RESEARCH AND THESIS COURSE SEQUENCE BIOL 494/495/489/490 SYLLABUS

Instructor of Record: Dr. Sarah Golding segolding@vcu.edu Office: LFSCB 218B

Enrollment: By override after approval by the Department of Biology. Please direct all questions to Dr. Golding.

PLEASE NOTE: To register for this class you must request an override using the form below. Overrides will not be released until after May 1st for summer and fall registration and Dec 1st for spring semester studies. Mentor confirmation must have been received for the overrides to be issued.

Course Description:
Research and Thesis is a 2-semester class series taken in the senior year where students engage in an undergraduate research project and use their data to compile a senior thesis. To complete the Research and Thesis class series, students will be expected to spend 3 h/per week/per credit gathering, analyzing and reporting data appropriate to their research project (ie. 3 credits of BIOL495 = 9 hours in the lab). The course will culminate in the writing of a research thesis of substantial quality. BIOL 489 Research Writing and BIOL 490 Communicating Research Seminars will support this process by using students' laboratory experience as source material to aid students in writing research proposals, discussing data interpretations, preparation for oral and visual presentations, and the crafting and editing of a research thesis. The class will culminate in the oral presentation and defense of their thesis. Students will also present posters at Research Week (last week in April).

This course is highly recommended for students wishing to pursue MS, Ph.D. in any discipline, MD-PhD, or other dual degrees, or MD at High Ranked institutions.

To request registration for these courses please complete the: Research Courses Registration Request Form

Completion of the Biology Research and Thesis sequence is one part of the “Honors in Biology” designation. Students can find our more information about graduating with Biology Honors. This designation is separate from the honors college and does not require honors college membership.

VCU REAL (Relevant Experiential and Applied Learning).

This course has been approved by the REAL Council as a: **REAL Research Experience Level 4**

To learn more about the requirements for REAL course designations please see the REAL website: https://provost.vcu.edu/initiatives/real/levels/

This course offers:

Hands-on learning in a research laboratory that engages the student in applying or exploring disciplinary knowledge in real-world or simulated contexts

Guided reflection assignment as an intentional metacognitive practice where students articulate personal, civic/social, or academic learning; identify values and attitudes developed through the activity; and/or explore and clarify career goals

Mentored experiences wherein the research faculty member responds regularly to student work, supports student reflection and integration of learning throughout the activity, and encourages goal-setting for future learning

Integrative Learning assessed by both presentation and defense of the research as a measure of a student's capacity to connect, synthesize and transfer learning to new, complex situations beyond campus

Course Goals:
Students will leave this course series having acquired knowledge and comprehension of the research process. They will have seen how to apply their knowledge to a scientific problem.

Structure of course sequence:

BIOL 494	1-4 credits	Research and Thesis I	Fall semester, schedule agreed with mentor
BIOL 489	1 credit	Research Writing	Fall Semester
BIOL 495	1-4 credits	Research and Thesis II	Spring semester, schedule agreed with mentor
BIOL 490	1 credit	Presenting Research	Spring Semester

Course Objectives: Students will leave this course having participated in a sustained research experience under the mentorship of a VCU faculty member. They will acquire knowledge and comprehension of the research process, including, but not limited to, reviewing the scientific literature, applying technical procedures, and data collection. Students in this course must be engaged in data analysis, begin to apply their knowledge to a scientific problem, and draw logical conclusions. They will have been instructed on how scientific findings are communicated to the greater scientific community via manuscript

Course Outcomes for Student and Mentors: It is expected that mentors ensure that students achieve the following learning outcomes:

To enable the student to demonstrate an ability to;

- Search the literature relevant to the topic
- Differentiate between primary, secondary and tertiary sources of information
- Produce a critical review of the literature relevant to the topic to be studied
- Formulate a hypothesis
- Carry out the investigations
- Collect, collate and analyze data from their investigations
- Draw valid conclusions from the analysis of the data
- Discuss the relevance of the conclusions in the context of the literature relating to that topic
- Report the findings of the investigation by all of the following media:
    - Manuscript (thesis)
    - Oral presentation
    - Poster
- Pose suggestions for further work based on the findings of the investigation
- Orally describe, discuss and defend their work
- Display professional behavior at all times
- Communicate clearly with mentors and larger lab group
- Work well in a team
- Display independence
- Respond well to critique

Research Course Commitment Attestation:
Students registering for research courses must understand that participation in Biology Research Experiences requires hands-on work, most often performed in person, at a physical laboratory or research site defined by the research mentor. They must discuss their in-person availability with their research mentor and mutually agree on a schedule and tentative plan for their contributions to the research group. This agreement must be re-evaluated prior to each semester for continuing research experiences.

Course Expectations for Student and Mentors:

It is expected that mentors ensure that students achieve the following learning outcomes:

To enable the student to demonstrate an ability to;

- Search the literature relevant to the topic
- Differentiate between primary, secondary and tertiary sources of information
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- Communicate clearly with mentors and larger lab group
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Course Descriptions:

BIOL 494. Research and Thesis I. 1-4 Hours.
Semester Course: 4-16 research hours. 1-4 credits. Pre-requisites: BIOL 392, permission of the faculty mentor and the department of biology. Corequisite: BIOL 489. A maximum total of six credits for all research and internship courses (BIOL 395, BIOL 451, BIOL 453, BIOL 492, BIOL 493, BIOL494, BIOL 495 and/or BIOZ 395) may be applied to the 40 credits of biology required for the major. A minimum of two credits is required for the course to count as a laboratory experience. Additional credits from these courses may be applied to upper-level and open elective credits toward the degree. Research and Thesis is a comprehensive two-semester course sequence designed for students to immerse themselves in a substantial research project and produce a high-quality research thesis. First, in the two-course sequence, students will engage in rigorous research activities collecting, analyzing and reporting their data. At the culmination of this course students will prepare a first draft of a research thesis. This course is highly recommended for students pursuing advanced degrees such as MS, Ph.D., MD-PhD or other dual degrees.

BIOL 489: Research Writing

Semester Course; 1 credit. Prerequisites: BIOL392. Co-requisites: BIOL 494. An opportunity for students to develop skills necessary for effectively communicating their research in writing. Activities include a variety of seminar discussions and activities, including preparing figures for publication and crafting a research paper that uses the primary literature correctly. Students will use this as an opportunity to aid the writing of their thesis for BIOL 494.

BIOL 495. Research and Thesis II. 1-4 Hours.

Semester Course; 4-16 research hours. 1-4 credits. Prerequisites: BIOL 494, permission of the faculty mentor and the department of biology. Corequisite: BIOL 490. May be repeated for a maximum of eight credits. Students may take a maximum of four credits per semester; maximum total of six credits for all research and internship courses (BIOL 395, BIOL 451, BIOL 453, BIOL 492, BIOL 493, BIOL494, BIOL 495 and/or BIOZ 395) may be applied to the 40 credits of biology required for the major. Additional credits from these courses may be applied to upper-level and open elective credits toward the degree. A minimum of two credits is required for the course to count as a laboratory experience. A minimum of four credits is required for honors in biology. Additional credits from these courses may be applied to upper-level and open elective credits toward the degree. Research and Thesis is a comprehensive two-semester course sequence designed for students to immerse themselves in a substantial research project and produce a high-quality research thesis. Second, in the sequence students will continue to engage in rigorous research activities collecting, analyzing and reporting their data. The culmination of this course will be the creation of a detailed and well-crafted research thesis. This course is highly recommended for students planning to pursue advanced degrees such as MS, Ph.D., MD-PhD or other dual degrees.

BIOL 490. Presenting Research. 1 Hour.

Semester course; 1 credit. Pre-Co-requisite: BIOL 492 or 495, and senior standing. Opportunity for students to develop skills necessary for effective oral presentation of their research work. This includes a variety of seminar discussions and activities such as the preparation of visual materials and the statistical analysis of data. Students will make several oral presentations directly related to their specific BIOL 492 or 495 projects.

Assignments Details:

ALL assignments must be proofread, edited and approved by the supervising faculty member prior to submission to Dr. Golding via Canvas.

Grading:	20%	Coursework
	40%	Final Thesis
	20%	Poster
	20%	Oral presentation and Defense

Students repeating the course: The Department of Biology allows students to use BIOL/Z395, BIOL492, BIOL 495 and/or BIOL495 to meet TWO Biology lab experiences. It is common and encouraged for students to stay with the same research mentor to continue their work. It is, however expected that written work submitted for subsequent semesters is significantly expanded and improved over prior submissions. All course assignments will be scanned via the TurnItIn software for plagiarism. Students submitting duplicate assignments are at risk of honor code violations. If your work is continuing from a previous semester, and you believe a lot of your work will be similar, please feel free to contact the instructor of record for additional guidance.

Attendance: Students are required to work with their research mentors for 3-4 hrs per week per credit hour. This time is monitored by the research mentor and attendance issues are reported to the course coordinator. Students are required to attend 80% of scheduled BIOL489/490 seminar classes.

Responsible Conduct of Research Requirement:

All students registering for this class must complete responsible conduct of research training (RCR). BIOL392 completes this requirement. Students who have not completed BIOL392 must take an online course hosted by the Collaborative Institutional Training Initiative (CITI) and can be found at www.citiprogram.org. At this site, Select "Create an Account", enter your organization (VCU), create an account, and then select 'general RCR training'. Training is free but requires a vcu.edu account. Students must take a screenshot to confirm they have completed this requirement and upload to the Canvas page for this class. If you have previously completed the CITI RCR training for another class you do not need to repeat it but you must provide proof. The CITI Human Subjects training cannot be substituted.

Writing guidelines/expectations: Please follow the writing guidelines posted to Canvas under course documents. Primary literature and full citations in the style of a journal of the field will be expected for all assignments.

Generative AI Use: It is a violation of university policy to misrepresent work that you submit by characterizing it as your own, such as submitting responses to assignments that do not acknowledge the use of generative AI tools. Generative AI responses should be cited as personal communication as described in the writing and citation guidelines. Please feel free to reach out to me with any questions you may have about any use of generative AI tools.

PLEASE NOTE: We are aware that much of the work will be preliminary in nature. But we still require that students share their findings in the format of a research paper. If the student has encountered significant technical difficulties and the data generated is weak or questionable, the student is advised to focus on the cause of the technical difficulties in the results section and suggest strategies to overcome these issues in the discussion section of the paper.

Final Reflection: In 1500 words or less take a moment to reflect on your REAL experience this semester with respect to the following;

1) Perseverance: What challenges did you face during your experience and how did you overcome them? Upon reviewing the experience can you identify and describe an example of a different approach (e.g., decision or action) you could have taken. Envisage the impact of such a change.

2) Professional Skills: In addition to scientific knowledge what life skills did you acquire this semester? How will you incorporate those into your future learning/career?

3) The Big Picture: What societal issue was your research focused on addressing? How will your work help to improve the human condition?

Assignment Submission: To reduce the chance of plagiarism all assignments for BIOL492 must be submitted via the safe assign database in Bb. Please see the BIOL492 Bb page for instructions on how to submit.

Please note seniors: If during the duration of your biology degree you have registered for more than 6 credits of Directed Study, Independent Study, or Research and Thesis degree works may not slot your credits correctly. Please bring this up with your biology advisor.

Honors in Biology

The Biology 489-490-494-495 course sequence helps students to qualify for the honors in Biology transcript designation.

Biology majors may graduate with honors in biology. To qualify, students must have overall and biology GPAs of at least 3.5 and must complete the following courses in this sequence: **BIOL 392**, at least four credits of **BIOL 495** and **BIOL 490**. Grades of A or B must be earned in each of the listed courses. Students who qualify will have the notation "Honors in Biology" placed on their transcript. Students must meet all Department of Biology requirements for graduation. Students should consult with their academic advisers to create a program suitable to their particular needs and interests.

VCU Academic rules and regulations:

Students should visit http://go.vcu.edu/syllabus and review all syllabus statement information. The full university syllabus statement includes information on safety, registration, the VCU Honor Code, student conduct, withdrawal and more.

Use **VCU Libraries** to find and access library resources, spaces, technology and services that support and enhance all learning opportunities at the university.