed a novel approach to addressing their hypothesis? Has the applicant brought together principles or methods from several areas or fields?
Critical Thinking	Does the applicant critically assess: the current state of knowledge; the quality and limitations of previously published work; the quality and limitations of their own preliminary results; the alternative approaches or outcomes?

F. Outcome and Decision

Passing the Comprehensive Examination requires satisfactory completion of all three of the exam sections (written thesis proposal, written off-topic proposal, and oral examination). Each member of the committee will evaluate each of the three sections separately, assigning a score of Pass, Remediate, or Fail. The committee will then compile a composite score for each section. A passing score on each section requires that at least three of the four voting members assign a Pass score.

For the examination as a whole, the committee must then assign one of the three following outcomes:

- a) Pass – No further work is required on the Comprehensive Examination itself. The committee may make recommendations for areas in which improvement should be sought or expected.
- b) Failure with opportunity to remediate – If the committee identifies weaknesses in a limited number of areas and believes that these deficiencies can be corrected with specific actions, the student may be offered the opportunity to remediate those portions of the examination. The committee will define explicitly the conditions for remediation. The remediation should be completed within three months of the initial examination date. If the remediation efforts are deemed satisfactory, the student will have passed the Comprehensive Exam. If the remediation efforts are deemed unsatisfactory, the student will have failed the Comprehensive Exam and the student will be asked to leave the doctoral program.
- c) Failure – If the student fails one or more portions of the Comprehensive Exam, with deficiencies beyond the scope deemed remediable within three months, the student will not be offered the opportunity to remediate and the student may be required to leave the doctoral program.

Because the CEOC member serves as Chair the exam and fully understands the rationale for the decisions reached, he/she will carry out the following:

- a) Complete "blue report form" with all committee signatures; file directly following exam with Enrollment and Records Administrator (ERA). Synopsis comments are included.
- b) Announce only positive exam outcomes to student, thesis adviser and Dean first. Then announce to VAIGS faculty, VAIGS Staff, VAIGS Students, MSU Students either the day of the exam or early the day following. (Template email available.)
- c) In all cases (Pass, Fail, or Remediate), compile major comments by email from the Comprehensive Exam Committee. After reaching consensus with the entire exam

committee, then send consensus document to Dean, ERA, student, and thesis adviser within three days. As necessary, include the Remediation plan with timeline.

d) Exam chair will monitor remediation and will report outcomes using steps above.

G. Submission of Proposal for External Fellowship Application

The thesis proposal must be submitted as a grant application (typically as a predoctoral fellowship) to an external agency within one year of the successful completion of the comprehensive examination. The candidate should work closely with the thesis adviser and the Grants and Contracts administrators to identify suitable funding sources and in the preparation of the application itself. Success in obtaining external fellowship support is NOT a requirement for passing the comprehensive examination.

Appendix 1. Research Plan. The following guidelines are excerpted with minor modifications from the NIH Publication entitled *Individual Fellowship Application Guide for NIH and AHRQ*. The full instructions can be found at the following web page:

<https://grants.nih.gov/grants/how-to-apply-application-guide/forms-d/fellowship-forms-d.pdf>

1. Specific Aims (1 page)

State concisely the goals of the proposed research and summarize the expected outcome(s), including the impact that the results of the proposed research will exert on the research field(s) involved. List succinctly the specific objectives of the research proposed, e.g., to test a stated hypothesis, create a novel design, solve a specific problem, challenge an existing paradigm or clinical practice, address a critical barrier to progress in the field, or develop new technology. **Specific Aims are limited to one page.**

2. Research Strategy (6-9 pages)

a) Significance

- Explain the importance of a problem or critical barrier to progress in the field addressed in the proposal.
- Explain scientific knowledge, technical capability, and/or clinical practice will improve.
- Describe how the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field will be changed if the proposed aims are achieved.

b) Innovation

- Explain how the application challenges and seeks to shift current research or clinical practice paradigms.

- Describe any novel concepts, methodologies, instrumentation or interventions to be developed or used, and any advantage over existing methodologies, instrumentation, or interventions.

c) Approach

- Describe the overall strategy, methodology, and analyses to be used to accomplish the specific aims
- Describe how the data will be collected, analyzed, and interpreted.
- Discuss potential problems, alternative strategies, and benchmarks for success.
- If the project is in the early stages of development, describe any strategy to establish feasibility, and address the management of any high risk aspects of the proposed work.

3. Bibliography and References Cited [excerpted from NIH Form 398 application guide]

Provide a bibliography of all references cited in the proposal. Each reference must include names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. Include only bibliographic citations. Follow scholarly practices in providing citations for source materials relied upon in preparing any section of the application. The references should be limited to relevant and current literature. While there is not a page limitation, it is important to be concise and to select only those literature references pertinent to the proposed research.

ADDENDUM B – PREPARING FOR THE COMPREHENSIVE EXAMINATION

Van Andel Institute Graduate School Preparing for the Comprehensive Examination

Revised 9/15/2014 KB

OVERVIEW – This document lists practical information to help VAIGS doctoral students prepare for the Comprehensive Examination, typically conducted in year 2 of their graduate studies. The purpose of this document is to present further information on the scope of the thesis and off-topic proposals, to give guidelines on appropriate resources and sources of advice, to suggest a timeline for preparation of the proposals (prior to February 28th of the second year for single-track Ph.D. students; dual-track students will be scheduled individually with the Dean), and to give guidelines for how much background preparation is necessary for the exam, including preparation of the chalk talk. A separate document, “Guidelines for the Comprehensive Examination” details how the Comprehensive Exam will be conducted, exactly what is expected and how the candidate will be judged.

A. Scope of the written components: on-topic proposal and off-topic proposal

1. On-Topic proposal – The aims and scope of the thesis proposal are developed between you and your thesis adviser, and should generally have been agreed upon at the first Thesis Advisory Committee (TAC) meeting. The breadth of this project should encompass research that you can accomplish in 4 years with minimal technical help. For the comprehensive exam, the KEY point is to present the depth of YOUR OWN thinking on the project. The proposal should have a clear hypothesis and distinct specific aims. The background should be sufficient to place your work clearly in the field, and should establish why this work is important. The experimental plan should clearly illustrate why each experiment is done, and how the anticipated outcomes will address your Specific Aims. You should anticipate technical issues that might need to be overcome, describe potential pitfalls, describe alternative approaches if the first approach fails, and list potential outcomes (the ones you expect and others that might happen) relevant to each specific aim. Do not describe technical details of experiments except when the approach you are taking utilizes or develops a novel technical approach. Emphasize the concepts/models/questions. Your thesis adviser can help you with the overall direction of the project and can guide you on principles and tactics of writing good proposals, but will not participate in writing or editing your Comprehensive Exam proposal.
2. Off-topic (non-thesis) proposal – The purpose of this proposal is to gauge your ability to attack a scientific problem outside your area of expertise using appropriate methodology, your ability to think critically and creatively about the problem, and how

you plan for alternative outcomes. The project described in the off-topic proposal should be limited to the scope of a pre-doctoral fellowship proposal; that is, the work should be reasonably performed by a single person within about 3 to 4 years. As a starting point, you may choose to build from proposals that you have submitted in the SABR course modules or from a lab rotation project. This would help a great deal since you will already be somewhat familiar with the research topic. However, remember this should be on a topic that is not closely related to your thesis research project.

3. Appropriate sources of advice – For both proposals, you may solicit advice from fellow graduate students, postdocs, the Dean/Assistant Dean, or your Thesis Advisory Committee (TAC). If you need advice on technical or feasibility issues you can also consult a VARI Principal Investigator or an expert in the field. However, development of the concepts in the specific aims and experimental design of your on-topic proposal should be between your adviser and you, and the formulation of the hypothesis, specific aims, and experimental design of the off-topic proposal should be your own independent intellectual work.

4. Timeline for preparation of the proposals:

a) On-topic proposal – You should start very early on this (i.e. by June of first year). Use your first TAC meeting to get consensus approval of the key question or hypothesis, the specific aims, your approach and potential methods. You should use the time between development of your specific aims and the thesis proposal due date to gather preliminary data on your project. The preliminary data should support the feasibility of your project. However, the comprehensive exam is NOT primarily a measure of how much work you have done. Rather, the exam is a measure of how well you understand the science behind your project. Writing the proposal is a substantial undertaking and its strength rests on the feasibility and relevance of your specific aims, as well the feasibility of your approach. Since the written proposal is due to the committee 2 weeks before the oral comprehensive exam, have your “final draft” ready at least a week prior to this.

b) Off-topic proposal – Start early. Start thinking about potential topics in October or by early November at the latest. Two off-topics must be proposed to the Comprehensive Exam Organizing Committee (CEOC) by December 1; copy the VAIGS Senior Administrative Assistant. These proposals should list each hypothesis that could serve as the basis for your off topic proposal. Students will submit the specific aims page of their on-topic with potential off topics. The off-topic proposals

should be a brief 1-2 paragraph rationale. The CEOC will approve one or both of these proposed topics by December 15, then you will start writing this proposal. For many students, it helps to formally set aside time each day to work on this proposal. The final form should be concise and focused. Simply formatting the document and assembling the bibliography will take a day or two. So plan to have the “final draft” completed a week before it is due so that you have time to proofread for final editing changes.

- c) Oral examination** – Students must take the Comprehensive Examination prior to February 28th of their second year of study. Exceptions will be made only with the approval of the Comprehensive Exam Organizing Committee (CEOC) and the Dean of the Graduate School. Prospective candidates are encouraged to consult with advisers (including thesis adviser, Comprehensive Exam Committee members, or the Dean) regarding preparation and planning for this exam. The written on-topic and off-topic proposals shall be submitted by email to the student’s Comprehensive Exam Committee at least two weeks prior to the scheduled examination date with the VAIGS Senior Administrative Assistant and ERA.

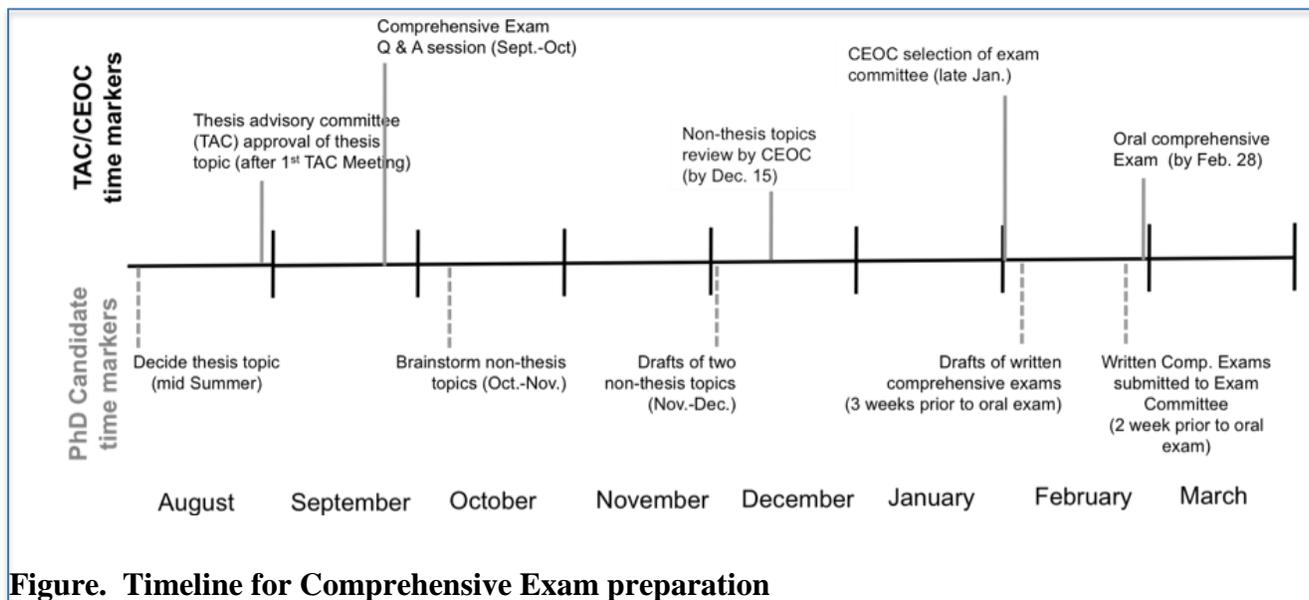


Figure. Timeline for Comprehensive Exam preparation

B. Preparation for the oral exam

1. Background and project-specific knowledge – You should know the biological context in which your project is placed. You should know the key issues or questions in the field around your project, as well as those directly addressed in your project. You should know the key concepts, approaches and methods relevant to your particular project. This certainly does NOT include all aspects of modern molecular and cancer biology. For

instance, if your thesis project revolves around a particular receptor tyrosine kinase, you will not have to recite the Krebs cycle or know the specific proteins that cells use to repair UV-induced lesions. However, you should have a comfortable working knowledge at the level of the Alberts Cell Biology or Watson Molecular Biology texts. You should spend a significant amount of time researching the background of your particular project and be up to date on the relevant literature. You should anticipate and prepare for questions that cover key areas of your research proposal. It would be helpful to list these key areas in advance (perhaps using a concept map to guide you) and then study the background material surrounding these. Write out and memorize the background material. For instance, if you are studying c-Met, know when was it discovered and how, what is its tissue-specific expression, what are the agonists, antagonists, downstream targets and regulators, etc. However, also know where to look if you don't know the answer to a specific question in the exam.

2. Preparing your chalk talk – You should prepare a “chalk talk” about 15-20 minutes in length to introduce your on-topic proposal, and another 10 minutes or so for the off-topic proposal. This is a talk that you will give at the white board and will NOT utilize PowerPoint slides. You should expect to be interrupted early and often during this talk, as committee members will want to probe the depth of your knowledge or your critical thinking on concepts along the way. It will be easier to get back on track after the inevitable interruptions if you prepare the structure of the talk well and if you practice finding your place again. First, make a list of points that you wish to cover during the talk as an outline. This may include the general background to your project including key unanswered questions in the field. You should introduce the topic you have chosen to investigate by stating your hypothesis and your specific aims. You should be prepared to defend the scientific importance and health significance of the project. Describe your experimental plan in broad terms but not using specific technical details. For example, do not explain details of mass spectrometry or confocal microscopy, buffer composition, genetic or biochemical methodologies, specific cell lines, and the like. However, the committee members may ask you to tell them about those details, so you should be prepared to respond appropriately. Practice your talk multiple times and once you are comfortable, give the talk to friends. Ask your fellow scientists to interrupt you during the talk so you can practice getting back on topic.
3. Anticipating the oral exam itself – As mentioned above, the committee members will almost certainly interrupt your chalk talk to ask questions along the way. Their job is to find the boundaries of your knowledge and capability, and then to judge whether those boundaries are at appropriate places for this stage in your development. They should push

the questioning to the limits of your knowledge, until you get to a point where you have to say “I don’t know”. Don’t pretend to know an answer if you don’t; but you can suggest where or how you might find that information. It can be helpful to practice this questioning with other students or postdocs, but they may or may not go to the depth that the Comprehensive Exam Committee will explore.

Bring a note pad to the exam so you can jot down useful ideas that are discussed.

Get plenty of rest before your exam, and keep up your nutrition and energy levels. Bring a water bottle or other liquids to keep you hydrated.

C. Outcomes of the oral exam

Passing the Comprehensive Examination requires satisfactory completion of all three of the exam sections (written on-topic proposal, written off-topic proposal, and oral examination). Each member of the committee will evaluate each of the three sections separately, assigning a score of Pass, Remediate, or Fail. The committee will then compile a composite score for each section. A passing score on each section requires that at least three of the four voting members assign a Pass score.

For the examination as a whole, the committee must then assign one of the three following outcomes:

- a) Pass – No further work is required on the Comprehensive Examination itself. The committee may make recommendations for areas in which improvement should be sought or expected.

- b) Failure with opportunity to remediate – If the Comprehensive Exam Committee identifies weaknesses in a limited number of areas and believes that these deficiencies can be corrected with specific actions, the student may be offered the opportunity to remediate those portions of the examination. The committee will define explicitly the conditions for remediation. The remediation should be completed within three months of the initial examination date. In the remediation efforts are deemed satisfactory, the student will have passed the comprehensive exam. If the remediation efforts are deemed unsatisfactory, the student will have failed the comprehensive exam and the student will be asked to leave the doctoral program.

- c) Failure – If the student fails one or more portions of the Comprehensive Examination, with deficiencies beyond the scope deemed remediable within three months, the student will not be offered the opportunity to remediate and the student may be required to leave the doctoral program.

Because the CEOC member serves as Chair the exam and fully understands the rationale for the decisions reached, he/she will carry out the following:

- a) Complete "blue form" with all committee signatures; file directly following exam with Enrollment and Records Administrator (ERA). Synopsis comments are included.
- b) Announce only positive exam outcomes to VAIGS Faculty, VAIGS students, MSU students either the day of the exam or early the day following. (Template email available.)
- c) In all cases (Pass, Fail, or Remediate), compile major comments by email from the Comprehensive Exam Committee. After reaching consensus with the entire Comprehensive
 - a. Exam Committee, they will send a consensus document to Dean, ERA, student, and Thesis Adviser within 3 days. As necessary, a Remediation Plan with a timeline is included.
- d) Exam chair will monitor remediation and will report outcomes using steps above.

D. Submission of proposal for external fellowship application.

The on-topic proposal must be submitted as a grant application (typically as a pre-doctoral fellowship) to an external agency within one year of the successful completion of the Comprehensive Examination. The candidate should work closely with the thesis adviser and the Grants and Contracts administrators to identify suitable funding sources and in the preparation of the application itself. Success in obtaining external fellowship support is NOT a requirement for passing the Comprehensive Examination.