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1. Introduction

This handbook is designed as a resource for graduate students working towards obtaining the Ph.D. degree in Cancer Cell Biology (CCB) at West Virginia University Health Sciences Center (HSC). Students and faculty alike should be able to find answers to common questions that arise during the course of graduate study specific to the CCB Program. Information regarding general policies, rules and regulations that govern CCB at the HSC level can be found at the HSC Office of Research and Graduate Education (ORGE) Biomedical Sciences (BMS) website (https://www.hsc.wvu.edu/resoff/graduate-education/phd-programs/biomedical-sciences/). This includes the BMS handbook, which is updated on a periodic (typically annual) basis. University-wide policies are detailed in the WVU Graduate Catalog (http://catalog.wvu.edu/graduate/).

2. Goals and Objectives of the Cancer Cell Biology Program:

Students in the doctoral program in Cancer Cell Biology (CCB) receive comprehensive in-depth training in modern areas of cancer biology, with a strong emphasis on cellular and molecular aspects of cancer origin, progression and treatment. The program is designed to produce scholarly researchers with aptitude in public speaking, scientific writing, evaluation of the scientific literature, community and professional service, interfacing with the clinical environment and critical thinking. Acquiring a functional skill set involving experimental design, execution of experimental procedures, generation of data and interpretation of results is also central to the CCB training mission. Completion of the Ph.D. degree is realized when the student successfully presents and successfully defends their research results to the graduate dissertation committee and program faculty in the form of a formal dissertation defense.

3. Entry into the Cancer Cell Biology Program:

**BMS Ph.D. Students** - CCB accommodates students with diverse backgrounds and a wide range of research interests. Students who obtain a GPA ≥ 3.0 in the undifferentiated first semester of the BMS Program are eligible to join the CCB graduate program. Individuals on academic probation after the first semester will be considered on a case-by-case basis. Students join the CCB Program by electing to do their dissertation research with an eligible CCB-affiliated faculty member (“eligible mentor”). This is typically one of the rotation mentors the student worked with in the first or (in some cases) second semester of graduate study. In addition to first semester BMS curriculum, students are expected to have undergraduate academic preparation in biology, chemistry, biochemistry and statistics. Deficiencies in specific areas apparent to the student, faculty and/or mentor can be corrected after enrollment by taking appropriate graduate-level course work recommended by the student’s mentor and/or dissertation advisory committee.

**M.D./Ph.D. (Dual Degree) Students** - CCB has a rich training history of M.D./Ph.D. students, where several members of the training faculty are actively engaged in clinical practice. M.D./Ph.D. students typically complete their first two years of medical school and conduct two research rotations, the first during the summer prior to MS1 and a second
rotation between MS1 and MS2. Completion of the first two years of the medical school curriculum satisfies the first year of graduate coursework. M.D./Ph.D. students therefore enter the CCB Program as second-year students, and henceforth are subject to all Program requirements. M.D./Ph.D. students typically take three-four years to complete their Ph.D. degree within the CCB Program, and ideally rejoin the medical school curriculum in July prior to the start of MS3.

Students transferring to WVU from another institution- Students that move with their mentors to WVU from another university can be eligible for completion of their Ph.D. training in CCB. In such cases, the mentor must be a member of the Graduate faculty, affiliated with the CCB Program and conducting cancer-related research. Such transfer students must relinquish their affiliation with their prior institution and complete all CCB degree requirements. Typically, if a student has not completed their proposal defense at their prior institution, they remain eligible to complete their training in the CCB Program at WVU. Curriculum issues, including substitution of prior courses as transfer credit toward the CCB degree, will be assessed on a case-by-case basis by the Assistant Vice President for HSC Graduate Education, the CCB Program Director and the CCB Scholarship Committee. This is done in conjunction with the student and mentor to best harmonize previous coursework with courses in the required CCB curriculum. Deficiencies subsequently recognized by the Dissertation Advisory Committee may require additional coursework beyond the minimal CCB curriculum standards as necessary.

In all cases, students are formally entered into the CCB Program when the Student Assignment Form is completed and signed by the student, mentor, Program Director and Assistant Vice President for HSC Graduate Education. The CCB Program reserves the right to place a hold on the Student Assignment Form in order for the Program Director, CCB Scholarship Committee, and/or Program faculty to review the student prior to acceptance into the Program. This usually applies for students that do not meet academic standards in the first year curriculum and are on Academic Probation. Provisional acceptance may be granted in such cases until the student is formally off of Probation, and dismissal may be recommended if the student remains on Probation for the first three (3) consecutive semesters.

4. CCB Program Governance and Structure

The CCB Program falls under the educational mission supported by the WVUCI under the auspices of the WVUCI Director (currently Interim, Dr. Hannah Hazard-Jenkins) and the Associate Director for Basic Research (currently Dr. Lori Hazlehurst). Program oversight is conducted by the CCB Scholarship Committee, comprised of the Program Director (currently Dr. Scott Weed), the co-Director/Curriculum Coordinator (currently Dr. J. Michael Ruppert), Drs. Lori Hazelhurst and Jun Liu. The Committee is responsible for monitoring student progress, interfacing with Course Directors, submitting grades to the University Registrar, assisting with student registration and other academic issues. Student files are maintained by CCB Administration (currently Ms. Tina Lankford) in the WVUCI and by the Office of Research and Graduate Education.
The CCB Scholarship Committee meets at least once annually (typically at the end of each semester) with the current CCB students to obtain feedback from students regarding the Program. All members of the Scholarship Committee have an “open door” policy and consistently work with students to address and resolve any academic issues. The CCB Director represents the Scholarship Committee at monthly CCB Faculty meetings, informing faculty of student issues and engaging in any CCB-related business as necessary. A senior CCB student (typically a student that has completed the Dissertation Proposal Defense) is selected by the faculty to serve as the CCB student representative for these meetings. The CCB student representative is free to engage in relevant discussion with the faculty at these meetings. The student representative reports back to the CCB student body information pertaining to the student aspects of the Program, and also receives a copy of the meeting minutes. Student representatives serve a one-year term.

5. Program Requirements:

Curriculum (Note that most recent syllabi with additional information for each CCB course are found in Section 28 of this handbook)

Formal Courses

Formal entry in the CCB Program typically occurs at the end of the first semester of Year 1. Students select a research mentor and commence their laboratory dissertation research work. In addition, students complete two courses during the spring semester of their first year in the Program:

Year 1

1. **CCB 730- Introduction to Cancer Cell Biology** (3 credit hours; Ruppert current Course Coordinator). CCB 730 introduces students to the processes involved in neoplastic transformation and the basic hallmarks of cancer. Faculty teach in areas that often reflect their research expertise. The class is comprised of a mixture of lecture and journal club-type paper discussions on modern advances in the selected areas of tumor biology.

2. **First Year Elective** (3 credit hours; various Course Coordinators): The elective requirement can be fulfilled by taking an appropriate 3 credit graduate-level course. Selection is typically based on student interest and recommendation of the mentor. Any approved 3-credit graduate course satisfies the elective requirement, with the course ideally taken within the first two academic years in the CCB Program. Example elective courses taken by recent CCB students include:
   a. Molecular Genetics (BMS 715)
   b. Advanced Molecular Biology (BIOC 751)
   c. Cellular Immunology (MICB 720)
Suitable courses in pharmacology, public health, bioinformatics or other disciplines are also acceptable (see Section 27 for further examples), provided they are 3-credit courses and have been approved as described. For students on T32 training grants, required T32 courses may be used to satisfy this requirement as long as they are similarly vetted and are 3 credit hours. First year electives may be taken in subsequent years if courses of interest are not offered in the spring of the first year.

Beginning in the Year 1 Spring Semester, students are required to register and attend all academic CCB functions, including Journal Club and Seminar/Student Form as described below.

Year 2

Year 2 CCB didactic coursework consists of three mandatory courses that are team taught by the CCB faculty, as well as a scientific writing course offered in the spring or summer semester (final timing of this course is still to be determined). All classes are offered yearly unless student enrollment is too low (typically < 3 students). In such cases, students who miss these courses in their second year due to lack of offering will take them the following year (third Program year for Ph.D.; second year for M.D./Ph.D. students) with current second year students in order to create suitable class sizes. Description and methods of assessment for these courses are as follows:

CCB 700- Selected Topics in Cancer Cell Biology (Fall Semester, 3 credit hours; Frisch current Course Coordinator). This course covers several areas of cancer biology that represent recent and important scientific advances in key research areas responsible for enhancing understanding of the neoplastic process. The course consists of a mixture of lectures and discussions of journal papers representing recent landmark discoveries. Faculty meet with students in their offices or in small informal settings to provide a relaxed atmosphere for discussions, which are highly detailed and in-depth. For assessment, students are required to write a mock grant proposal and brief review article on any topic covered during the course, with these items graded by the faculty member that taught that particular course section.

CCB 701/BIOC 701- Biochemical and Oncogenic Signaling (Fall Semester, 3 credit hours; Liu current Course Coordinator). This course is merged with BIOC 701 offered by the Biochemistry and Molecular Biology (BMB) Program. The goal is to enhance cross-discipline coverage between basic biochemistry and cancer-relevant signal transduction pathways that are the focus of current therapeutic interventions. The joint course ensures that sufficient student numbers are available every academic year to allow students in CCB and the BMB Programs to complete this course at the proper time in their academic schedules. The class is a mixture of lectures and journal article presentations. Students are assessed by taking three exams during the course and by their class participation.

CCB 702- Cancer Pharmacology and Therapeutics (Spring Semester, 3 credits; current Course Coordinators are Liu and Weir). This course covers clinical aspects of cancer
relevant to basic scientists, with the goal of fostering a knowledge base in translational and clinical cancer science to enable enhanced understanding and participation in clinical-based research. The course is taught by WVU Cancer Institute clinicians, epidemiologists from the School of Public Health, pathologists and basic scientists. The course consists of didactic lectures and discussions covering introductory aspects of cancer treatment, population-based studies and tumor pathology. Assessment is accomplished by students taking three exams during the course.

BMS 720- Scientific Writing (Summer or Spring Semester, 2 credits; Schreurs current Course Coordinator). This course covers practical aspects of writing an NIH F31 fellowship application, introducing the student to all aspects involved in assembling an application. Students use their own data to construct their proposals, which are then reviewed in a mock study section consisting of faculty and class peers. This activity is germane to the Proposal Defense and fellowship submissions encouraged by the CCB Program and ORGE. Student mentors receive the grant and are responsible for assigning a grade (pass/fail) to each document. Students that take an F30/F31 writing workshop prior to the end of year 2 are exempt from this course, as the activities are largely redundant.

Year 3-beyond

Ideally, the major didactic coursework for CCB students is completed by the end of Year 2, but can be extended as necessary in order for students to complete the curriculum as noted above. From Year 3 to graduation, CCB students enroll in several recurrent courses designed to complement and maintain current understanding of the latest developments in the oncology field.

CCB 796- CCB Graduate Seminar and Student Forum (Fall and Spring Semesters, 1 credit hour each semester; Weed current Course Coordinator). This course consists of two different types of presentations that are integrated throughout the semester: A) Students attend research seminars given by faculty from outside the institution. B) Each student in the Program presents their dissertation research progress in a similar formal seminar format to the CCB faculty and peer student group. Students are required to formally present their work in progress one time within each academic year, with the typical student presenting three-four times prior to graduation. The first presentation is given in the spring of the first year or during the second year, with the emphasis on the overall project and Specific Aims, rather than on student-generated data. Subsequent Forum presentations focus on student progress towards the Aims of their Dissertation Proposal and Dissertation Defense. Students must submit the title of their Forum presentations to the CCB administrator no less than two (2) weeks before their Forum date. For the visiting Seminar portion, students are assessed by the Course Coordinator based on attendance and participation (asking questions to the seminar speaker). The faculty host is responsible for organizing an informal luncheon with the speaker following the seminar, and may invite their own or other students as they see fit. Student attendance is mandatory at Seminar and Forum. Online platforms for Student Form and/or Seminar may be utilized as appropriate.
In addition, CCB students working with mentors affiliated with additional graduate programs also have the opportunity to present their work in the research forum for that specific graduate program. CCB students are also strongly encouraged to present their work at the annual E. J. Van Liere Convocation and Research Day sponsored by the WVU HSC, as well as at regional and national meetings.

**CCB 705- CCB Journal Club** (Fall and Spring Semesters, 1 credit hour each semester; Ivanov and Liu current Course Coordinators). This course consists of formal discussions of a recent research papers that are of high impact within the cancer field. Each student presents a paper (presenter) selected by a peer student (who serves as the student facilitator). A faculty moderator is assigned to work with the presenter and facilitator, who construct a PowerPoint presentation describing the background of the study, methods, results, limitations, rigor and reproducibility. All students and Program faculty engage in discussing the data reported in the paper in a critical manner. Assessment is conducted by the Course Coordinator and faculty present at each discussion, and is based on a combination of sufficient knowledge of the presented paper, ability to answer questions posed to the student, and attendance. Students in their 6th year and beyond are exempt from taking CCB 705.

**CCB 797- CCB Graduate Research** (Fall and Spring Semesters, 1 credit hour minimum each semester; Ruppert current Course Coordinator). This course provides official credit hours for research time in any form that is designed to be in pursuit of the CCB Ph.D. degree. Students design research in consultation with their mentor and dissertation committee, and involves literature evaluation, writing, preparation of scientific presentations and bench and computational research. Students take a minimum of 1 credit hour per semester, with additional hours used to make up the necessary credit hours to maintain full-time student status (9 credit hours in fall and spring; 6 credit hours in the summer). Research progress is evaluated by the dissertation committee as detailed below. If progress is deemed unsatisfactory by the committee, the student is notified by the committee, mentor and Graduate Director by the mid-point of the semester, permitting sufficient time to remedy their situation. Completion of the Individual Development Plan (IDP) is required on an annual basis, or a grade of incomplete (I) is assigned until this this task is completed and documented by the CCB Program and ORGE. The I grade is then replaced with the appropriate grade for that semester.

**BMS 707- Experiential Learning for Biomedical Trainees** (Variable, 2 credits calculated at 45h/credit; Julie Lockman current Course Coordinator). Experiential learning is designed to allow CCB students to engage in experiences and/or garner new skills in an area outside of the immediate scope of their laboratory work. The experience can take on many forms, where it is tailored to student interests and Dissertation Committee recommendations. As examples, recent CCB experiential learning experiences have included students taking workshops at Jackson Laboratories, in-house or external omics workshops, internships at WVU Tech Transfer and serving as guest editors on journal review editorial boards. Students can fulfill the 2 credit requirement over a single semester with a single learning experience, or have two shorter 1-credit experiences in different
areas. Limited financial support may be available to cover travel and associated registration costs from the WVU HSC Office of Research and Graduate Education.

For assessment, students are required to present a written evaluation of their experience to the Course Coordinator. Students are also required to present a brief overview to CCB faculty and students covering the experience and how it benefited the student as part of the student presentation at their next scheduled CCB Student Forum. This presentation should be no longer than 15 minutes, and is presented at the beginning of the Forum prior to the presentation of the student’s research.

6. Teaching Requirement
There is no formal teaching requirement for the CCB doctoral degree. Students have an opportunity to obtain teaching experience through in the BMS Cellular Methods Course and through tutoring first year BMS students. Students interested in pursuing teaching during their Dissertation work can apply to serve as Teaching Assistants in the WVU Department of Chemistry or Biology (e.g.; Biol 690). A program for mentored teaching of interested students by faculty is also available, as well as a formalized Certificate in University Teaching is offered by the Graduate Academy through the WVU Teaching & Learning Commons (link here). The Certificate Program is two-years in duration, including a pedagogy course, seminars, multiple teaching experiences, practicum and capstone courses. Interested students are required to confer with their mentor and Dissertation Committee before commencing any extracurricular teaching activities, as these typically take considerable time away from the bench.

7. Additional Educational Opportunities
As a Program supported in part by the WVU Cancer Institute, CCB Students have the opportunity to attend several internal lecture series and participate in local outreach events sponsored by the CI. These events may be general or targeted to specific cancer types, to the patient or the overall community at large. Interested students are encouraged to pursue these opportunities based on particular interest, mentor or committee recommendation.

Tumor Boards and Grand Rounds- Many CCB investigators are engaged in patient-based research and undertake extensive engagement with the clinical practice. As an extension of this, CCB students routinely attend weekly Integrative Tumor Boards for the cancer type pertinent to their research, as well as Grand Round presentations by clinicians as relevant to their work. Tumor Boards attended by CCB students typically include breast, lung, head and neck and leukemia, although they are welcome to attend any that are offered by the CI. Students must be compliant with the Health Information Privacy and Affordability Act (HIPAA) through CITI and notify the Tumor Board coordinator prior to attending a meeting for the first time.

Fall Cancer Conference- This conference is clinician-driven and is hosted by WVU Medicine/WVUCI, the SoM and the WV Oncology Society. The conference brings clinicians, other providers, staff and researchers from across the state to engage in
exchanging research results, discussing standard of care, providing the latest clinical trial opportunities and other educational activities. This conference is held annually in October.

**Delynn Lecture Series** ([link](#)) - This is an endowed series initiated in 1993 designed to provide educational and informational in areas of cancer research, treatment, education and prevention from eminent and influential individuals. It is held annually and is open to CCB students and the WVUCI community. Recent speakers include Rebecca Skloot, Siddartha Mukherjee, Lewis Cantley, David Scadden, Dennis Slamon and Maura Gillison.

**Soup for the Soul** ([link](#)) - This is an outreach opportunity for students to directly engage with patients being treated at the CI. The program is sponsored by an endowment that provides free lunches to patients undergoing induction chemotherapy in the WVUCI infusion center during the noon hour. Students can volunteer to deliver lunch to patients and sit with them during their treatment. This is a powerful opportunity for students to learn what cancer patients encounter during therapy and how patients cope with the disease. Interested students are required to have necessary background checks and be cleared by the WVU Hospital.

**Monongalia County Relay for Life** - Historically, CCB students have had a long and deep participation in the local Relay for Life chapter, having organized their own team for the past several years. Many CCB students have served as long-standing team members and/or Relay Captains. Participation is coordinated with the WVUCI and the local chapter of the American Cancer Society.

### 8. Dissertation Research

The dissertation advisor (mentor) is the student’s primary advisor during the graduate program. Most of the student's time in the CCB Program will be committed to focused research on a topic of interest within the advisor’s laboratory. A critical aspect of this effort is for the student to make progress on their research while engaging in course work, journal club, teaching, and attending seminar. This time should be used wisely, as the goal for CCB students is to have two first author papers published based on their dissertation work. Importantly, CCB students may not defend their dissertation and graduate until they have had one first author manuscript of original research work accepted for publication in a peer-reviewed journal. This is a firm Program requirement. Co-first authorship on a manuscript is acceptable at the discretion of the CCB Scholarship and dissertation committees. Such manuscripts will count towards the thesis of only one graduate student if two or more graduate students are involved. In such cases where more than one graduate student is a co-first author, the student’s major advisor (or advisors if from different labs) will determine which student will obtain first author credit for thesis purposes. The published work in all cases must be part of the student’s dissertation project. Review or methods papers, while encouraged where appropriate, do not fulfill this requirement but are encouraged and should be included in the appendix of the dissertation. While one paper is the minimal CCB program requirement, some advisors or dissertation committees may impose more stringent requirements with regard to number of papers, the quality and the journal impact level that exceed the minimum to
qualify for the Ph.D. defense and degree. In such cases, these requirements will be presented to the student prior to acceptance into their prospective research laboratory, and made clear to the student’s dissertation committee by the student and advisor early in the student’s research career.

9. How to Choose a Mentor for Research Work?
Incoming Year 1 students with an interest in cancer research and the CCB degree are encouraged to meet with prospective CCB mentors early in the semester to gauge mutual interest. Three short laboratory experiences (e.g., research rotations) are conducted by students during the fall of Year 1; rotation selections for CCB faculty should be selected from the eligible mentor list provided to all students prior to enrollment at WVU. Importantly, CCB eligible mentor status can change within given semesters, as faculty attain funding during grant cycles that do not coincide with the academic calendar. Therefore, if a student has a specific interest in a particular faculty member for their research work, it is best to express that interest early in the rotation process. Rotations are ideally designed to allow the student to be involved in a research project that may ultimately represent part of a dissertation. Rotating students should become fully integrated into their host laboratory, including attendance at all program-specific seminars, journal clubs, lab meetings and other events as their time and schedules permit.

10. Dual Degree Requirements
As noted above, M.D./Ph.D. dual degree students typically enter the CCB Program at the end of MS2. Additional specific items of note that apply to M.D./Ph.D. students:

A. The first two years of the medical school curriculum satisfies the CCB 730 Introduction to Cell Biology requirement. MD/PhD students are required to take all other mandatory CCB courses, including a first year elective course as listed above. The elective can be taken any time following the first semester in the program (e.g., from the spring of year 1 in the program onward).

B. Laboratory rotations are chosen through the M.D./Ph.D. program after consulting with CCB host faculty.

C. A faculty member engaged in clinical practice is required to be either the student’s mentor or else a member of the dissertation committee. Students with physician scientist mentors will have this requirement fulfilled. For students working with basic science mentors, either a physician scientist or clinician is required to be a member of the committee. Such a member can co-Chair the committee with a basic scientist. As for other faculty, physician scientists and clinicians must be members of the Graduate faculty in order to mentor students and/or serve on dissertation committees.

D. The proposal defense will follow the same rules as for all other graduate students. It is recommended that this occurs no later than the end of the first year of research
(fall of Y2 in CCB). The firm deadline for the MD/PhD student dissertation proposal is December 1 of Y2 in the program, and students are encouraged to defend earlier as data and schedules permit.

E. The recommended time to complete the Ph.D. portion of the degree is three (3) years. No more than four years are allowed for dual degree students to complete the Ph.D. portion of the degree.

F. There is no experiential learning requirement for MD./Ph.D students.

11. Academic and Professional Standards

Grades

It is expected that students will perform satisfactorily in all required and Program-specific courses. To remain in good academic standing in the CCB program, a student must maintain the following standards:

A. An overall cumulative grade point average of 3.0 in graduate level coursework. Students with a GPA below 3.0 will be placed on academic probation; a GPA below 2.75 may be grounds for immediate dismissal.

B. Progress in CCB 797 (Research) is rated as “S-satisfactory” or “U-unsatisfactory” or “I-incomplete” in each semester. One “U” grade will result in the student being placed on academic probation. A second “U” grade in consecutive semesters is grounds for dismissal from the program. Written narratives from the research mentor and written evaluations from committee meetings submitted by the dissertation advisory committee need be included in the student file as evidence of student performance. Students performing below the standards of a given laboratory must be informed by the mentor at least by the halfway point in the semester that the student is on trajectory to receive a “U” grade. This allows ample time for students be made aware of deficiencies in order to improve their performance. An incomplete grade is reserved for students unable to participate in laboratory work due to exenuating circumstances.

C. Removal of any incomplete (I) grades within one semester or summer session of their award, unless special permission is granted by the Assistant Vice President for Research. Failure to remove an incomplete within one semester results in a permanent F on your transcript, and this F figures into the GPA.

D. Course-related assignments, such as take-home exams that are turned in late, are subject to a grade reduction at the discretion of the course coordinator.

Failure to comply with these standards will result in the student being placed on academic probation and may result in dismissal from the graduate program.
NOTE: You cannot graduate with a D or F grade on your Plan of Study. You must retake the course and improve the grade to graduate. Both grades will count toward your GPA on your transcript, and the higher grade will be placed in the Plan of Study.

Professional Standards

Throughout their tenure in the CCB Program, students are required to adhere to the WVU Student Conduct and Discipline Policy (link) that governs behavior in the classroom, research work, academic meetings, travel and daily conduct within and outside of the University. Links to policies on Academic and Scientific integrity can be found below. Issues regarding student questions or complaints involving mentors, other students or faculty requiring confidentiality are encouraged to utilize CCB student members of the Peer Resource Outreach (PRO) administered by the OR&GE.

Although a student may be in good academic standing, any student will be dismissed from the CCB program in cases involving clear violation of Title IX, egregious breeches of academic integrity, or if convicted of a felony offense.

12. Changing Mentors

Occasionally students need to change mentors in the course of completing their dissertation research. The protocol to be followed varies depending on the reason:

1. Mentor has left the University and you are remaining at WVU. In this situation, you should immediately meet with your graduate program director and set up a plan based on whether or not you will continue on the same project and/or if the mentor will remain involved after he or she leaves. Regardless, you should expect to have another faculty member as an on-site advisor and you should expect to be moved into the laboratory of the on-site advisor or another faculty member conducting similar research.

2. You are not getting along with your mentor. Unhappiness in your chosen laboratory and/or with your mentor does not mean that you will definitely need to leave the laboratory. The key to handling these situations effectively is to act as soon as you sense a problem.

First, discuss with your mentor what is troubling you. The mentor may not realize that you were having trouble and may be willing to work with you on a solution. Consider if you were expecting the mentor to fill too many roles and that additional mentors may be helpful for concerns that are less “research-based”.

Second, if talking with your mentor or spreading mentoring roles does not work, immediately involve another faculty member. Ideally, this should be the CCB program director, a member of your committee, the department chair most associated with your program or the Assistant Vice President for Graduate Education (note: this individual is always willing to help but may require that you ultimately go through channels with your program director).
Third, if remaining in the mentor’s laboratory is no longer an option, you need to work with the CCB program director and the Assistant Vice President for Graduate Education to identify candidate mentors.

Fourth, candidate mentors will need to be interviewed as to their willingness to accept a new student and a trial period is established to determine if the laboratory is a good fit. The trial period is generally at least 2 weeks but should not extend beyond a month.

Fifth, once a new mentor is found, you need to re-do your committee approval form. This will both indicate the new mentor and ensure that the committee is appropriate for the new project. If you will be deleting committee members, please inform them in writing that they will no longer be on your committee and thank them for their service or willingness to serve. If the timing is such that you may be delayed in completing the candidacy exam (Proposal defense), you need to petition the Graduate Program Director and the Assistant Vice President for Graduate Education for an extension. A firm date will be determined by which time the exam will be completed.

Finally, you are strongly encouraged to refrain from negative comments about the previous mentor. Mentor/mentee relationships sometimes fail. Fortunately this is not often. In each case it reflects mutual problems that could not be overcome. No one person is assigned blame. Maintaining a professional approach will result in a smooth transition.

13. Dissertation Advisory Committee

Student dissertation committees will be selected no later than the fall semester of Y2 in the CCB program. The duty of the dissertation committee is to evaluate student coursework, proposals and research results. The committee also functions to provide a sounding board for problems encountered and progress made, and to examine the student during the proposal and dissertation defense seminars. Members of this committee are selected by the student in consultation with his/her dissertation advisor. The committee will consist of at least five members: At least four must be affiliated CCB program faculty. One member must be from outside of CCB and not part of the program. Beginning in fall 2020, the chairperson for the student’s committee will be the student’s major advisor, who will be responsible for running committee meetings and writing the mandatory student evaluation reports as noted below. The majority of the committee members must have full regular Graduate Faculty status at the HSC; one member can have associate/adjunct status (typically applies to outside members or clinicians). The committee Chair must be a full member of the regular Graduate Faculty; associate Graduate Faculty may serve on the students’ dissertation committee, but not as Chair. Committees may have co-Chairs; in such cases one co-Chair must have full Graduate Faculty status. The Student and mentor should work together to agree on identification of the dissertation committee. In each case, the selection will be based on the nature of the research to be carried out and how best to benefit the student’s interests, strengths and to mitigate deficiencies.
In general, the first meeting of this committee will convene no later than the spring of Y2 prior to the first student forum. Students should aim for a meeting that lasts no more than 90 minutes. Committee meetings are a formal academic exercise and need to be viewed as such by student and faculty members alike. The current meeting protocol will consist of the student leaving the room at the beginning of the meeting, where the PI gives a brief overview of student progress to the committee. The student then returns to the meeting, and the PI leaves, allowing the student to discuss their research progress freely with the committee, independently of PI. Each of these individual meetings with the committee will be no longer than 10 minutes in length. If protracted discussion is required regarding any academic issues, it will take place outside of the meeting with the Scholarship Committee serving as mediator. This policy is to ensure that meetings are not overly long and that the student, mentor and committee stay on task.

At this meeting the student should have a general idea of what they propose to research, structured in a formal talk (e.g. PowerPoint) containing Specific Aims for the project. The presentation should be brief (20-30 minutes) showing past work and describing future plans. The meeting is most productive if the presentation is organized as a logical story based on key results, whether positive or negative, rather than being simply a list of every experiment that has been done. This allows the meeting to focus on the most important issues, maximizing constructive feedback and advice the committee can give to the student. Again, meetings should last no longer than 90 minutes. After the first meeting, the student should have two (2) forms completed and ready for signatures from their committee members: 1) Committee Approval Form; 2) Plan of Study. Links for these forms can be found in Section 26 of this handbook.

14. Schedule for Advisory Committee Meetings

CCB students are expected to schedule and hold meetings of the dissertation committee on a regular basis. After formulation of the committee in Y2, dissertation committee meetings are to be held at 6-9 month intervals (not 12 as previously mandated). In addition, students are mandated to hold committee meetings after the noon hour during the week (e.g., no meetings to be scheduled in the morning hours prior to noon). This is to protect time for initiating experiments and for faculty to conduct other work.

Annual meetings are mandated by the Office of Research and Graduate Education, and this schedule should be strictly adhered to. It should be emphasized that the biomedical sciences are ever-changing disciplines in which new research information appears at a rapid pace. Consequently, the Ph.D. candidate must keep abreast of these developments, as well as obtain a solid grasp of fundamental concepts in cancer biology.

In addition to research progress, during committee meetings the students are also assessed for progress towards proficiency for each of the Core Competencies for Ph.D. level students. These are detailed in Section 31. Such progress is part of the evaluation during committee meetings. A written record of each dissertation meeting, prepared by the dissertation committee chair (e.g., the student mentor) in consultation with the committee, must be submitted to the Program Director for review no later than 2 weeks...
after each meeting. There are specific forms and templates for these letters that can be obtained from the CCB Graduate Director. Students must be given the opportunity to review the letter with the committee chair and discuss content if there are objections. Students must sign each committee letter indicating they have read and understand the content. Students are then responsible for making three (3) copies and disseminating these as follows: 1) to the ORGE; 2) to the CCB administrator in the CI (currently Ms. Tina Lankford), 3) to the student dissertation advisor. The student is to keep the original copy. Ms. Lankford and/or ORGE will scan a copy of the letter and place it in the student’s file on SOLE.

15. Annual Evaluation

Prior to all dissertation committee meetings, students are required to complete and submit a two (2) page self-evaluation of research progress report to all members of the committee. This report is due to the committee no later than two (2) days prior to the scheduled meeting. This form is found on page 25. Copies are to be generated and distributed the same as dissertation committee meeting letters.

Students are also required to complete an individual development plan (IDP) on an annual basis. Forms are specific to the year of graduate study (Y1, Y2, Y3-beyond) and program (Ph.D. or M.D./Ph.D.). IDPs should be completed in consultation with the student mentor, with copies generated and distributed the same as dissertation committee meeting letters. See forms link in Section 26 for access to IDPs.

16. Qualifying Exam

The CCB Qualifying exam has been discontinued and is not a Program requirement.

17. Dissertation Proposal Defense (Candidacy Exam)

The proposal defense is the examination used to admit a CCB student to doctoral candidacy, with the purpose to demonstrate that the student is prepared and equipped to undertake doctoral research in their chosen area of interest. This exam consists of two parts: 1) A written portion in the form of an extramural pre-doctoral fellowship grant (typically in the style of an NIH F31 proposal) and 2) a public oral defense of a written proposal of the student’s dissertation research project presented in seminar format. The presentation includes background information, rationale for the proposed experiments and discussion of preliminary data generated to date. Following the oral seminar, the student meets with the dissertation advisory committee in private to evaluate the proposal and defend their proposed work in a formal setting. The dissertation committee then votes to determine if the student passes or fails the exam, with a majority vote deciding the outcome. Students failing this exam are given a second attempt within a six-month period to re-take the written or oral portions of the defense as necessary. Failure to pass this second attempt results in remedial action determined by the Dissertation Committee, which may include dismissal from the CCB Program.
For the written portion of the proposal defense, the proposal must be prepared in the standard SF424 format of an F31 NIH predoctoral proposal, with the intention of submitting the written proposal to the NCI according to NIH instructions (link here). The following elements are included in the proposal:

- Face Page
- Abstract
- Table of contents
- Detailed budget and budget justification (one page)
- Biographical sketch
- Specific aims (one page)
- Research Strategy (No more than 6 pages total)
  - Significance
  - Innovation
  - Research Approach

Students should consult using the SF424 Research and Related (R&R) forms and the SF424 (R&R) Application Guide when preparing their proposal. The Research Strategy section may not exceed 6 pages, including tables, graphs, figures, diagrams, and charts. Additional components (such as sections on vertebrate animals or human subjects) should be included as relevant to the proposal, but do not count against the six-page limit for the Research Strategy. The student and mentor work together to construct the Specific Aims and Research Strategy. To be clear, ALL elements of the proposal must be completed, whether or not the proposal is submitted to the NIH. As the priority for student evaluation is the scientific aspects of the Proposal (Aims and Research Strategy), these are the most important aspects of the document. The other elements (Vertebrate Animals, Human Subjects, Mentoring Plan, etc.) also need to be included, but can be in draft form for the purposes of the Proposal defense. These documents should be completed in the BMS 720 Scientific Writing course and/or the Pre-doctoral fellowship writing class, and with help and input from the mentor.

The student should determine the Aims of the project in conjunction with their advisor, and should consult with their advisor on writing style and grantsmanship issues. The written proposal cannot be a “copy and paste” of passages extracted from the advisor’s grants, and should be given to the dissertation committee at least two weeks before the meeting. This permits sufficient time for evaluation of the document by the committee prior to the defense. As this is an examination, the committee will not provide feedback to the student or mentor prior to the defense, but is encouraged to do so afterwards as the student prepares the document for fellowship submission.

The proposal defense is designed to assess the student’s proposed research work, not a completed/nearly-completed Specific Aim (e.g., should not encompass a completed manuscript). As such, the proposal defense is conducted no later than August 1 of Year 2 in the CCB program (prior to the start of the third academic year of graduate
school). Note this deadline is moved back from the previous June 1 deadline enacted in 2018. This allows for students to utilize skills they learn in the BMS 720 writing course in constructing the written portion of the examination, as well as to align and format the proposal as a bona fide F31 fellowship for submission for the August or December deadlines. Early submission is important owing to the extended interval between first submission and re-submission of a revised proposal (approximately 12-16 months).

Successful completion of the written and oral portions of the proposal defense permits the student to be advanced to Candidacy. The proposal defense meeting counts as one of the 6-9 month dissertation committee meetings, and is to be documented and filed accordingly. Students that do not successfully pass the Proposal Defense must retake the defense within six (6) months of their first attempt, and are encouraged to meet with their mentor, committee and graduate director for necessary remediation. Failure to pass the proposal defense after the second attempt will serve as grounds for dismissal from the CCB Program.

18. Deadline for Completion of the Degree

Students should strive to complete their Ph.D. degree within five (5) years of matriculation into the BMS Ph.D. program, and within three years after entering the laboratory phase of the M.D./Ph.D. program. After successful completion of the Proposal Defense and granting of Candidacy, a student must defend their dissertation within five (5) years of the Candidacy date. Therefore, students have a maximum of 7 years to complete their PhD, from entry into the biomedical first semester curriculum to defense of their dissertation and submission of the dissertation to the Electronic Thesis and Dissertation repository (ETD). For example, a student entering in the Fall of 2020 will need to complete all program requirements by the end of summer session in August of 2027. Students that do not meet this deadline will be dismissed from the CCB program with a terminal Masters of Science degree in Biomedical Sciences. Extensions to this policy can be granted under extraordinary circumstances after petitioning the CCB Program Director and Vice President for Graduate Education. Extensions will be no longer than one (1) year. Additional details on the University time to degree policy and degree regulations can be found here. These time limits include students who have switched laboratories, as 7 years is still 2 years longer than the recommended 5-year timeline. Students entering their 6th year in graduate school will hold committee meetings every 6 months in order to better ensure progress. Failure to meet the committee meeting interval requirement may result in suspension of the student’s stipend and tuition waiver until this requirement is met. Note that students who have a documented Leave of Absence can extend the 7-year deadline by the duration of their LOA.

19. Continuous Enrollment Requirement

The University requires that students be continuously enrolled for at least 1 credit each semester between achieving candidacy and defending their dissertation (e.g., the student must be enrolled in the University the semester that they defend their dissertation. This can be for 1 credit to reduce the student fee amount). This also includes the summer
For full-time student status, students must be enrolled in at least nine (9) credit hours for fall and spring semesters, and three (3) credit hours for each summer semester.

20. Dissertation Preparation, Seminar and Defense

When research has progressed to a point considered satisfactory by the major advisor and the dissertation committee, including acceptance of at least one first-author manuscript representing the student’s dissertation work, the student will be given the authority to proceed with writing their doctoral dissertation according to HSC guidelines (link here). The written dissertation must be approved by the major advisor prior to distribution to the dissertation committee before the final oral defense. This document must be given to the committee members NO LESS THAN 2 WEEKS prior to the date of the defense. Exceptions to this time schedule are strongly discouraged. In addition, students must complete and submit the Shuttle Sheet Request Form containing the title of their dissertation to the ORGE at least two weeks prior to the scheduled defense date. This is necessary for public advertising of the defense. CCB Program administration should also be contacted with the title of the defense, scheduled date, time and location two weeks prior to the defense.

The final examination for the Ph.D. degree will be the public dissertation defense. This consists of a public seminar detailing the student’s completed dissertation before the Advisory committee, the CCB program faculty and any other interested parties. After the public defense, the student will conduct their defense of the written document before their committee in a closed door private session. Satisfactory performance in the oral defense and written dissertation as judged by the dissertation committee will result in a recommendation for granting of the Ph.D. degree by the CCB Graduate Program.

Following a satisfactory defense, the student must prepare the dissertation for electronic submission (ETD) to the University. The ORGE will alert students with regards to University deadlines for graduation and advise students regarding forms required for thesis submission. Approval of the written dissertation and the electronic submission, which includes signatures from all committee members and the major advisor, must be completed before the Ph.D. can be conferred. One printed and bound copy of the final dissertation is required for the CCB program archives. Students cannot make firm commitments for starting dates in postdoctoral positions or other employment prior to completion of these requirements.

21. Graduation Requirements

Students that are nearing graduation are encouraged to obtain the ORGE Graduation Checklist (link) to ensure all requirements are met and necessary activities scheduled. In addition to the requirements on the Graduation Checklist, students must have a clean audit of their DegreeWorks page conducted by the ORGE in order to obtain Registrar approval for graduation. Students are encouraged to check their DegreeWorks page in the months leading up to the anticipated graduation date in order to correct any errors.
22. Appeals

Students have the right to appeal course grades, dissertation committee evaluations or other academic issues pertaining to progress towards the Ph.D. degree. In all situations, appeals should be viewed as an action of last resort. Prior to such an impasse, students are encouraged to work with their course instructor, mentor, CCB Graduate Director and/or Assistant Vice President of HSC Graduate Education as appropriate in order to rectify disagreements in a professional manner. In cases where a student absolutely feels the need to appeal, the CCB Director and Assistant Vice President of HSC Graduate Education must be notified in advance, and in most cases the appeal is heard by the Graduate Program Committee on Academic and Professional Standards (GP-CAPS). In the case of disputed grades in a CCB course, the CCB Program does not have traditional departmental oversight of courses. As such, the final appeal decisions are rendered directly at the level of the Vice Dean for Medical Education. Additional information on the appeals process can be found in the WVU graduate catalog (link).

23. Work Schedules, Vacations and Sick Leave

Graduate study is not constrained by the University academic calendar, and while CCB faculty and students tend to follow the academic calendar for holidays at the end of the fall semester, they do not readily observe the published “vacation” schedule of the University. Holidays and Special Days of Concern that are observed by graduate students are recognized by course directors, and absence on these days should be approved by their dissertation advisor.

If a student is ill, the student’s major advisor and the faculty in charge of any course(s) the student is taking should be notified immediately. This can be by phone or e-mail and should be done prior to the time of the class or meeting, or as soon as possible thereafter.

Vacations are to be approved by the dissertation advisor. While work-life balance is important and is recognized as such by the CCB faculty, the student must realize that the Ph.D. degree is granted based on completion of the Program requirements. This includes research and publication, not based on the length of time in the program. Thus, undue time spent away from the University will likely hamper the student’s research and delay their progress. Plan vacations accordingly so time away can be enjoyed.

The student should discuss expectations for their laboratory work schedule with their dissertation advisor. These expectations vary between laboratories, so it is important to establish expectations before selection of a specific laboratory. Advisors need to make work expectations clear to new students and remind existing students in their laboratories on a regular basis. Faculty, staff and graduate students are expected to work a minimum of 37.5 hours per week in compliance with WVU guidelines. Given the high time demand inherent to research, students are discouraged from engaging in additional work (e.g., a second job) outside of the laboratory.
Regarding class attendance, students are expected to be on time to class, to attend all scheduled lectures, seminars and journal clubs, and to contribute to class discussions where appropriate. There is no “optional” attendance policy, and lectures/class activities are not recorded for subsequent viewing. Punitive action in the form of reduced class grades will be applied to students that are chronically late, who miss class or who fail to contribute to class discussions. Such policies are detailed in each course syllabus.

24. Leave of Absence

In situations where students need to deal with extended periods of leave longer than two (2) weeks, the Leave of Absence (LOA) policy should be enacted. Examples include pregnancy, paternity leave, serious illness or a family crisis. The detailed LOA policy can be found [here](#) and should be consulted with the student’s mentor and CCB Program Director prior to submitting the appropriate request form (found in the policy). Student-initiated leave can be medical, personal or academic-based. Students can also be given an LOA for administrative reasons based on failure to progress in research or professional or academic deficiencies. Under these cases, the LOA is NOT accompanied with stipend support, and students will not be paid when on LOAs under these categories.

In cases involving maternity/paternity leave, students will remain on stipend support for a maximum of six (6) weeks for an individual, or eight (8) weeks total per family if both parents are graduate students in HSC programs. Longer leave is possible if complications occur, and are assessed on a case-by-case basis. Additional LOA with pay may include time away from the laboratory where the student may not be present for over one (1) month, but still may be able to achieve significant progress towards the degree. These situations are assessed by the Program Director and CCB Scholarship Committee in conjunction with the student and mentor to determine suitability of the leave, length of absence and re-entry strategy.

25. Grading Policy During Leave of Absence

When a student goes on a leave of absence, whether less than one (1) month or a longer leave without stipend, issues develop regarding the grading of courses when the leave begins mid semester. To a large extent this will need to be handled on a case-by-case basis. For defined courses, the student will need to work with the instructor to come up with a strategy and generally will need to take an incomplete (I) grade. Courses like research and seminar (when used to monitor attendance) generally do not have a mechanism to fulfill an incomplete. If the length of the leave is known and it is before the deadline to withdraw, it would be best for the student to withdraw from these courses during the semester. If that deadline has past, a student in good standing should be able to receive a grade reflecting their participation prior to the leave, especially when the course is graded S/U or P/F. Journal clubs can be handled by having the student write summaries of papers that were missed. If the student is having a major medical crises and can’t work during the leave, then either grade them for the time in the course or give an incomplete and come up with a protocol for making up the work. The student and
instructor should work together to devise a plan to rectify the Incomplete grade in the following semester.

26. Forms and Links

Many of the policies and forms noted above can be found on the appropriate OR&GE webpage. At present, the Progress Report form for dissertation committee meetings is not online, and is found on page 23.

HSC Policies: https://www.hsc.wvu.edu/resoff/graduate-education/policies-and-forms/
(Includes policies on international travel, LOA, ETD, Travel Award applications, etc.)

HSC Forms: https://www.hsc.wvu.edu/resoff/graduate-education/policies-and-forms/forms/
(Contains many of the necessary student forms for committees and graduation)

University policy on Academic and Professional Standards: http://catalog.wvu.edu/graduate/enrollmentandregistration/#academicdishonestytext

27. Institutional Policies, Guidelines and Statements

Campus Safety Statement

If an event occurs, dial 3034-293-3677 or 911 and stay on the line.

West Virginia University provides the WVU Alert system. Students may sign up to receive alerts and messages concerning safety. Sign-up information and procedures may be found at: http://emergency.wvu.edu/alert

Inclusivity Statement

The West Virginia University community is committed to creating and fostering a positive learning and working environment based on open communication, mutual respect and inclusion. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in your classes, please advise your instructors and make appropriate arrangements with the Office of Accessibility Services. More information is available at the Division of Diversity, Equity, and Inclusion as well.

Sexual Misconduct Statement

West Virginia University does not tolerate sexual misconduct, including harassment, stalking, sexual assault, sexual exploitation, or relationship violence [BOG Rule 1.6]. It
is important for you to know that there are resources available if you or someone you know need assistance. You may speak to a member of university administration, faculty or staff; keep in mind that they have an obligation to report the incident to the Title IX Coordinator. (https://titleix.wvu.edu/staff).

If you prefer to speak to someone who is permitted to keep your disclosure confidential, please seek assistance from the Carruth Center 304-293-9355 or 304-293-4431 (24-hour hotline), and locally within the community at the Rape and Domestic Violence Information Center (RDVIC) 304-292-5100 or 304-292-4431 (24-hour hotline). For more information, please consult WVU’s Title IX Office.
Graduate Advisory Committee Meeting: Progress Report

<table>
<thead>
<tr>
<th>Name:</th>
<th>Meeting Date:</th>
</tr>
</thead>
</table>

Part 1. Progress Report of Research Accomplishments Since the Last Committee Meeting

**Directions:** The entire Progress Report for sections A through D **should not exceed two pages.** Tables and figures of results are **not** counted in the two-page limit and should be attached after section D. Be sure to include a legend for each figure or table of data provided. (NOTE: This is very close to the format used for grant progress reports). If a committee meeting is held prior to the proposal defense, the aims section can be abbreviated to include only the study objective.

**A. Specific Aims**
List the aims, as originally proposed. If the aims have been modified, give the revised aims and the reason for the modification.

**B. Studies and Results**
The intent here is to provide a summary of where you are in completing all the proposed work as well as a report of your productivity since the last meeting. Describe the studies that you have completed toward each specific aim and the positive and negative results obtained (recommended to list these under that particular aim). If technical problems were encountered in carrying out this project, describe how the approach was modified. If an aim was completed prior to the last committee meeting, simply write completed next to the aim. If there was no progress on an aim, write “no progress” next to that aim. Include any publications that resulted since the last committee meeting.

**C. Significance**
Emphasize the significance of the findings to the scientific field.

**D. Plans**
Summarize plans to address the Specific Aims during the next year. Include any important modifications to the original plans.

Part 2. Biosketch
Attach your biosketch in NIH format after the figures and tables. On the biosketch be sure to include any honors, fellowships, or patents received.
28. Sample Curriculum

Overview of CCB Graduate Training Program

Year 1  Common Integrated Core Curriculum
Years 2 - 3  Advanced Coursework
Dissertation Proposal (end of Year 2)
Years 4 - 6  Independent Research and Dissertation Defense

Details of CCB Graduate Training Program

**Year 1 Common, Integrated Core Curriculum: Fall Semester**

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundation for Contemporary Biomedical Research 1 (BMS 747) (August-October)</td>
<td>4</td>
</tr>
<tr>
<td>Foundation for Contemporary Biomedical Research 2 (BMS 777) (October-December)</td>
<td>4</td>
</tr>
<tr>
<td>Cellular Methods (BMS 706)</td>
<td>1</td>
</tr>
<tr>
<td>Discussions in Scientific Integrity (BMS 700)</td>
<td>1</td>
</tr>
<tr>
<td>Short Lab Experience (Rotations) (BMS 791A)</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

**Year 1 Common Core Curriculum: Spring Semester**

Selection of Elective/Required Courses (select 2 courses, each 3 credits)

<table>
<thead>
<tr>
<th>Examples of Courses Currently Offered</th>
<th>Training Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular Biology (BMS 715)</td>
<td>BMB</td>
</tr>
<tr>
<td><strong>Intro to Cancer Cell Biology (BMS 730)</strong></td>
<td><strong>CCB (REQUIRED)</strong></td>
</tr>
<tr>
<td>Physiological Systems &amp; Disease (BMS 793)</td>
<td>CIP</td>
</tr>
<tr>
<td>Muscle Structure &amp; Function (BMS 738)</td>
<td>EP</td>
</tr>
<tr>
<td>Neurobiology 1 (BMS 740)</td>
<td>Neuro</td>
</tr>
<tr>
<td>Immuno/Microbial Pathogenesis (BMS 736)</td>
<td>IMP</td>
</tr>
<tr>
<td>Drug Discovery/Development (PHAR 779)</td>
<td>PPS</td>
</tr>
</tbody>
</table>
Graduate Seminar in Cancer Cell Biology (CCB 796) &nbsp;&n
<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Graduate Seminar in Cancer Cell Biology (CCB 796)</td>
<td>1</td>
</tr>
<tr>
<td>Cancer Cell Biology Journal Club (CCB 705)</td>
<td>1</td>
</tr>
<tr>
<td>Dissertation Research (CCB 797)</td>
<td>4</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>9</strong></td>
</tr>
</tbody>
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**Year 2 Cancer Cell Biology Program Curriculum: Summer**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Writing (BMS 720)</td>
<td>2</td>
</tr>
<tr>
<td>Dissertation Research (CCB 797) (12 weeks)</td>
<td>1</td>
</tr>
<tr>
<td><strong>Dissertation Proposal Defense (Complete by Aug. 1)</strong></td>
<td>-</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
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**Year 3-6 Cancer Cell Biology Program Curriculum: Fall & Spring Semesters**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate Seminar in Cancer Cell Biology (CCB 796)</td>
<td>1</td>
</tr>
<tr>
<td>Cancer Cell Biology Journal Club (CCB 705)</td>
<td>1</td>
</tr>
<tr>
<td>Dissertation Research (CCB 797)</td>
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<td><strong>TOTAL</strong></td>
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**Years 3-6 Cancer Cell Biology Program Curriculum: Summer**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissertation Research (CCB 797) (12 weeks)</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3</td>
</tr>
</tbody>
</table>
29. LISTING OF CURRENT CCB FACULTY AND THEIR RESEARCH INTERESTS

Yehenew Agazie – Professor, PhD, University of Saskatchewan, Canada. Signal transduction by tyrosine kinases and phosphatases in breast cancer.
Sonikpreet Aluakh - Assistant Professor, MBBS, Shyam Shah Medical College, India. Novel aspects of treatment in leukemia.
Amanda Gatesman Ammer – Research Assistant Professor, PhD, West Virginia University. Applied aspects of microscopy in vitro and in vivo settings.
Brian Boone- Assistant Professor, MD, University of South Florida. Role of neutrophil nets in pancreatic cancer.
Wei Du - Assistant Professor, MD/PhD, Tohoku University, Japan. Tumor microenvironment and stem cell polarity in leukemia.
Tim Eubank- Associate Professor, PhD, Ohio State University. Macrophage activation in the tumor microenvironment.
Steven Frisch – Professor, PhD, University California, Berkeley. Molecular mechanisms regulating anoikis.
Werner Geldenhuys- Associate Professor, PhD, North-West University, South Africa. Development of novel anti-cancer therapeutics.
Lan Guo –Professor, PhD, West Virginia University. Bioinformatics and computational identification of biomarkers in lung cancer.
Lori Hazlehurst – Professor, PhD, University of Vermont. Experimental therapeutics in novel treatment of hematological malignancies.
Alexey Ivanov – Research Assistant Professor, PhD, Russian Academy of Sciences. Regulation of gene transcription in breast cancer progression and dormancy.
David Klinke – Assistant Professor, PhD, Northwestern University. Systems biology in signal transduction networks and exosome secretion in cancer.
Sarah Knox- Professor, PhD, University of Stockholm, Sweden. Systems biology and biophysics in the etiology of malignancy.
Jun Liu – Associate Professor, PhD, Oxford University; MD China Medical University. Caveolin-1, endothelial cell motility and angiogenesis.
Brock Lindsey- Assistant Professor, MD, University of Cincinnati. Role and targeting of the immune response in osteosarcoma.
Paul Lockman – Professor, Texas Tech University. Drug distribution across the blood-brain barrier.
Karen Martin – Research Associate Professor, PhD, North Carolina State University. Imaging technologies in cancer.
Ivan Martinez – Associate Professor, PhD, U. Pittsburgh. Role of non-coding RNAs in HPV-positive cancers.
Mark McLaughlin- Professor, PhD, Georgia Institute of Technology. Anticancer drug discovery and development.
Emidio Pistilli- Associate Professor, PhD, West Virginia University. Effects of interleukin signaling on breast cancer-induced muscle cachexia.
Elena Pugacheva – Associate Professor, PhD, Russian Academy of Sciences. Signal transduction and primary cilia in breast cancer and glioblastoma.
Yon Rojanasakul – Professor, PhD, University of Wisconsin. Reactive oxygen species and nanoparticles in lung cancer progression.
J. Michael Ruppert – Professor, M.D./PhD, Johns Hopkins University. Tumor suppressor genes and transcriptional regulation in breast cancer.

Michael Schaller – Professor, PhD, McMaster University. Tyrosine kinase signaling in cell migration, proliferation and survival.

Peter Stoilov – Associate Professor, PhD, Friedrich-Alexander-University, Germany. Drugs targeting alternative splicing as cancer therapeutics and research tools.

Linda Vona-Davis – Adjunct Professor, PhD, West Virginia University. Obesity and cancer.

Scott Weed – Associate Professor, PhD, Yale University. Actin cytoskeleton regulation in tumor cell invasion; regional disparities in head and neck cancer.
# Introduction to Cancer Cell Biology

## CCB 730

### Spring 2019

**When:** Tuesdays/Thursdays – 08:00 – 08:50 a.m.  
**Where:** G252  
**Course Coordinator:** Linda Vona-Davis, Ph.D.  
**Office phone #:** 293-1280  
**Email:** lvdavis@hsc.wvu.edu

**Course format:** Classroom lecture and discussion  
**Credit hours:** 3

**Course Description:** This course will introduce students to the principles that define the biological characteristics of cancer cells and tumors and the process by which a normal cell is transformed into a cancer cell. Faculty members will introduce one lecture topic on Tuesday of each week followed by a discussion of a related experimental research paper on Thursday.

**Purpose of Course:**
- To introduce graduate students to current topics in cancer cell biology.  
- To critically evaluate the scientific literature as it relates to the genetic, biochemical, and cell biology involved in all types of cancer development.  
- To provide opportunities for students to explore the techniques used by cancer biologists in defining the mammalian genomes of human cancer.

**Expected Learning Outcomes:**
- Students will be able to comprehend the concepts of cancer cell biology.  
- Students will develop an elaborate, specialized vocabulary that will allow them to comprehend the primary scientific research literature in the field of cancer biology.  
- Students will understand how techniques and experimental strategies are used in contemporary cancer research.

**Course textbook:** *The Biology of Cancer* by Robert A. Weinberg, 2nd edition (2014, Garland Science)  
**Media items:** [http://www.garlandscience.com](http://www.garlandscience.com)

**Criteria for grade:** Performance in this class is evaluated with the letter grades of A, B, C or F based on cumulative points from take home exams and paper discussions. All grades and written comments will be part of the student’s file kept both in the graduate program office and the Office of Research and Graduate Education. An overall grade point average of 3.0 in graduate level coursework must be maintained to avoid being placed on academic probation.

**Participation in paper discussions:** Students are required to be *active and engaged* in the discussion of assigned scientific papers each week. Faculty members will lead the paper discussions and will be responsible for the progress of the discussion. Students should
demonstrate thorough familiarity with the paper. Contributions to the discussion include descriptions of the methodology, data, results, conclusions and significance of the paper presented. Contributions to the discussion should be accurate, logical and contribute to the progress of the discussion. Students will be expected to respond thoughtfully to ideas and questions from the faculty member and other students. These discussions can also be used to address questions to the faculty members to gain a further understanding of the methods and concepts described in the assigned papers. Faculty members leading the discussion will evaluate the participation of each student.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage of total</th>
<th>Total Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>90 – 100%</td>
<td>360 – 400</td>
</tr>
<tr>
<td>B</td>
<td>80 – 89%</td>
<td>320 – 359</td>
</tr>
<tr>
<td>C</td>
<td>70 – 79%</td>
<td>280 – 319</td>
</tr>
<tr>
<td>F</td>
<td>60 – 69%</td>
<td>240 – 279</td>
</tr>
</tbody>
</table>

**Exam Dates:** Exam 1 – Mar 5-7
Exam 2 – Apr 20, 25

**Attendance Policy:** If you are unable to attend class for any reason, you must be excused by the faculty coordinator. This can be done by emailing the faculty coordinator prior to class. An unexcused absence is one in which you simply do not attend class and fail to inform the faculty coordinator prior to the absence. Excused absences will result in your needing to make-up the missed work.

**Adverse Weather Commitment Syllabus Statement:** In the event of inclement or threatening weather, everyone should use his or her best judgment regarding travel to and from campus. Safety should be the main concern. If you cannot get to class because of adverse weather conditions, you should contact me as soon as possible. Similarly, if I am unable to reach our class location, I will notify you of any cancellation or change as soon as possible (before class starts), using (MIX) to prevent you from embarking on any unnecessary travel. If you cannot get to class because of weather conditions, I will make allowances relative to required attendance policies, as well as any scheduled assessments.
**CCB 730  Introduction to Cancer Cell Biology**  
**When:**  Tuesdays/Thursdays – 08:00 – 08:50 a.m.  **Where:**  G252 HSC South

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Textbook</th>
<th>Faculty</th>
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<tbody>
<tr>
<td>Jan 8, 10</td>
<td>Cancer Virology</td>
<td>Weinberg Chapter 3</td>
<td>Melinda Varney</td>
</tr>
<tr>
<td>Jan 15, 17</td>
<td>Maintenance of Genomic Integrity and the Development of Cancer</td>
<td>Weinberg Chapter 12</td>
<td>Alexey Ivanov</td>
</tr>
<tr>
<td>Jan 22, 24</td>
<td>Cell Immortalization and tumorigenesis</td>
<td>Weinberg Chapter 10</td>
<td>Erik Bey</td>
</tr>
<tr>
<td>Jan 29, 31</td>
<td>The Oncogenic Epithelial-to-Mesenchymal Transition (EMT)</td>
<td>Weinberg Chapter 14</td>
<td>Steve Frisch</td>
</tr>
<tr>
<td>Feb 5, 7</td>
<td>Invasion and Metastasis</td>
<td>Weinberg Chapter 14</td>
<td>Scott Weed</td>
</tr>
<tr>
<td>Feb 12, 14</td>
<td>Treatment of Cancer &amp; Cancer Resistant</td>
<td>Weinberg Chapter 16</td>
<td>Bill Petros</td>
</tr>
<tr>
<td>Feb 19, 21</td>
<td>Tumor Immunology and Immunotherapy</td>
<td>Weinberg Chapter 15</td>
<td>David Klinke</td>
</tr>
<tr>
<td>Feb 26, 28</td>
<td>Clinical Imaging in Cancer Treatment</td>
<td>No textbook</td>
<td>Mark Tseytlin</td>
</tr>
<tr>
<td>Mar 5-7</td>
<td>Take Home - Exam 1</td>
<td></td>
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</tr>
<tr>
<td>Mar 11, 14</td>
<td>Spring Break</td>
<td></td>
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<tr>
<td>Mar 19, 21</td>
<td>Molecular Imaging in Cancer Biology</td>
<td>No textbook</td>
<td>Karen Martin</td>
</tr>
<tr>
<td>Mar 26-28</td>
<td>Cancer Metabolism</td>
<td>No textbook</td>
<td>Linda Davis</td>
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<tr>
<td>Apr 2, 4</td>
<td>Cancer Epigenetics</td>
<td>No textbook</td>
<td>Sarah Knox</td>
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<tr>
<td>Apr 9, 11</td>
<td>Nanomedicine &amp; Carcinogenesis</td>
<td>No textbook</td>
<td>Yon Rojanasakul</td>
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<tr>
<td>Apr 16, 18</td>
<td>Systems Biology &amp; Bioinformatics</td>
<td>No textbook</td>
<td>Lan Guo</td>
</tr>
<tr>
<td>Apr 20, 25</td>
<td>Take Home - Exam 2</td>
<td></td>
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</table>

**Attendance:**  Attendance is mandatory for the lecture and active participation in the paper discussion is part of the final grade. Students should contact the professor scheduled to lecture or the course coordinator when an *excused* absence is necessary.

**Adverse Weather Commitment:**  In the event of inclement or threatening weather, everyone should use his or her best judgment regarding travel to and from campus. Safety should be the main concern. If you cannot get to class because of adverse weather conditions, you should contact me as soon as possible. Similarly, I will notify you of any cancellations or change as soon as possible (before class starts), using email through SOLE to prevent you from embarking on any unnecessary travel. If you cannot get to class because of weather conditions, I will make allowances relative to required attendance policies, as well as any scheduled tests, quizzes, or other assessments.
Social Justice Statement: “West Virginia University is committed to social justice. I concur with that commitment and expect to maintain a positive learning environment based upon open communication, mutual respect, and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran’s status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise the course coordinator and make appropriate arrangements with the Office of Disability Services (293-6700).

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Syllabus for CCB 700, Special Topics in Cancer Cell Biology
Fall 2018 (S. Frisch, course coordinator)
Wed-Fri: 2:00-3:30 PM, meetings in individual faculty offices

<table>
<thead>
<tr>
<th>Week</th>
<th>Instructor</th>
<th>Topic</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Aug.15,17</td>
<td>Steve Frisch</td>
<td>Epigenetics and cancer</td>
<td>2836-MBRCC</td>
</tr>
<tr>
<td>(2) Aug. 22, 24</td>
<td>Mike Ruppert</td>
<td>Re-programming transcription factors in cancer</td>
<td>212 Erma Byrd</td>
</tr>
<tr>
<td>(3) Aug 29,31</td>
<td>Ivan Martinez</td>
<td>Non-coding RNA</td>
<td>1838 (MBRCC)</td>
</tr>
<tr>
<td>(4) Sept. 5,7</td>
<td>Scott Weed</td>
<td>Mechanisms of Cancer Cell Invasion</td>
<td>1833 (MBRCC)</td>
</tr>
<tr>
<td>(5) Sept. 12,14</td>
<td>Paul Lockman</td>
<td>Pharmacokinetic distribution and accumulation of chemotherapy in malignancies</td>
<td>2037D</td>
</tr>
<tr>
<td>(6) Sept. 9,21</td>
<td>Valery Khramtsov</td>
<td>Chemical tumor microenvironment and Redox: Relationship to cancer metabolism</td>
<td>5524 HSC</td>
</tr>
<tr>
<td>(7) Sept. 26,28</td>
<td>Linda Vona-Davis</td>
<td>NAD+ Metabolism and the Control of Energy Homeostasis</td>
<td>7700 HSS</td>
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<tr>
<td>(8) Oct. 3,5</td>
<td>Sarah Knox</td>
<td>Implications of Systemic Dysfunction for the Etiology of Malignancy</td>
<td>3812C</td>
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<tr>
<td>(9) Oct. 10,12</td>
<td>Mike Schaller</td>
<td>Tumor dormancy</td>
<td>3123(HSC-N)</td>
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<tr>
<td>(10) Oct. 17,19</td>
<td>Wei Du</td>
<td>Molecular biology of leukemia</td>
<td>7700M-HSC-S</td>
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<td>(11) Oct. 24,26</td>
<td>David Klinke</td>
<td>Exosomes as modes of intercellular communication within the tumor microenvironment</td>
<td>219 Erma Byrd</td>
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<td>(12) Oct 31, Nov 2</td>
<td>Yehenew Agazie</td>
<td>Tyrosine phosphatases in cancer</td>
<td>3131C(HSC-N)</td>
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<td>(13) Nov. 7,9</td>
<td>Tim Eubank</td>
<td>Macrophage Regulation and Function in Solid Tumors</td>
<td>5613 HSC</td>
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<tr>
<td>(14) Nov. 14,16</td>
<td>Lori Hazlehurst</td>
<td>Emergence of resistance to tyrosine kinase inhibitors</td>
<td>207 Erma Byrd</td>
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<tr>
<td>(15) Nov. 28,30</td>
<td>Patrick Ma</td>
<td>Lung Cancer – Era of Personalized Genomics and Immuno-Oncology</td>
<td>1814 MBRCC</td>
</tr>
</tbody>
</table>

Attendance policy

Attendance is mandatory for the lecture. Students should contact the professor scheduled to lecture and the course coordinator when an excused absence is necessary.

Participation in paper discussions

Some lecturers may choose to assign scientific papers for discussion. Students are required to participate in these discussion, which will be led by the faculty. Students should demonstrate familiarity with the paper.

Grading
Students are required to submit a mini-review paper and mini-grant before the end of the semester:

--One self-written review article (with references and at least one conceptual diagram, each) on any one topic covered in the course that you choose. 3-5 pages (no more please). Do not copy published review article.

PLUS

--one "grant proposal" on any one course-related topic that you choose. You do NOT need to use a template, have a budget, personnel. All you need is: Abstract/summary, Specific Aims, Background, Experimental Plan. 3-5 pages total (no more). Must have references and at least one conceptual diagram.

These will be graded by the relevant lecturer on a standard A-F scale.

Inclusivity Statement

The West Virginia University community is committed to creating and fostering a positive learning and working environment based on open communication, mutual respect, and inclusion.

Adverse Weather Commitment

In the event of inclement or threatening weather, everyone should use his or her best judgment regarding travel to and from campus. Safety should be the main concern. If you cannot get to class because of adverse weather conditions, you should contact me as soon as possible. Similarly, if I am unable to reach our class location, I will notify you of any cancellation or change as soon as possible (before class starts), using email through SOLE to prevent you from embarking on any unnecessary travel. If you cannot get to class because of weather conditions, I will make allowances relative to required attendance policies, as well as any scheduled tests, quizzes, or other assessments.
Course Description. This course is a 3 credit, designed for advanced graduate student. The course will focus on the principles that define the biochemical signaling mechanisms employed by all cells, including cancer cells. Material covered in this course includes structures, functions and regulations of signaling molecules including proteins, steroids, vitamins and lipids. This course consists of eleven topics covering a variety of signal transduction pathways utilized by normal and cancer cells. Each topic starts with lecture(s) followed by paper(s) for discussion.

Course Objectives. This course aims at providing students an in-depth understanding of the principle of signaling pathways; the control of cellular behaviors by the signaling pathways in malignant and non-malignant cells; and typical approaches to study signaling pathways.

Expected Learning Outcomes. By successful completion of this course, students are expected to describe the molecular mechanisms that control cellular communications to achieve an excess of cellular responses; to develop an understanding of the contemporary research literatures in signaling networks relevant to biochemistry and cancer biology; and to develop critical thinking and analytical skills.

Course Materials.
1. PowerPoint Files: Lectures will be presented as PowerPoint slide shows. The PowerPoint files will be available on the Health Sciences Center educational website (SOLE) for viewing and downloading before each lecture.
3. Additional Materials: Research papers and review articles for paper discussion, and additional material to assist student preparation for lectures will be posted on the SOLE site.

Block I. RECEPTOR SIGNALING (Week 1-4, block leaders: Ruppert/Agazie)

Week 1-2. Signaling by Receptor Tyrosine Kinase (RTK) - The objective of this section is to understand the structure, function, regulation, and signaling of receptor tyrosine kinases in normal cells, and mechanisms related to their dysregulation in cancer cells. There will be two lectures and two articles for discussion. These two weeks will focus on structure and activation of TRKs including EGFR, IR, PDGFR, MET, TrkA, Eph and Axl, formation of multiprotein signaling complex, downstream signal pathways, and regulation of RTK signaling.

Michael Ruppert and Yehenew Agazie August 21 and 23; August 28 and 30

Week 3-4. Signaling by Cytokine Receptors (CRs) - The objective of this section is to understand the structure, function, regulation, and signaling of CRs in normal cells, and mechanisms related to their dysregulation in cancer cells. There will be two lectures and two articles for discussion. These two weeks will focus on structure of EpoR, IL-R, TGFβ-R and GH-R.

Michael Ruppert and Yehenew Agazie September 4 and 6; September 11 and 13

Block II. SIGNALING VIA OTHER CYTOPLASMIC AND NUCLEAR RECEPTORS (Week 5-7, block leaders: Vona-Davis/Leonardi)

Week 5. Cellular Regulation via mTOR and AMPK Pathways - The objective of this topic is to introduce the concept of metabolites as signaling molecules, and the concept of nutrient-sensing with a focus on the mTOR and AMPK signaling pathways. Particular consideration will be given to the role of the mTOR and AMPK pathways in cell survival and metabolic regulation in health and disease.

Linda Vona-Davis and Roberta Leonardi September 18 and 20
Week 6. Cellular Regulation via mTOR and AMPK Pathways (continue from Week 5).

*Linda Vona-Davis and Roberta Leonardi*  
*September 25 and 27*

Week 7. Signaling via Nuclear Hormone Receptor Superfamily Members - The objective of this topic is to understand the commonalities and differences amongst the members of the steroid hormone superfamily of receptors. Actions of estrogens, androgens, vitamins and lipids as ligands for these receptors and their intracellular actions will be considered in detail.

*Linda Vona-Davis and Roberta Leonardi*  
*October 2 and 4*

Exam 1  
*October 8*

**Block III. RAS AND MAPK (Week 8-10, block leaders: Liu)**

Week 8-10 will illustrate how intracellular signaling molecules are organized in response to extracellular stimulation in normal cell and cancer cells. Specific topics in this block include Ras superfamily GTPases, MAP kinases, PI3 kinase and PTEN.

**Week 8. Ras Superfamily GTPases**

*Jun Liu*  
*October 9 and 11*

**Week 9. MAP Kinases**

*Jun Liu*  
*October 16 and 18*

**Week 10. PI3 Kinase and PTEN**

*Jun Liu*  
*October 23 and 25*

**Block IV. SIGNALING IN DEVELOPMENT (Week 11-13, block leaders: Mathers/Ivanov)**

Week 11-13 will follow extracellular signaling factors from their activation of receptors to their transcriptional readouts in the nucleus, including their roles in normal development
and cancer progression. The specific pathways to be discussed are Wnt/beta-catenin, Hedgehog, and Notch signaling.

**Week 11. Wnt**

*Peter Mathers and Alexey Ivanov*  
*October 30 and November 1*

**Election Day**  
November 6 (no class in this week)

**Week 12. Hedgehog**

*Peter Mathers and Alexey Ivanov*  
*November 13 and 15*

November 19-23  
Thanksgiving recess

**Week 13. Notch**

*Peter Mathers and Alexey Ivanov*  
*November 27 and 29*

**Exam 2**  
December 3

**Exams and grading.** Class participation will count as 20% of final grade. Participation grades will be given in each block. Faculty will evaluate student class participation on a scale of 0-5 (5 is the highest). There will be two take-home exams. Each of the exams will count as 40% of the final grade.

**Grades.** The following scale is a guide for how grades are usually assigned:

- A = 90 – 100%
- B = 80 – 89.9%
- C = 70 – 79.9%
- D = 60 – 69.9%

**Faculty:**

Dr. Yehenew Agazie
Room: 3151 HSC-N  
Phone: 293-7756  
Email: yagazie@hsc.wvu.edu

Dr. Linda Vona-Davis  
Room: 7700 HSS  
Phone: 293-1280  
Email: lvdavis@hsc.wvu.edu

Dr. Alexey Ivanov  
Room: 218 Byrd Biomedical Building  
Phone: 293-4936  
Email: aivanov@hsc.wvu.edu

Dr. Roberta Leonardi  
Room: 3143A HSC-N  
Phone: 293-7591  
Email: roleonardi@hsc.wvu.edu

Dr. Jun Liu, Course Coordinator  
Room: 217 Byrd Biomedical Building  
Phone: 293-1503  
Email: junliu@hsc.wvu.edu

Dr. Peter Mathers  
Room: 310 Byrd Biomedical Building  
Phone: 293-0271  
Email: pmathers@hsc.wvu.edu

Dr. Michael Ruppert  
Room: 212 Byrd Biomedical Bldg.  
Phone: 293-5246  
Email: mruppert@hsc.wvu.edu
**Faculty Consultation.** Course instructors are available for consultation at any time. Students should contact instructors by email to schedule an appointment.

**Attendance policy.** Attendance is mandatory for the lectures and the paper discussions. Students should contact the professor scheduled to lecture and the course coordinator when an excused absence is necessary. Each unexcused absences will result in a drop of grade.

**Participation in paper discussions**
Students are required to participate in the discussion of assigned scientific papers each week. Class participation will count as 20% of your course grade. Evaluation of students’ performance will be based on the quality for preparation of assignment(s), i.e. whether students have critically read paper(s) before class and made significant contribution to paper discussion. Faculty members will oversee the paper discussions and will be responsible for the progress of the discussion. Students should demonstrate thorough familiarity with the paper. Contributions to the discussion include descriptions of the methodology, data, results, conclusions and significance of the paper presented. Contributions to the discussion should be accurate, logical and contribute to the progress of the discussion. Students will be expected to respond thoughtfully to ideas and questions from the faculty member and other students. These discussions can also be used to address questions to the faculty members to gain a further understanding of the methods and concepts described in the assigned papers.

**Social Justice Statement**
"West Virginia University is committed to social justice. I concur with that commitment and expect to maintain a positive learning environment based upon open communication, mutual respect, and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran’s status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration."
If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise the course coordinator and make appropriate arrangements with the Office of Disability Services (293-6700).

**Academic Integrity.** The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code at http://campuslife.wvu.edu/r/download/180235. Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me before the assignment is due to discuss the matter.
Course Syllabus – Cancer Pharmacology & Therapeutics CCB 702 Spring 2019

Course Coordinators: J. Michael Ruppert MD PhD, Jun Liu PhD and Malcolm Mattes MD

Office Hours: by appointment

Class Meeting Format: In class. 9:30 AM – 10:45 AM, Wednesday and Friday; Room 7606 HSS

Description: This course is designed for upper level graduate students. The course will provide a pharmacologic overview of each major drug class utilized in the treatment of cancer in addition to the standard approaches used to diagnose and treat major types of malignancies. There are no required textbooks.

Expected Learning Objectives:
Students are expected to understand the pharmacologic, pathologic and therapeutic principles involving cancer care. Levels of analysis will include:
- The mechanism of action of each of the major classes of anticancer drugs
- Differences in clinical pharmacology of drugs within each class
- Basic diagnostic/pathologic approaches used in oncology
- Treatment approaches for common cancers
- Students will demonstrate competence and proficiency in the analysis of data from published manuscripts and clinical trial protocols, in particular for scientific rigor and reproducibility.

<table>
<thead>
<tr>
<th>Date (2019)</th>
<th>Subject</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/9</td>
<td>Course Overview/Basic Principles of Clinical Oncology</td>
<td>Malcolm Mattes</td>
</tr>
<tr>
<td>1/11</td>
<td>Anticancer Drug Discovery</td>
<td>Mark McLaughlin</td>
</tr>
<tr>
<td>1/16</td>
<td>Radiation Biology and Radiosensitization</td>
<td>Paul Renz</td>
</tr>
<tr>
<td>1/18</td>
<td>Overview of Cytotoxic Chemotherapy</td>
<td>Gao/Seago</td>
</tr>
<tr>
<td>1/23</td>
<td>Hematopoietic Growth Factors</td>
<td>Wei Du</td>
</tr>
<tr>
<td>1/25</td>
<td>Pharmacologic Approaches to Cancer Prevention</td>
<td>Linda Vona-Davis</td>
</tr>
<tr>
<td>1/30</td>
<td>Cancer Prevention Article</td>
<td>Linda Vona-Davis</td>
</tr>
<tr>
<td>2/1</td>
<td>Anti-Microtubule Drugs &amp; Topoisomerase Inhibitors</td>
<td>Jun Liu</td>
</tr>
<tr>
<td>2/6</td>
<td>Antitumor Antibiotics</td>
<td>Jun Liu</td>
</tr>
<tr>
<td>2/8</td>
<td>Anti-Hormonal Agents</td>
<td>Gerald Higa</td>
</tr>
<tr>
<td>2/13</td>
<td>Signal Transduction Inhibitors I</td>
<td>Jun Liu</td>
</tr>
<tr>
<td>2/15</td>
<td>Signal Transduction Inhibitors II</td>
<td>Jun Liu</td>
</tr>
<tr>
<td>2/20</td>
<td>Therapeutic Monoclonal Antibodies I</td>
<td>William Petros</td>
</tr>
<tr>
<td>2/22</td>
<td>Therapeutic Monoclonal Antibodies II</td>
<td>William Petros</td>
</tr>
<tr>
<td>2/27</td>
<td>HDAC and proteasome inhibitors</td>
<td>Lori Hazlehurst</td>
</tr>
<tr>
<td>3/1</td>
<td>HDAC and proteasome inhibitors Article</td>
<td>Lori Hazlehurst</td>
</tr>
<tr>
<td>3/6</td>
<td>Management of Lung Cancer</td>
<td>Malcolm Mattes</td>
</tr>
<tr>
<td>3/8</td>
<td>Midterm Exam</td>
<td>No Class</td>
</tr>
<tr>
<td>3/13</td>
<td>Spring Recess</td>
<td>No Class</td>
</tr>
<tr>
<td>3/15</td>
<td>Spring Recess</td>
<td>No Class</td>
</tr>
<tr>
<td>3/20</td>
<td>Tumor Pathology &amp; Therapeutics</td>
<td>Matthew Smolkin</td>
</tr>
<tr>
<td>3/22</td>
<td>Van Lier Research Day – No Class</td>
<td>No Class</td>
</tr>
<tr>
<td>3/27</td>
<td>Management of Gastrointestinal Cancers</td>
<td>Richard Goldberg</td>
</tr>
<tr>
<td>3/29</td>
<td>Management of Head and Neck Cancer</td>
<td>Mohammed Almubarak</td>
</tr>
<tr>
<td>4/3</td>
<td>Management of Hematologic Cancers</td>
<td>Kelly Ross</td>
</tr>
<tr>
<td>4/5</td>
<td>Management of Breast Cancer</td>
<td>Ann Morris</td>
</tr>
<tr>
<td>4/10</td>
<td>Special Treatments for Hematologic Malignancies</td>
<td>Aaron Cumpston/ Michael Chargualaf</td>
</tr>
</tbody>
</table>
Grading:
Students will complete a take-home midterm exam covering the first part of the course. For the second portion of the course students will present the protocol for an active clinical trial to discuss the approaches used in the trial. The exam and presentation will each account for 50% of the final grade.
Scale 100-90% A; 89-80% B; 79-70% C; < 70% F
Faculty members leading article discussions will evaluate the participation of each student.

Adverse Weather Commitment:
Adverse Weather Commitment: In the event of inclement or threatening weather, everyone should use his or her best judgment regarding travel to and from campus. Safety should be the main concern. If you cannot get to class because of adverse weather conditions, you should contact me as soon as possible. Similarly, I will notify you of any cancellations or change as soon as possible (before class starts), using email through SOLE to prevent you from embarking on any unnecessary travel. If you cannot get to class because of weather conditions, I will make allowances relative to required attendance policies, as well as any scheduled tests, quizzes, or other assessments.

Attendance: Attendance is mandatory for the lecture and active participation in the paper discussion is part of the final grade. Students should contact the professor scheduled to lecture or the course coordinator when an excused absence is necessary.

Social Justice Statement:
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Syllabus
CCB 705 – Journal Club

Course Format: Classroom Discussion (see detailed description below)

Credit Hours: 1

Course Coordinator: Dr. Alexey Ivanov (fall), Dr. Jun Liu (spring)

Schedule: Thursdays, 12:30 pm – 1:40 pm

Location: 1394 HSC

Purpose of Journal Club:

- To introduce graduate students to new topics in cancer biology and oncology.
- To critically read and interpret the literature over a broad range of topics related to animal and laboratory research techniques used by cancer biologists.
- To provide opportunities for students to develop skills in public speaking and build their knowledge in science literacy.

Expected Learning Outcomes:

- Students will learn about recent advances in various fields of cancer cell biology and oncology.
- Students will learn about new techniques and experimental strategies that are used in contemporary cancer research.
- Students will learn to critically analyze, present and discuss selected papers from the research literature in the field of cancer biology.
- Students will improve their skills in research presentation and public speaking.
- Students will enrich their professional interactions with fellow students and faculty through open discussion of recent research publications in cancer biology.

Course Format

Eligibility

Graduate students in the Cancer Cell Biology program take this course every semester that they are in residence. Election of this course by students from other graduate
programs is welcome but optional. All faculty, postdocs, technicians and students are welcome to attend Journal Club meetings.

**Paper selection before semester start**

The paper to be covered each session is chosen by each student before the beginning of semester and provided to JC faculty coordinator (currently Dr. Alexey Ivanov) in PDF format. Supplementary figures, methods or other important supplementary material (except large Excel spreadsheets and movies) as well as (optional) published Commentaries and an accompanying review article should be appended to the paper PDF file. The paper selection has to be approved by student’s mentor (PI) and JC faculty coordinator. The paper could be switched for a better alternative given enough time before scheduled presentation, 1-2 weeks. The student who chose the paper assumes the role of facilitator and is expected to contribute to presentation significantly (see role of facilitator student as described below).

**Suggested criteria for paper selection**

Clinical relevance: patient data (clinical trials or expression/survival data) and in vivo experiments (mouse tumor models or xenografts)

High impact for a field: novel idea(s), paradigm shift or significant new findings and conclusions

Emerging promising technologies/treatments/etc

Rigor and Reproducibility - Appropriately controlled experiments (two or more cell lines; two or more si/sh/sgRNAs; etc) and statistical analysis (error bars and p-values etc; quantitation of IF/IHC images)

**Presentation guidelines:**

For each session two CCB faculty members: moderator and host faculty are expected to contribute actively to the discussion. Moderator is assigned based on closest expertise to the topic of a paper (when possible). Host faculty is mentor of the facilitator student, who helped/approved the paper selection.
At the beginning of presentation facilitator student and moderator faculty provide their brief take on a paper – why paper is interesting, its potential impact for a field, novelty and significance.

It is the responsibility of facilitator student to communicate with moderator, host faculty or JC faculty coordinator before their presentation to seek guidance, advice, help with figures, methods or introduction. Cooperation is highly encouraged.

**Role of facilitator student:**

Prepare PowerPoint presentation with all figures for class discussion and provide it to JC coordinator at least one day in advance. Please include full title, authors list and journal citation on the first slide. (Not all sub/figures need to be presented. If it is an extensive *Cell* paper (>7 figures), some less essential sub/figures should be dropped for the sake of time. Mentioning their results/conclusions should be sufficient. At the same time, if certain Supplementary sub/figures add important information, they should be presented.)

Provide introduction/background of the study. In few slides cover current knowledge in the field (type of cancer, signaling or metabolic pathways, role of main genes/proteins etc). Describe main genes/proteins/molecules and models used (cell or mouse lines, microarray or patient datasets, drugs/agonist/inhibitors etc). State research question posed and its significance. Briefly highlight major experimental approach/methods undertaken.

Present the first figure.

Evaluate strength and limitations of the paper. Comment on Rigor and Reproducibility of the experiments.

Provide model/diagram of newly discovered interactions adding to the existing paradigm.

During presentation facilitator student complements presenters with additional comments and helps with description of figures, evaluation of results and conclusions, answering questions.
Suggested times: 10 minutes for introduction, models, drugs, pathway and first figure; 30 minutes for the remaining main figures; 15 minutes for general discussion.

Role of presenter students:

Presenter students will present the remaining main figures of the paper. They will be randomly selected by faculty moderator and/or JC coordinator during class, one student per figure. For each figure, student should start with a statement describing the purpose of the experiments, followed by describing the experimental results, conclusion from the figure and whether the conclusion is supported by the data. In addition, student will evaluate quality of the data, and discuss if there is any issue with experimental design or rigor.

Role of all students including presenter and facilitator: Participate actively in discussion: provide relevant comments, ask questions, and answer questions.

Role of faculty moderator: At the beginning of presentation moderator briefly describes paper's significance, evaluates its findings and potential impact for a field.

Moderator moderates presentation and discussion managing time, questions and figures.

Moderator provides additional comments and if needed helps with figures, methods, evaluation of results and conclusions, and answering difficult questions.

Role of host faculty: Host faculty provides additional comments based on his/her expertise relevant to the paper.

Role of all attending faculty: Participate actively in discussion: provide relevant comments, ask questions, and answer questions.

Evaluate student presentation based on the criteria described above and listed on the evaluation form, and return filled out evaluation form to JC coordinator (paper or electronic copy).

Evaluation:
Selection of a paper for presentation will count as 10% of final grade. 50% of final grade will come from student’s facilitation of their selected paper, 40% from figure presentations and from participation in paper discussions. Attending faculty will anonymously evaluate the student in each criterion on a 5 point scale and provide their comments as a feedback commending strengths and weaknesses for student’s improvement in the future. A 5 is excellent and means the student has fulfilled the expectation of the criterion. A 1 is unsatisfactory and means that the student has not exhibited any traits within that criterion. Journal Club coordinator will evaluate faculty’s scores to assign final grades.

For a standard paper with 7 figures and 15 spots for 15 registered students in the course, each student will have the opportunity to facilitate their paper and present 6 figures from other papers (randomly selected) over the course of semester.

Criteria for evaluation of student facilitator:

1. Described how this paper has added to the knowledge in the field and summarized main paper conclusion.
2. Provided appropriate background for the topic and described the experimental approach/methods, models/drugs.
3. Critically evaluated the quality of the data, the success with which the data support the conclusions, the relevance of the science for the clinic. Discussed strength and limitations of the paper.

Criteria for evaluation of student presenter:

1. Explained the purpose of the experiments.
2. Discussed the conclusions from the figure.

Criteria for grade:

Journal club is graded A, B, C, etc. These grades are assigned based on evaluation of the student’s performance using the criteria listed above. It is important to remember that students are not necessarily compared to each other in making this evaluation. For instance, a second year student is not expected to have the insight of a more senior student. In contrast, however, a senior student is expected to be able to answer more difficult questions than a less experienced student. Adequate preparation is the key to participation.

Grade Percentage of total
A 90 – 100%
B 80 – 89%
C 70 – 79%
D 60 – 69%
F 59% and below

**Attendance Policy:** If you must miss a Journal Club for any reason, you must be excused by the JC faculty coordinator. This can be done by you personally emailing or calling the JC faculty coordinator prior to the journal club. Each unexcused absences will result in a drop of grade. An unexcused absence is one in which you simply do not attend and fail to inform the JC faculty coordinator prior to the absence. **Excused absences will result in your needing to make-up the missed work. This will involve writing a 1-page summary of the paper.** More than one excused absence may affect your grade as well.

**Social Justice Statement:** "West Virginia University is committed to social justice. I concur with that commitment and expect to maintain a positive learning environment based upon open communication, mutual respect, and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran’s status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise faculty course coordinator and make appropriate arrangements with the Office of Disability Services (304-293-6700).
Syllabus
CCB 796 – Graduate Seminar and Student Forum

Course Format: Seminar Series and Student Forum in a classroom setting
Credit Hours: 1
Course Instructor: Linda Vona-Davis
Schedule: Wednesday, 12:00 – 1:00pm
Location: TBA

Purpose of Seminar:
The Seminar course is designed to broaden the cancer education of graduate students by inviting guest speakers to present research topics and to network with students informally outside the classroom. In Student Forum, students will have the opportunity to present their own research and receive immediate feedback on best research practices and to hone their skills in science communication.

Expected Learning Outcomes:

- Students will obtain knowledge from a number of disciplines that emphasize cancer in the context of human disease and therapeutics.
- Students will gain an appreciation for scientific leaders in the cancer field.
- Students will receive career counseling from invited speakers.
- Students will practice articulating their proposed research at the institutional level.
- Students will demonstrate and apply their general knowledge of cancer biology.

Evaluation:
The course is divided into two parts. Section 1 is attendance and performance at the Seminar Series in conjunction with invited guest speakers and Section 2 is attendance and performance at Student Forum. Attendance at each Seminar and Student Forum is mandatory for all students enrolled, unless formally excused. Students with unexcused absences will jeopardize their grade.
The effort by students to meet these expectations will be considered in the determination of your final grade. Each of the following expectations is worth 25%.

1. Students will actively participate in Seminar by asking questions of the guest speaker.
2. Students will demonstrate professionalism during speaker luncheons.
3. Students will present their research yearly at Student Forum according to guidelines.
4. Students will invite their graduate committee members to all Student Forums.

Criteria for grading:

Collectively, Seminar and Student Forum will be graded A, B, C, etc. These grades are assigned based on evaluation of the student’s attendance and performance using the criteria listed above. It is important to remember that students are not necessarily compared to each other. For instance, a second year student is not expected to have the insight of a more senior student. In contrast, however, a senior student is expected to be able to ask and answer more difficult questions than a less experienced student. Active participation and adequate preparation are key to receiving full credit.

Grade
A 90 – 100%
B 80 – 89%
C 70 – 79%
D 60 – 69%
F 59% and below

Attendance Policy: If you must miss a seminar or student forum for any reason, you must be excused. This can be done by you personally emailing or calling the coordinator prior to the event. Each unexcused absences will result in a drop of grade. An unexcused absence is one in which you simply do not attend and fail to inform the faculty coordinator prior to the absence. Excused absences will result in your needing to make-up the missed work. More than one excused absence may affect your grade as well.

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University does not discriminate on the basis of race, sex, age, disability, veteran’s status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with the **Office of Disability Services (304-293-6700).**

**Guidelines for Student Forum**

Students will present one Student Forum each academic year. It is advisable to have your graduate committee in place to help you develop your research aims before vetting them publicly in Student Forum. Your final grade will be determined by several factors: the quality and content of your seminars, your participation in the class as a whole, and your ability to meet deadlines and guidelines. Students will receive in-class evaluations from peers and faculty in attendance to foster improvement.

- Introduce your advisor and committee members (if they are present).
- Give an introduction and background information on your topic. What research has been performed previously and where are the gaps in our knowledge?
- Statement of the problem(s) and translational relevance to cancer biology.
- State your overall hypotheses and specific aims.
- Describe the methodology you will use to test your hypotheses. Be sure you fully understand your chosen methods. You may be asked to defend your methods over other approaches.
- Present your data in readable form without typographical errors.
- Describe future experiments and expectations.
- Explain the impact of your findings (or potential future findings).
- Present Experiential Learning as part of your Forum after experience completion.
Syllabus
CCB 797 - Research

Course Format: Laboratory and independent study
Credit Hours: 1 – 15 credits
Course Coordinator: __________________________
Instructor: Dissertation mentor
Schedule: Arranged
Location: Research laboratory of the dissertation mentor

Purpose of Course:

- Perform independent exploration of a hypothesis as part of the completion of their dissertation research.
- Read the scientific literature both broadly within their discipline and deeply within their dissertation topic.
- Keep a laboratory notebook to record procedures and results following best practices for maintaining this scientific record.
- Present their results orally as a seminar or poster presentation at scientific conferences, and at graduate program or department based seminars and research forums.
- Summarize results in a manuscript(s) for publication in a scientific journal. One of these publications must be as first author.

Expected Learning Outcomes:

Note: The research process is a continuum in which the student enters the program with a limited skill set and by the point of defense of the dissertation demonstrates significant independence as a scientist and expertise on the project. Thus, in any given semester the student will make progress on one or more of these outcomes but would not be expected to achieve all of them until near the time of defense of their dissertation research.

1. Student will be able to formulate novel questions or hypotheses, and test these by independently designing, preforming, and optimizing experiments, and interpreting the data resulting from these experiments.

2. Student will demonstrate self-directed learning skills through reading the scientific literature, talking to colleagues/scientists both in this institution and
nationally/internationally, attending seminars and lunches with the seminar speaker, attending scientific meetings, and through webinars.

3. Student will increase their proficiency in oral and written communications.

4. Student will gain experience supervising and teaching others in laboratory research.

5. Student will learn to defend ideas, approaches, and conclusions in front of other scientists.

6. Student will be able to conduct research in an ethical manner, maintaining appropriate documentation of their activities, and complying with all University, state and federal regulations associated with research.

Evaluation:

Performance in research is evaluated with the grades of S, U or I and written comments from their mentor and/or Dissertation Advisory Committee. All written comments will be part of the student’s file kept both in the graduate program office and the Office of Research and Graduate Education. Students who receive letter grades of S but have consistent written concerns may be recommended for remediation. These written concerns can be used in subsequent disciplinary actions by the graduate program. A grade of U subjects a student to probation and can be grounds for dismissal when it follows a consistent pattern of written concerns despite the presence of a grade of S when those concerns were noted. Receiving 2 U’s in research can be grounds for dismissal from the graduate program and/or the University.

Criteria for grade:

S – Student makes progress toward dissertation completion and progress in achieving the learning outcomes listed above; demonstrates a strong work ethic by an organized approach to experiments and activities of self-directed learning; conducts experiments in a timely and responsible manner; maintains a safe and effective work environments; and demonstrate good laboratory citizenship. Student organizes and meets with the dissertation advisory committee on an annual basis or more frequently if requested by the committee, the graduate program director, or the assistant VP for graduate education. Student achieves benchmarks set forth by their dissertation committee and the graduate program. Student is routinely present in the laboratory and communicates absences to their dissertation mentor before the absence occurs.

U – Unsatisfactory performance in research can involve any of the following. Failure to make sustained progress toward completion of the dissertation research; inability to master or to demonstrate progress in mastering the expected outcomes listed above; extended absences or a consistent pattern of absences without approval; breach of University rules for the safe and ethical conduct of research; disruptive behavior in the laboratory; and failure to meet benchmarks set forth by the mentor, dissertation advisory committee, or graduate program.
I – An incomplete in research can be given if a student fails to meet a specific benchmark. This can include failure to have a meeting of the dissertation advisory committee in the previous 12 months, failure to draft a manuscript of component of their dissertation proposal or the dissertation itself by a specified deadline, and/or failure to complete required regulatory compliance steps including the annual review by advisor and student of the student’s individual development plan. An incomplete must be remediated within one semester or it automatically becomes a U.

Attendance Policy:

The PhD degree is awarded based on the completion of the dissertation, not total time in the program. Thus dedication to the experiments and tasks associated with research are essential. Student should consult with his/her dissertation advisor regarding expectation for presence in the laboratory. This includes days of the week, hours during the day, and procedures for vacation and sick time. As a general guideline, the student should avoid vacations in excess of 2 weeks per year or use of more than one sick day per month. The student should not consider the credit hours of research to be directly proportional to the time spent doing research. If for personal or medical reasons, an extended absence is necessary. The student should consult the Leave of Absence Policy for requesting this leave.

Social Justice Statement:

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If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise the course coordinator and make appropriate arrangements with the Office of Disability Services (293-6700).
31. Assessment of Core Competencies for Ph.D. Students at the WVU HSC

I. **Broad Conceptual Knowledge of a Scientific Discipline**

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<tr>
<th>Beginning PhD student</th>
<th>On the way to proficiency</th>
<th>Proficient</th>
<th>Advanced proficiency</th>
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<tr>
<td>Basic knowledge of physics, chemistry, mathematics, and advanced college level knowledge of biology.</td>
<td>Reads research and review articles on broad set of topics including but not limited to biochemistry, genetics, pharmacology, [physiology], neuroscience and molecular biology. When reading an article, can identify research questions, describe experimental approaches, outline major findings and identify future lines of research.</td>
<td>Familiar with the most significant achievements of current biomedical research, and the principles and capabilities of the major experimental approaches. Identifies the directions in which biomedical research is moving, and the challenges it faces.</td>
<td>Identifies knowledge gaps, proposes hypothesis and formulates general research strategies on significant topics in biomedical research that are not part of the specific field of research he/she is currently working in.</td>
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II. **Deep Knowledge of a Specific Field/Scientific Knowledge Competency**

- Working knowledge in basic biological/physiological systems and pharmacology
- Familiarity with common technical approaches
- Historical knowledge for area of particular research focus
- Working knowledge of current literature and expertise of current content within research focus
- Intimate familiarity with theory/strengths/weaknesses of techniques within specific area of research focus

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<tr>
<td>With guidance, the student grasps the concepts, hypothesis and approaches immediately related to the experiments he/she is performing. The student is in the process of building the knowledge required for formulating the proposal for the doctoral research.</td>
<td>The student understands the historical context (concepts, experimental approaches, findings) that has lead to the current state of his research field. Has a good grasp of the concepts and experimental approaches immediately related to his/her own research.</td>
<td>The student has deep understanding of the broad field of which his/her research is part of and requires little guidance from the mentor in critically evaluating new research. This understanding includes the broad historical context, current concepts, experimental approaches, and research challenges, regardless if these topics are part of his/her own research.</td>
<td>The student can identify without guidance significant questions and knowledge gaps in the broad field of research not limited to their immediate projects, formulate detailed hypothesis and plan experimental approaches to test them.</td>
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III. **Critical Thinking, Experimental Design, & the Scientific Method**

- Identifying important questions and gaps in knowledge within area of focus
- Formation of testable hypotheses and objectives
- Application of appropriate experimental designs to test hypotheses
- Appropriate statistical approaches
- Interpretation of results
- Basic understanding of bioinformatics

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<tr>
<td>With guidance can describe simple experiments: state the premise, describe the capabilities of the approach, outline the expected outcomes and interpret the results taking into account the controls and potential alternative explanations.</td>
<td>Independently evaluates published experiments: identifies capabilities of the approach, outlines the use of controls, describes how the data was interpreted, identifies potential weaknesses and alternative explanations.</td>
<td>Independently designs experiments with well-argued choice of approach and analytical methods, proper use of controls, and rigorous interpretation of the results. Demonstrates understanding of experimental methods, and allows for troubleshooting when positive controls do not work.</td>
<td>Independently designs research strategies that use orthogonal approaches and combine data obtained at multiple levels (molecules, cells, organisms) in order to mitigate the limitations of the individual approaches and convincingly demonstrate the significance of the phenomena being investigated. When evaluating the results, can identify predictions that...</td>
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apply to a context different from the one in which the results are obtained.

IV. Communication Skills
- Technical writing/written communication skills (abstracts, manuscripts, grants, posters)
- Oral Communication both formal and informal (journal clubs, seminars, scientific meetings, elevator pitch)
- Ability to develop and deliver lectures

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<tr>
<td>Creates and presents talks at lab and departmental meetings with support from the mentor. Communicates with colleagues to gain knowledge. Timely conveys information required for the smooth operation of research at the levels of the laboratory, department and school. Writing is concise and to the point.</td>
<td>Strives to take a leading role with support from the mentor in presenting their own research and writing funding applications. Argues points and answers questions based on facts and logic. When presenting clearly separates facts from hypothesis and beliefs. Uses appropriate terms. Statements are unambiguous.</td>
<td>Leads the creation of communications that include but are not limited to presentations, papers, and funding applications. Communications are designed to match the level of expertise of the audience by providing adequate background and tailoring the technical level of the language.</td>
<td>Effective communicator that engages audiences ranging from lay persons to leading experts in the field.</td>
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V. Collaboration and Team Skills
- Capable of personal interaction
- Professional conduct
- Professional responsibilities (personnel management, budget management)

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<th>Proficient</th>
<th>Advanced proficiency</th>
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<tbody>
<tr>
<td>Follows instructions as agreed by the team under supervision by the mentor.</td>
<td>Identifies the expertise of the team members and places his/her contribution within the context of the team.</td>
<td>Sets up realistic expectations and delivers on them. Communicates timely and concisely.</td>
<td>Leads efforts involving multiple team members. Identifies expertise gaps and recruits team members to fill them.</td>
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VI. Experimental Skills for Conducting Research
- Identify, design and execute experimental protocols
- Identify and troubleshoot technical issues
- Lab safety & regulatory issues
- Documenting and maintaining research records

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<tr>
<td>Familiar with lab safety procedures and regulatory requirements. Executes simple experiments under close supervision</td>
<td>Demonstrates good bench/analytical skills and good consistency. Maintains research records. Troubleshoots technical issues with guidance from the mentor. Requires little supervision when conducting experiments</td>
<td>Results from experiments consistently meet the expected technical range. Independently selects, executes and troubleshoots experimental protocols. Research records are detailed enough to allow independent reproduction of the experiments with no additional input</td>
<td>Independently develops novel approaches and tools. Effectively transfers skills to trainees</td>
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VII. Computational Skills

A. Quantitative analysis

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<tr>
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<th>Proficient</th>
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<tr>
<td>Follows instructions to carry basic quantitative analysis (estimate averages, error, etc.)</td>
<td>Identifies the appropriate analysis procedures. Explains the results of analysis</td>
<td>Independently incorporates data collection, analysis and visualization procedures as part of experimental design</td>
<td>Carries out analysis and visualization procedures in a programmable environment (Matlab, R, Python, etc)</td>
</tr>
</tbody>
</table>

B. Bioinformatics skills
Familiar with nucleic acid and protein sequence nomenclature. Familiar with nucleic acid and protein structure (primary, secondary, tertiary) 

Familiar with types of data stored in online databases. Carries out similarity and keyword searches to retrieve sequence, structure and annotation data. Familiar with genome organization and gene structure principles across the major clades 

Interprets independently the results of sequence and structure analysis (alignments, location of key residues and structural domains). As part of the interpretation of sequence and structure results provides context related to biological function, activity, phenotypes and disease 

Can execute genomics, structure and sequence analysis in a programmable environment

<table>
<thead>
<tr>
<th>Beginning PhD student</th>
<th>On the way to proficiency</th>
<th>Proficient</th>
<th>Advanced proficiency</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Can execute genomics, structure and sequence analysis in a programmable environment</td>
</tr>
</tbody>
</table>

**VIII. Responsible Conduct of Research & Research Ethics**

- Knowledge of expectations (WVU, granting agencies)
- Exposure through formalized seminars/courses
- Ability to make reasoned decisions
- Knowledge of unethical practices (i.e. plagiarism etc.)
- Knowledge about RCR and how it relates to ethical decision making
- Moral courage and integrity

Graduate students in the Biomedical Sciences programs adhere to the highest ethical and integrity standards. Students will strive to the best to their abilities, in accordance with their training and following the established rules, regulations and policies to:

(ii) Protect Human Subject data.
(iii) Care for and protect the health, safety and welfare of research subjects, patients, colleagues, students and visitors.
(iv) Record and report experiments completely, accurately and objectively.
(v) Care for the well fare of the laboratory animals.
(vi) Recognize and acknowledge in full the contributions of others.
(vii) Object to and report unethical behavior and scientific misconduct.
(viii) Protect any information given to them in confidence as long as it does not mask unethical behavior and misconduct.
32. Signature Sheet

Acknowledgement Form for entering graduate students

As an entering CCB graduate student, I agree to review the policies and procedure published in the student handbook provided to me by the CCB Program Director, as well as the additional information in the on-line Student Conduct Code listed below. I understand that I may seek discussion and clarification of these documents from the CCB Director or Assistant VP for Graduate Education at the Health Science Center as appropriate. Please be sure to review these specific policies and sign each statement below.

Name: (printed or typed)_______________________________Date:___________

The Student Handbook for Graduate Students in the Biomedical Sciences Graduate Programs at the WVU Health Science Center.

I have read and understand the Cancer Cell Biology Student Handbook at the WVU Health Science Center; both the information within this handbook and on-line catalogs and policies to which this handbook refers. These include but are not limited to:

- WVU Graduate Catalog (http://catalog.wvu.edu/graduate/), and
- Campus Student Code (http://campuslife.wvu.edu/office_of_student_conduct).

I agree to abide by the requirements outlined in this document as well as the University requirements governing these degrees.

Signature:__________________________________________________________

Academic and Professional Standards

I pledge to adhere to the Academic and Professional standards for graduate students and to maintain the highest standard of scientific integrity in all that I do.

Signature:__________________________________________________________

Federal, State, and University Requirements for Laboratory Conduct

I agree to adhere to all Federal, State, and University policies and requirements for the conduct of work in the laboratory. I will remain up-to-date on all certifications for both laboratory conduct and the responsible conduct of research.

Signature:__________________________________________________________