



**BIOLOGY SENIOR
CAPSTONE
MANUAL**

2020-2021

Dear Fredonia Biology Department Student:

All students in the Fredonia Biology Department are required to complete a senior capstone as part of their degree requirement. There are many options available to you, also many expectations for a successful experience.

This manual contains information that will help you understand the options and expectations. It is critically important you read this information soon after you arrive at Fredonia. Freshman year is not too early. If you are a transfer student, you need to begin thinking about capstone options very soon after arriving at Fredonia.

The first person to discuss the capstone with is your academic advisor. Your advisor will help you determine the capstone experience that will best meet your needs and interests. Please talk to your advisor early and often about your questions and ideas.

While there are many resources available to help you navigate this process, please remember that the ultimate responsibility for successful completion of your senior capstone belongs to you.

Best wishes for a successful and purposeful capstone experience,

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I) Introduction

What is a Senior Capstone experience?

Senior Capstone experiences help students think critically, solve challenging problems, and develop skills such as oral communication, written communication, research skills, teamwork, planning, self-sufficiency, and goal setting—skills that will help prepare them for employment, graduate school and professional school. The Biology Department offers three capstone options – Research, Internship and Course.

Who has to take a Biology Senior Capstone?

All Biology department students are required to complete a capstone experience in their senior year. Students have a variety of options depending upon their major.

What types of Senior Capstones are available?

- Biology majors, Molecular Genetics majors and Exercise Science majors can choose Capstone Research, Internship or Course. These options are typically worth 3 credits and are discussed in detail in this booklet.
- Medical Technology majors fill capstone requirements through successful completion of an 11 month internship performed at a hospital based school approved by the National Accrediting Agency for Clinical Laboratory Sciences. This 30 credit internship is required for the student to complete the major in Medical Technology, and become board certified by the American Society of Clinical Pathologists and licensed by the NYS Department of Education. See “Medical Technology Internship” at the end of this manual for additional information.
- Biology Adolescence Education majors fill capstone requirements through successful completion of one semester of student teaching. This 15 credit experience is required for the student to complete the major in Biology Adolescence Education, and become licensed by the NYS Department of Education. See “Student Teaching” at the end of this manual for additional information.

How will I know what Capstone experience is right for me?

- If you are a Biology, Exercise Science and Molecular Genetics major, you should start giving serious consideration to your capstone in your sophomore year.
- Your advisor will help you determine the best capstone experience for you, so it is very important to discuss your interests and career goals with him or her.
- Taking the Science Communication Seminar during the sophomore or junior year is strongly recommended. The seminar is designed to help you choose a capstone and improve your writing and oral presentation skills.
- This manual provides detailed information about Capstone Research, Internship and Course. Each of these options will require you to think critically and perform significant problem solving activities. You will also be required to develop a formal paper and offer an oral presentation.
- If you perform capstone research or take a capstone course, the specific expectations will be provided by your professor. Because capstone internship typically requires off-campus work under the mentorship of a site supervisor outside of the Biology department, a more detailed list of application instructions is included in this manual.
- The selection of a capstone is fairly straight forward for Medical Technology majors and Adolescence Education majors (see above).

When do I have to decide what type of capstone experience I plan to perform?

- You should begin discussing ideas for your capstone with your advisor in your sophomore year.
- You will have to make your final decision by your second semester junior year. Tell your advisor your plans and he/she will note it in your folder.
- You will be expected to tell your advisor what you plan to do for your capstone by advising week in the fall semester junior year.

When do I perform the capstone experience?

- In general the capstone will be performed at some time during the year preceding your graduation.
- For example, if you wish to graduate Spring 2021, your capstone, depending on the type, can be performed during summer 2020, Fall 2020, J term 2021 or Spring 2021.

II) Capstone Research

What is undergraduate research?

Undergraduate research is an educational collaboration between the undergraduate student and faculty member. Research projects involve inquiry, experimental design, investigation, data analysis and drawing conclusions and take place on and off campus, in labs and in natural environments. Students can perform research during the academic year and/or summer and can fill the senior capstone requirement by doing research. Fellowships for summer research are available for our students.

What is the benefit of performing research?

Undergraduate research students benefit in many ways from the experience:

- They gain a better understanding of biology and the opportunity to learn something new
- They hone problem solving skills, develop critical thinking skills, and learn how to work collaboratively with their research team.
- Career exploration – many science jobs require research, you won't know if you like it unless you try it!
- Research is challenging, but the sense of accomplishment is great when the project and presentations are complete.
- One-on-one faculty mentorship increases student learning.
- Great to have on your resume, as many professional programs (like medical school), graduate schools and employers value research.
- Students performing research often have more detailed letters of recommendation from faculty mentors.

Who should do capstone research?

- As a general rule, students interested in graduate school should give strong consideration to capstone research. Pre-health students may also benefit from capstone research.
- Students interested in performing capstone research will need to be capable of doing independent work, reliable and well organized.
- Your advisor will help you determine if your capstone experience should be research.

General Information and Expectations

- Capstone research will require you to perform work on a project mentored and evaluated by a Biology department faculty member; a formal paper and oral presentation are required.
- Information about faculty research is provided in the next section. Discuss any interest you may have in capstone research with your advisor as soon as possible.
- Taking the Science Communication Seminar during the sophomore or junior year is strongly recommended. The seminar is designed to help you choose a capstone and improve your writing and oral presentation skills.
- Capstone research can be performed during the summer or the academic year.
- Summer Research
 - Capstone research can be performed during a 10 week summer research position at Fredonia the summer before the senior year
 - Students interested in performing capstone research during the summer must apply for a summer research fellowship in March, details are provided in an application distributed by the department.
 - If you apply for and receive a fellowship, you will receive funding for research and living expenses.
 - If you choose to perform summer research for capstone credit, you must register for 1 credit of BIOL 491 for the summer. You will also register for two credits of BIOL 491 for the following fall semester during which time your PowerPoint and paper will be developed and presented.
- Academic Year Research
 - Capstone research can be performed during the senior year and carries a minimum of three credits.
 - Students performing capstone research during the academic year will typically perform research during the fall semester and develop and present the formal paper and oral presentation during the spring semester.
 - Some faculty will require capstone research students to carry more than three credits.
 - Some faculty may permit a student to complete capstone research and the formal presentations in one semester.
- Evaluations
 - Your research mentor will tell you how he or she will grade you on your performance, your paper and your oral presentation.

Faculty Information

This is an overview of faculty research projects and faculty expectations for their capstone research students. Please notice there is variability in when students can begin research in specific labs and that it is important to begin the discussion with faculty early.

Additional information about faculty research can be obtained by going to <https://www.fredonia.edu/biology/faculty-research>

Dr. Todd Backes, Science Center 238 – Applied Human Physiology

Areas of study - Potential research areas of study include, human stress response, human performance, exercise and cognition, fluid consumption/dehydration, human movement, and muscle activation. All projects will involve human subjects.

Requirements and Expectations - Requirements for capstone research in my lab include, senior standing, completion of the CITI Human Subject Research tutorial, and current CPR and first aid certification. Prior to data collection, students must complete a human subject research proposal and acquire Human Subject Review (HSR) board approval for the proposed project. Planning, submission, and approval by the HSR board may be lengthy. Due to this lengthy planning process, students wishing to do capstone research in my lab should meet with me one academic year in advance to discuss project viability and planning.

Dr. Bill Brown, Science Center 132 – Behavioral Ecology

Areas of study - We study behavioral ecology, the biology of animal behavior from an evolutionary and ecological perspective. We generally use insects as model systems. Our current work focuses on the evolution of sexual cannibalism in praying mantids during the fall semester and the social ecology of acoustic communication in crickets during the spring semester. Methodology in the laboratory is quite mixed, often quite low tech but with opportunistic use of technology, including digital sound analysis, GPS, molecular DNA methods, and radioactive markers, as appropriate for the questions being asked. We typically do lab work in the spring and a mix of field and lab work in the summer and fall. We have particular expertise in experimental design and data analysis.

Requirements and expectations - I accept students majoring in biology at any level. There are no course prerequisites but student must have a sincere interest in ecology, evolution, or organismal biology.

Dr. Scott Ferguson, Science Center 233 – Developmental Genetics in *Drosophila melanogaster*

Areas of study - My lab uses the fruit fly *Drosophila melanogaster* to study the control of gene expression at the level of transcription and RNA localization. Two active areas of research include testing the effect of mutations on the ability of an mRNA to be translated using one of two different mechanisms. This is tested both *in vivo* by making transgenic flies and *in vitro* by adding synthetic mRNAs to a translation reaction with a defined composition. The other area of research is to identify new genes that regulate translation during development. We use a hybrid of classical Mendelian and advanced molecular genetic approaches to address cutting edge research questions.

Requirements and expectations - My research application process is competitive and new students typically begin in the fall of their sophomore year and stay in the lab for up to 6 semesters, though shorter terms will be considered. If you are interested, stop by and introduce yourself early in your sophomore year. Applications are online and due in late September / early October.

Dr. Fred Harrington, Science Center 233 – Green Algae and Biofuels

Areas of study - Undergraduate students should know that my research area is in the connection of green algae and the environment. A holistic approach, with biochemical, cellular and molecular techniques, is used to address the responses of algae to environmental stress. Further, real world issues of pollution remediation, aquaculture and biofuels are topics students can work toward solutions.

Requirements and expectations - Ideally, a student should begin working in the lab in their junior year to prepare for capstone research, but this is not required. In some cases, students could come in prior to their junior year. Interested students are encouraged to come speak with me if they have an interest in my areas of study; I use an online application process.

Dr. Jon Kniss, Science Center 230 – Development and Regeneration in Zebrafish

Areas of Study – My lab uses the zebrafish lateral line to investigate organ formation and regeneration. The organs of the lateral line are called neuromasts and contain mechanosensory hair cells that project into the environment to detect changes in water flow. Lateral line neuromasts are functionally similar to the inner ear of mammals, but fish hair cells can rapidly regenerate after damage whereas mammalian hair cells cannot. I am interested in how the neuromast hair cells form and how they regenerate. I have identified genetic mutants that are defective in either hair cell development, maintenance or regeneration. Research projects in the lab focus on identifying the causative genetic changes in these mutants and placing them into an emerging network of genes that direct lateral line hair cell formation and regeneration. Research in the lab primarily utilizes molecular genetics techniques and fluorescent microscopy.

Requirements and Expectations – Prospective research students must complete Genetics before they can work in the lab. New students usually join the lab in the spring semester after an application process conducted the previous fall. Students interested in performing capstone research need to begin working in the lab no later than spring of their junior year. Interested students should contact me via email or in person to find out more.

Dr. Karry Kazial, Science Center 124 – Animal Behavior and Communication

Areas of study - My research interests are in animal behavior, animal communication, and wildlife conservation. Students and I have conducted research on the use of echolocation for communication as well as conservation-related research with little brown bats and big brown bats. Conservation-related research has included an investigation of insect availability and bat diet, environmental and bat house characteristics affecting the use of bat houses, the effect of artificial night lighting on bat activity, habitat use by bats through acoustic monitoring of sonar calls, and ectoparasites and grooming behavior. I have also mentored a student examining the effect of environmental enrichment on male/female interactions in a critically endangered species of macaque at the Buffalo Zoo. Another research direction in my lab involves the interaction between bats and insects. Specifically,

students and I have been investigating insect response to bat sonar while in the context of mate attraction.

Requirements and expectations - I expect students interested in capstone research in my lab to have taken my course in Animal Behavior and plan to take Animal Communication and Biostatistics. In addition, any students working directly with bats are required to submit an animal care and use protocol for approval and have pre-exposure rabies vaccinations. All research students complete animal care and use training. Interested students should talk with me in spring of their junior year (prior to registration week) as students should plan for 2 semesters in order to complete their capstone research work.

Dr. Ted Lee, Science Center 212 – Environmental Microbiology and Honduras Program

Areas of study - My research interests are in the area of environmental microbiology. My students use molecular and genetic approaches to study bacteria from different environmental sources.

Areas of study – Students can also do a capstone through the Honduras program, please see information in the Study Abroad section. Post-Covid, I anticipate that we'll travel to Honduras in January each year.

Requirements and expectations - Students interested in doing research in my lab as a capstone experience should begin doing research their junior year. Please note that doing research in the junior year does not guarantee a student the opportunity to do a capstone research project in my lab. Students should also take BIOL 338 Microbiology in their junior year.

Dr. Emeka Okeke, Science Center 229 – Immunology

Areas of study - My lab is focused on the understanding of the molecular mechanisms involved in the inflammatory response of the host to stimuli or infection. We are interested in the role of neutrophils in the inflammatory response and vascular function. Neutrophils are the most abundant immune cells in the vasculature and neutrophil inflammatory response has been implicated in the pathogenesis of several diseases. Recently, neutrophils were shown to extrude their cellular contents in a framework of chromatin to immobilize microorganisms by a novel mechanism called neutrophil extracellular traps (NETs) formation. DNA and neutrophil granular proteins released during NETs formation have been shown to contribute to several autoimmune diseases and cancer. My previous work showed that inhibition of NET formation can prevent mortality in an animal model of sepsis. Our goal is to understand the necessary signals that mediate NET formation and neutrophil inflammatory responses in general. We use a wide range of techniques including cell culture, immunological techniques like flow cytometry and ELISA and microscopy. We hope to unravel novel therapeutic targets with wide-ranging applications for the treatment of inflammation-related diseases.

Requirements and expectations: Students will have to take BIOL 461: Immunology and serology before or after joining the lab. Enrollment in other courses like BIOL 333: Biochemistry and BIOL 380: Cell and Molecular Biology will be taken into consideration.

Students in the second and third years still have ample time to contribute to research in the lab and are highly preferred. Interested students should contact Dr. Okeke via email.

Dr. Nicholas Quintyne, Science Center 224 – Microtubule regulation in cancerous and noncancerous cells

Areas of study - My lab is interested in the regulation of microtubules throughout the cell cycle. There are two major areas of research: First, I am investigating the function, regulation and structural organization of the microtubule anchoring complex. During interphase, microtubules are held in a specific orientation and pattern around the microtubule organizing center (MTOC). Within the MTOC, the anchoring complex exists to hold the microtubules at their ends. My previous work has identified the multisubunit protein complex dynactin as a key player in the anchoring process. I am interested in finding out how dynactin works in this essential cellular process. Second, I am also examining the formation, repair and resolution of mitotic defects in cancer cells. Mitotic defects are a strong contributor to genomic instability, a hallmark of tumor progression. Misregulation of a large number of proteins can lead to the appearance of these defects. By teasing apart specific functions of certain proteins within these processes, I hope to build a better understanding of how these defects arise and what defenses – both intrinsic to the cell and induced experimental changes – exist. The research in my lab relies heavily upon cell culture, modern molecular biology techniques and above all fluorescent microscopy.

Requirements and expectations: Students must be enrolled/have completed genetics before joining the lab. All my research students are required to take BIOL 380: Cell and Molecular Biology and expected to take BIOL 381: Cell and Molecular Biology Lab.

Ideally, a student will apply to work with me during their sophomore year (taking BIOL 250 – Introduction to Cell Biology Research in their spring semester). I will entertain applications from juniors for the lab as well. It is unlikely that I will accept students in their final year – there is insufficient time to learn all the techniques necessary to succeed and perform meaningful research in a semester or two.

Applications are available in the fall semester (usually announced by Dr. Ferguson in his genetics class as part of a common application for several laboratories). Informal applications will be entertained by email, and follow-up discussion if warranted.

Dr. Jon Titus, Science Center 133 – Plant Ecology

Areas of study - Students who are interested in plants and ecology and enjoy the challenges of being outdoors may want to consider doing research with me. Plant ecology can take you to incredible and beautiful places around the world and is directly connected with many of the major issues of our time. My current research projects are described below:

- Rapid anthropogenic forest change. That means how our forests are changing. To do this I have permanent plots set up in the College Lodge mature Preserve forest, the Campus Woodlot and in 4 swamps across the county. These plots are used to track tree growth, tree diseases and death, vines, tree establishment and downed woody debris dynamics. Smaller quadrats within the plots track the understory. As factors such as beech bark disease, emerald ash borer, hemlock woolly adelgid, invasive plant species and climate change continue to change our forests these plots will track the response of the vegetation. Deer exclosures have also been constructed to be able to factor in the effects of our deer overpopulation. These plots are amenable to an endless number of experiments.

- Seedbanks of black oak savannas. Black oak savannas are a rare plant community type in NY and PA. Seedbank explores the role of buried seeds in successional dynamics and relationships to the standing vegetation. This research involves a mix of field and greenhouse work. The current field sites are in back of Eastern Hills Mall in Clarence and at Erie Bluffs State park south of Erie, PA. This spring the research focus will shift to Rush Oak Openings near Rochester.
- Flora of bentonite clay ecosystems. Bentonite clay is a rare soil type in our region which supports a unique and diverse flora. Bentonite clay expands nine times when wetted and is a very difficult substrate for vegetation. I am working on understanding the species which inhabit these sites.
- Propagating rare New York State species. With the new greenhouse up and running I am propagating species rare in western New York. Germination requirements for many of these species are unknown. This is a combination of field work (finding the species and collecting seeds) and greenhouse work.
- Invasive species projects. My large invasive species research projects have been completed but I continue to have smaller monitoring projects concerning day lily, goutweed, Eurasian buckthorn and Phragmites.

Requirements and expectations - Even as a senior Biology major, you may know very little about plant ecology and so I do not expect that you would know what kind of research you would like to do – we would devise a study which interested you. There are an infinite number of experiments which can be done and projects do not need to be related to any of the studies above. I am a big fan of the European model where students start conducting research as freshmen. Therefore I accept students of any year. There are no class requirements and there is no application.

Dr. Courtney Wigdahl-Perry, Science Center 237 – Aquatic Ecology

Areas of study - As an aquatic ecologist, I am interested in how lakes respond to environmental changes. I work on local lakes here in western New York as well as other systems around the world, primarily focusing on algae and zooplankton communities. My research interests span different timescales, so I use field sampling techniques and high-frequency sensors to study lakes today, and I also study biological fossils preserved within lake sediments to explore the past history of lakes. Students working in my research program will gain experience in the field and laboratory, learning a variety of skills including basic sampling techniques for water quality in lakes, water chemistry analyses, sediment core collection and processing, microscopy approaches, algae and zooplankton taxonomy, sensor technologies in monitoring buoys, etc.

Requirements and expectations - Students interested in working in my research lab will need sophomore standing, and will preferably have taken BIOL 330: Ecology or ESCI 310: Methods in Environmental Analysis prior to working in the laboratory. Most projects will involve both field and laboratory components. Interested students should contact Dr. Wigdahl-Perry to complete a short application and meet to discuss student goals, laboratory expectations, and research projects.

III) Capstone Internship

What is an internship?

An internship is a work-related learning experience for students who wish to develop hands on work experience in a specific occupational field. Internships are usually performed off-campus, and can take place during the academic year or the summer.

What is the benefit of performing an internship?

There are many reasons why you might wish to consider performing an undergraduate internship before graduation. Internships:

- Provide opportunities to experiment and pursue careers that match academic and personal interests.
- Enable students to gain practical experience.
- Enable students to develop new skills and refine others.
- Increase the likelihood of building professional networking contacts.
- Help students become viable, experienced job applicants when seeking employment after graduation.
- Help students gain confidence in their abilities.

Many employers consider internship experience in the hiring process, and often look to their own interns as the best potential candidates for full-time positions.

Who should do a capstone internship?

- As a general rule, students interested in employment upon graduation benefit from capstone internship. Pre-health students may also benefit from capstone internship.
- The Career Development Office (<http://www.fredonia.edu/cdo/>) has an extensive amount of information about internships. Students interested in performing a capstone internship will need to be well-organized, dependable and very capable of doing independent work.
- Your advisor will help you determine if your capstone experience should be an internship.

Types of Internships

There are three basic types of capstone internships:

- An internship performed in the United States. These internships are usually in a health care/wellness or ecological/conservation setting and represent the most common internship experience.
- Study Abroad
- A summer REU (Research Experience for Undergraduates) performed at another institution.

General Information and Expectations

- The capstone internship requires a 120 hour experience.
- Your internship must include an applied research project or an extensive literature review based upon an interesting question developed during a senior year career shadowing internship.
- An off-campus supervisor will provide evaluations to the capstone internship coordinator; the capstone internship coordinator will bear responsibility for the final evaluation of the learning experience.

- A formal paper and oral presentation are required.

Internship

Exploring internship options

- Discuss internship interest and ideas during your sophomore year with your academic advisor, with Jennifer Wilkins from the Career Development Office (CDO), and with a representative from the prospective internship site.
- The CDO can help you identify internships that can be performed locally, in-state or outside New York. Many online sites offer information about internships; here are links to two sites you may find useful:

<https://www.fredhutch.org/content/dam/www/about-us/internships/surp/internships.pdf>

<https://www.fredhutch.org/en/about/internships/summer-undergraduate-research-program.html>

- Taking the Science Communication Seminar during the sophomore or junior year is strongly recommended. The seminar is designed to help you choose a capstone and improve your writing and oral presentation skills.
- Finalize your internship ideas with your faculty advisor, Jennifer Wilkins and the off-campus site supervisor during your junior year.

Development and submission of application, Registration for internship

- Students planning to graduate Spring 2021 can intern during Summer 2020, Fall 2020, or J term 2021.
- Students planning to graduate Fall 2021 can intern during Summer 2021.
- Students planning to graduate Spring 2022 can intern Summer 2021, Fall 2021 or J-Term 2022.
- Complete and submit the [Capstone Internship Application](#) to Dr. Backes, Capstone Internship Coordinator. Be sure to include all information requested, or the application will be returned to you.

Students wishing to intern J term 2021

- Submit your completed [capstone internship application](#) to Dr. Backes by October 30, 2020. You will be notified if the application is incomplete or approved.
- Once you have received approval, you will begin work on the CDO contract, <http://students.fredonia.edu/cdo/x-main>. Fill out your part and work with your site supervisor to fill out their part.
- You will then set up an appointment to meet with Dr. Backes to discuss the project and to fill out the remainder of the CDO contract.
- You will register for 2 credits of BIOL 492 for J term 2021.
- You will also register for 1 credit of BIOL 492 for Spring 2021 which is when you will complete and offer your PowerPoint presentation and formal paper.
- There will be a one hour weekly class associated with BIOL 492 in the Spring 2021 semester.

Students wishing to intern Summer 2021

- Submit your completed [capstone internship application](#) to Dr. Backes by February 15, 2021. You will be notified if the application is incomplete or approved.
- Once you have received approval, you will begin work on the CDO contract, <http://students.fredonia.edu/cdo/x-main>. Fill out your part and work with your site supervisor to fill out their part.
- You will then set up an appointment to meet with Dr. Backes to discuss the project and to fill out the remainder of the CDO contract.
- You will register for 2 credits of BIOL 492 for Summer 2021.
- You will also register for 1 credit of BIOL 492 for Fall 2021 which is when you will complete and offer your PowerPoint presentation and formal paper.
- There will be a one hour weekly class associated with BIOL 492 in the Fall 2021 semester.

Students wishing to intern Fall 2021

- Submit your completed [capstone internship application](#) to Dr. Backes by Feb. 23, 2021. You will be notified if the application is incomplete or approved.
- Once you have received approval, you will begin work on the CDO contract, <http://students.fredonia.edu/cdo/x-main>. Fill out your part and work with your site supervisor to fill out their part.
- You will then set up an appointment to meet with Dr. Backes to discuss the project and to fill out the remainder of the CDO contract.
- You will register for 2 credits of BIOL 492 for Fall 2021.
- You will also register for 1 credit of BIOL 492 for Spring 2022 which is when you will complete and offer your PowerPoint presentation and formal paper.
- There will be a one hour weekly class associated with BIOL 492 in the Spring 2022 semester.

Evaluation

- The final grade for the two credit internship will be based upon the site supervisor's evaluation and materials provided by the student to Dr. Backes.
- The final grade for the one credit follow-up will be based on Dr. Backes' evaluation of the formal PowerPoint and paper.

Study Abroad

Exploring internship options

- Discuss study abroad interest and ideas during your sophomore year with your academic advisor, with Erin Willis from the [International Education Office](#), and with Jennifer Wilkins from the [Career Development Office](#) (CDO).
- Taking the [Science Communication Seminar](#) during the sophomore or junior year is strongly recommended. The seminar is designed to help you choose a capstone and improve your writing and oral presentation skills.
- Finalize your study abroad ideas with your faculty advisor, Erin Willis, Jennifer Wilkins and the study abroad program during your junior year.
- If you plan to enroll in a study abroad program that awards college credit, you will register for 1 credit of BIOL 492 during the study abroad, and 2 credits of BIOL 492 the following semester when your oral and written presentations are developed and presented.
- If you plan to enroll in a study abroad program that does not award college credit, you will register for 2 credits of BIOL 492 during the study abroad, and 1 credit of BIOL 492 the following semester when your oral and written presentations are developed and presented.

Development and submission of application, Registration for internship

- Students planning to graduate Spring 2021 can study abroad during Summer 2020, Fall 2020, or J term 2021.
 - Students planning to graduate Fall 2021 can study abroad during Summer 2021. Application deadline for Summer 2021 internship is Feb. 15, 2021.
 - Students planning to graduate Spring 2022 can study abroad during Summer 2021, Fall 2021 or J term 2022.
 - Complete and submit the [Capstone Internship Application](#) to Dr. Backes, Capstone Internship Coordinator. Be sure to include all information requested, or the application will be returned to you.
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Students wishing to intern J term 2021

- Submit your completed [capstone internship application](#) to Dr. Backes by September 21, 2020. You will be notified if the application is incomplete or approved.
- Once you have received approval, you will begin work on the CDO contract, <http://students.fredonia.edu/cdo/x-main>. Fill out your part and work with your site supervisor to fill out their part.
- You will then set up an appointment to meet with Dr. Backes to discuss the project and to fill out the remainder of the CDO contract.
- You will register for 1-2 credits of BIOL 492 for J term 2021.
- You will also register for 1-2 credits of BIOL 492 for Spring 2021 which is when you will complete and offer your PowerPoint presentation and formal paper.
- There will be a one hour weekly class associated with BIOL 492 in the Spring 2021 semester.

Students wishing to intern Summer 2021

- Submit your completed capstone internship application to Dr. Backes by March 31, 2021. You will be notified if the application is incomplete or approved.
- Once you have received approval, you will begin work on the CDO contract, <http://students.fredonia.edu/cdo/x-main>. Fill out your part and work with your site supervisor to fill out their part.
- You will then set up an appointment to meet with Dr. Backes to discuss the project and to fill out the remainder of the CDO contract.
- You will register for 1-2 credits of BIOL 492 for Summer 2021.
- You will also register for 1-2 credits of BIOL 492 for Fall 2021 which is when you will complete and offer your PowerPoint presentation and formal paper.
- There will be a one hour weekly class associated with BIOL 492 in the Fall 2021 semester.

Students wishing to intern Fall 2021

- Submit your completed [capstone internship application](#) to Dr. Backes by March 31, 2021. You will be notified if the application is incomplete or approved.
- Once you have received approval, you will begin work on the CDO contract, <http://students.fredonia.edu/cdo/x-main>. Fill out your part and work with your site supervisor to fill out their part.

- You will then set up an appointment to meet with Dr. Backes to discuss the project and to fill out the remainder of the CDO contract.
- You will register for 1-2 credits of BIOL 492 for Fall 2021.
- You will also register for 1-2 credits of BIOL 492 for Spring 2022 which is when you will complete and offer your PowerPoint presentation and formal paper.
- There will be a one hour weekly class associated with BIOL 492 in the Spring 2022 semester.

Evaluation

- The final grade for the study abroad will be based upon the study abroad supervisor's evaluation and materials provided by the student to Dr. Backes.
- The final grade for the remaining credit(s) will be based on Dr. Backes' evaluation of the formal PowerPoint and paper.

Research Experience for Undergraduates (REUs)

General Information

- This is a summer research experience but because it is performed under the mentorship of faculty at an institution other than Fredonia, it is counted under Capstone Internship.
- Taking the Science Communication Seminar during the sophomore or junior year is strongly recommended. The seminar is designed to help you choose a capstone and improve your writing and oral presentation skills.
- The National Science Foundation funds many REU opportunities; visit this site for additional information - <https://www.nsf.gov/crssprgm/reu/>
- Discuss your interest in REUs with your advisor. To obtain capstone credit, the REU will need to be performed the summer prior to your senior year.
- Complete and submit your application and have a back-up plan for a senior capstone; competition for REUs is strong and they are difficult to obtain.
- If you are awarded an REU, you will likely be notified in April. Once you accept the REU, immediately complete and submit the Capstone Internship Application to Dr. Backes, Capstone Internship Coordinator. Be sure to include all information requested, or the application will be returned to you.
- Once you have received approval from Dr. Backes, you will begin work on the CDO contract, <http://students.fredonia.edu/cdo/x-main>. Fill out your part and work with your REU supervisor to fill out their part.
- You will then set up an appointment to meet with Dr. Backes to discuss the REU and to fill out the remainder of the CDO contract.
- You will register for 1 credit of BIOL 492 for summer 2021. You will also register for 2 credits of BIOL 492 for Fall 2021 which is when you will complete and offer your PowerPoint presentations and formal paper.
- There will be a one hour weekly class associated with BIOL 492 in the Fall 2021 semester.

Evaluation

- The final grade for the summer REU credit will be based upon the REU supervisor's evaluation and materials provided by the student to Dr. Backes.
- The final grade for the fall credits will be based on Dr. Backes' evaluation of the formal PowerPoint and paper.

IV) CAPSTONE COURSE

General Information and Expectations

- One-two capstone courses will be offered every semester.
- The main objective of the course will be group research, grant proposal development or review of research literature.
- The content will be ecology, organismal biology or cell/molecular biology.
- Expectations for a capstone course experience will be the same as for research and internships – inquiry based learning/problem solving, written and oral presentation. Students will present their oral and written presentations in class.
- A capstone course offers similar benefits to capstone research and internship, but provides more directed instruction than research or internship.
- Capstone courses also provide greater opportunity for group work and interaction.
- Capstone courses typically enroll 6-8 capstone students/course.
- Your advisor will help you determine if your capstone experience should be a capstone course.

Here are four capstone course descriptions:

Animal Behavior (Literature Review, Ecology) - Dr. Karry Kazial

This capstone course will include significant inquiry based learning/problem solving, and written and oral presentation through group research projects on animal behavior topics. Animal behavior integrates several subdisciplines in Biology making the course valuable as a capstone experience for students. The course will first provide background to the discipline of animal behavior and examine the levels of questioning in this field. We will discuss the influence of genetics and the environment on behavior (nature vs. nurture). We will magnify our focus on the roots of behavior, the proximate causes of behavior, specifically its neural and hormonal control. We will examine cases such as bird song, electric fish EODs, shark electroreception, moth hearing and bat echolocation, and then focus on those behaviors that make up the many tasks animals must accomplish to survive and reproduce.

Molecular Biology of Disease (Literature Review, Molecular and Cellular Biology) –
Dr. Scott Ferguson

A capstone course should be an opportunity for you to apply what you have learned during your undergraduate career to a specialized topic that interests you. Molecular Biology of Disease does this through analysis of primary literature about the genetic and biochemical etiology of human disease. We will focus on the current mechanisms for diagnosing disease and designing interventional therapies tailored to the molecular root of the condition. Specific topics covered include inborn errors in metabolism, cholesterol homeostasis, protein folding diseases, cancer, gene therapy, and stem cell therapy. You will meet the capstone writing and oral communication requirements through several assignments. Written and discussion-based critiques of journal articles throughout the semester. The final project will be a research-based grant proposal about a topic that interests you. The proposal will be peer reviewed, revised and presented to the class during the finals period.

Mechanisms of Obesity (Literature Review, Exercise Physiology – only open to Exercise Science students) – Dr. Todd Backes

The main emphasis of the course will be the obesity epidemic in the adult population. Students will be introduced to current scientific literature covering neural and hormonal control of metabolism, energy, balance, and body weight regulation. The course will also cover fat cell biology, and the development of diseases associated with obesity. Finally, students will gain an understanding of current treatments for obesity and obesity associated diseases both in clinical and experimental settings.

V) **Medical Technology Internship**

- This internship is a required part of the Medical Technology program and occurs in the senior year.
- Students intern for 11 months at a hospital internship accredited by the National Accrediting Agency for Clinical Laboratory Sciences.
- Fredonia is affiliated with 3 programs: WCA Hospital, Jamestown; Rochester General Hospital, Rochester; St. Vincent's Hospital, Erie, PA.
- Medical Technology students apply for this internship the summer before the junior year under the supervision of Medical Technology Program Director Patricia Astry.
- Application review and interviews occur during the fall semester of the junior year; most students know if they will be offered a position by the beginning of the spring break (The application process is competitive, typically requiring a science GPA of 3.00 or better.)
- Students spend their senior year at the hospital, studying Clinical Hematology, Clinical Immunology, Clinical Microbiology, and Clinical Chemistry in preparation for the exam that will lead to national certification, state licensure and employment as a Medical Technologist.
- Detailed information about the program and the clinical internship can be found on the department webpage, in the catalog, and in the UG Student handbook.

VI) **Student Teaching**

- The Adolescence Education in Biology degree prepares students to teach Biology to middle and high school students, and leads to New York State certification grades 7-12.
- Student teaching is the culminating experience in this teacher education program, and provides an opportunity to put into practice the skills developed from courses and early field experiences.
- Student teaching generally occurs over a sixteen week period in two separate assignments in Chautauqua County, Erie County or Cattaraugus County.
- Applicants for Teacher Candidacy must meet a variety of expectations, including an overall GPA of 3.0 or better and a record of positive Professional Dispositions.
- Detailed information about the program and student teaching can be found on the department webpage and in the catalog.

VII) **Capstone Internship Application**

- Please follow the detailed instructions in the Capstone Manual about the application process.
- [Complete this 1 page application](#) (typed) and return to Biology or Chemistry Department Secretary, Science Center Administrative Suite.

- Dr. Backes will notify you when your application is approved (or if you need to provide additional information).
- After your application is approved, you and your site supervisor may begin work on your CDO contract. <http://students.fredonia.edu/cdo/x-main>.
- You will then meet with Dr. Backes to complete the contract.
- You will be permitted to register for the Capstone Internship once your CDO contract is completed.

CAPSTONE INTERNSHIP APPLICATION
Electronic Application

First Name, Middle Initial and Last Name

Fredonia ID #

Email Address

Street Address, State and Zip Code

Academic Advisor:

Semester you hope to perform your internship

Name of Internship Business or Organization

Internship Site Address

Internship Employee Supervisor Name and Title

Internship Employee Supervisor Email

Internship Employee Supervisor Phone number

Total number of hours to be worked (120 hours minimum)

Description of Internship – 150-200 words maximum. The description should include the nature of the duties and responsibilities of the interns, including the following:

- If the internship is an applied research project, explain the project.
- If you are investigating an interesting question connected to a career shadowing experience, state the question, why it is of interest to you, and explain the nature of the job shadow.

Relation to Long-term Goals – 150-200 words maximum.

- How does the internship relate to your interests?
- How will successful completion of the internship help you achieve your career objectives?

Literature used in the project– 100-150 words maximum.

- You will be expected to perform a significant literature review for your capstone project. Please cite books and articles you plan to use in your project.

Is this internship paid or unpaid?

- For unpaid internships, students must intern 40 hours per credit hour. For paid internships, students must intern 60 hours/credit hour. Students are not permitted to claim summer jobs or other employment for internship credit.