

Fiscal Unit/Academic Org	Evolution, Ecology & Org Bio - D0390
Administering College/Academic Group	Arts and Sciences
Co-administering College/Academic Group	
Semester Conversion Designation	New Program/Plan
Proposed Program/Plan Name	Research Methods in Biological Sciences
Type of Program/Plan	Undergraduate certificate program
Program/Plan Code Abbreviation	
Proposed Degree Title	

Credit Hour Explanation

Program credit hour requirements		A) Number of credit hours in current program (Quarter credit hours)	B) Calculated result for 2/3rds of current (Semester credit hours)	C) Number of credit hours required for proposed program (Semester credit hours)	D) Change in credit hours
Total minimum credit hours required for completion of program				12	
Required credit hours offered by the unit	Minimum			7	
	Maximum				
Required credit hours offered outside of the unit	Minimum				
	Maximum				
Required prerequisite credit hours not included above	Minimum			3	
	Maximum				

Program Learning Goals

Note: these are required for all undergraduate degree programs and majors now, and will be required for all graduate and professional degree programs in 2012. Nonetheless, all programs are encouraged to complete these now.

- Program Learning Goals**
- Plan, conduct, and report findings from independent research in biological sciences.
 - Understand the importance of ethics and risk reduction/management in research.
 - Communicate the relevance of skills gained through conducting research to prospective employers in a range of fields.

Assessment

Assessment plan includes student learning goals, how those goals are evaluated, and how the information collected is used to improve student learning. An assessment plan is required for undergraduate majors and degrees. Graduate and professional degree programs are encouraged to complete this now, but will not be required to do so until 2012.

Is this a degree program (undergraduate, graduate, or professional) or major proposal? No

Program Specializations/Sub-Plans

If you do not specify a program specialization/sub-plan it will be assumed you are submitting this program for all program specializations/sub-plans.

Pre-Major

Does this Program have a Pre-Major? No

Attachments

- Research Methods Certificate EEOB.pdf
(Program Proposal. Owner: Hamilton, Ian M)

Comments

- Document includes memo, proposal, letter of support from Chair of EEOB, and support from other units *(by Hamilton, Ian M on 04/15/2024 04:07 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Hamilton, Ian M	04/15/2024 04:07 PM	Submitted for Approval
Approved	Hamilton, Ian M	04/15/2024 04:08 PM	Unit Approval
Approved	Vankeerbergen, Bernadette Chantal	04/25/2024 04:09 PM	College Approval
Pending Approval	Jenkins, Mary Ellen Bigler Hanlin, Deborah Kay Hilty, Michael Neff, Jennifer Vankeerbergen, Bernadette Chantal Steele, Rachel Lea	04/25/2024 04:09 PM	ASCCAO Approval



THE OHIO STATE UNIVERSITY

Ian M Hamilton
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Vice Provost W. Randy Smith
Council on Academic Affairs
Office of Academic Affairs
203 Bricker Hall
190 North Oval Mall
Columbus, OH 43210

April 15, 2024

Dear Randy,

The Department of Evolution, Ecology and Organismal Biology is proposing a Category 1.b Certificate in Research Methods in Biological Sciences starting in Spring 2025. This certificate will bring together three core courses in research design (EEOB 3494), research ethics (EEOB 3495), and career opportunities (EEOB 3496) with electives from a variety of units across the university providing hands on experience with research methods.

This proposal was reviewed and unanimously approved by the Evolution, Ecology and Organismal Biology Curriculum Committee on March 29, 2024. We also attach a letter of support from Bryan Carstens, Chair of Evolution, Ecology and Organismal Biology. A draft of this proposal was sent to the following units for review on February 26, 2024: Center for Life Sciences Education (CLSE), the College of Food, Agriculture, and Environmental Sciences (CFAES), Geography, Microbiology, and Molecular Genetics. Feedback was received from CLSE, CFAES and Geography (see attachments).

Sincerely,

Ian Hamilton
Professor
Department of Evolution, Ecology, and Organismal Biology
Department of Mathematics
Chair, ASCC Natural and Mathematical Sciences Subcommittee

Included:

- I. Program Summary and Goals
- II. Coursework
- III. Enrollment, Implementation, & Assessment
- IV. Certificate Advising Sheet
- V. Semester-by-Semester Sample Implementation Plan
- VI. Certificate Completion Sheet
- VII. Letter of Support, Bryan Carstens, Chair EEOB
- VIII. Feedback from CFAES, CLSE, Geography

Copied:

Bryan Carstens, Chair, EEOB
Bernadette Vankeerbergen, Assistant Dean, Curriculum, ASC

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Undergraduate Certificate of Research Methods in Biological Sciences

Department of Evolution, Ecology, and Organismal Biology

I. Program Summary and Goals

As a premier research and teaching unit, the *College of Arts and Sciences* at OSU is a home to over 16,000 undergraduate students¹. Although only a fraction of these students are enrolled in biological sciences, the small faculty to student ratio and the limited number of available research positions render seeking individual research opportunities a daunting and intimidating experience. Academic advisers, campus-wide newsletters, and student success stories emphasize the importance of engaging in research to help gain transferable skills in critical thinking, data literacy, written and oral communication for a post-graduation career. And, yet undergraduate students at OSU have limited venues to pursue this activity. In fact, surveys in our classes indicate that many students in biological sciences reach their senior year without any research experience.

We thus propose a ***Category 1.b Research Methods Certificate in Biological Sciences*** embedded in *Evolution & Ecology* and *Zoology* majors to widen research and future career opportunities for undergraduates in natural sciences.

Participation in research as an undergraduate student increases interest in pursuing STEM careers², enrollment in graduate programs³, development of professional skills, and helping underrepresented groups to enter STEM fields and scientific workforce^{4,5}. Considered as a “High Impact Practice” undergraduate research experiences greatly benefit student engagement and academic achievement^{6,7}. In addition, these experiences help students further build their general professional qualifications by equipping them with key competences, such as communication, presentation, and problem-solving skills^{1-3, 8}.

The certificate program will train undergraduate students in logical and quantitative reasoning, research design, data collection, and statistical analyses commonly used in ecology and evolutionary biology. All aspects of the research process will be covered in this program, including methods, ethics, protocols, grant writing, dissemination of results, and exploring career opportunities that require research skills in biological sciences.

Learning Goals/Objectives

Upon successful completion of the academic certificate, learners will be able to:

- a. Plan, conduct, and report findings from independent research in biological sciences.
- b. Understand the importance of ethics and risk reduction/management in research.
- c. Communicate the relevance of skills gained through conducting research to prospective employers in a range of fields.

II. Coursework

The research certificate has **3 required core courses** (7 credit hours total). These courses were specifically developed by the *Department of Evolution, Ecology, and Organismal Biology* for an undergraduate research experience to train students in all aspects of the research process. In addition, students will take **2 methods electives** for a total of 5 to 8 credit hours culminating in **12-15 hours of credits for certification**. The electives will provide students with a broad range of research methods to focus on based on interest and future goals. They will equip students with experimental, field, and laboratory techniques, and data analysis applications commonly used in natural sciences.

The course descriptions, credit hours, semesters of offering, and prerequisites are as follows. All courses are delivered in-person unless stated otherwise.

Core Courses (required): 3

(7 cr hrs total):

- Each course requires a min of C- grade upon completion to count towards the certificate.
- Students can take these courses in any sequence.

EEOB 3494 – Entering Independent Research (3 cr) (SP) Fundamentals of research design in biological sciences, including human and nonhuman animal behavior and ecology; hypothesis testing, sampling and data collection methods, applied statistical analysis, preparing budgets and proposals, presenting results. Prerequisites: none

EEOB 3495 – Research Ethics and Protocols in Behavior, Ecology, and Evolution (2 cr)(SU) **ONLINE** (SU)- research ethics, including scientific misconduct, risk and benefit analyses, and data management; training in nonhuman animal (IACUCC), human (IRB), and biosafety (IBC) research training; and occupational health in EEOB research areas. Prerequisites: min 3 cr hrs in Biological Sciences or permission of the instructor.

EEOB 3496 – Career Exploration in Ecology and Evolution (2 cr) (AU) - exploring career opportunities in *Ecology, Behavioral Ecology, Evolutionary Biology, and Wildlife Conservation* research with the skills gained by the program. Includes seminars, invited guests, scheduled visits of a pool of faculty labs, OSU alumni Association and ASC career service resources, and mock interviews. Prerequisites: min 3 cr hrs in Biological Sciences or permission of the instructor. Students in ENR and MOLGEN can substitute ENR 1500 and MOLGEN 2220H respectively for this course upon approval.

Electives – Methods and Practical Applications (5-8 cr hrs):

- Each course requires a min of C- grade upon completion to count towards the certificate.
- Students can take these courses in any sequence.

Select 2 from below.

(min 5 credit hours total)

EEOB 3498 – Applied Undergraduate Research in Behavioral Ecology (4 cr) (AU) - In-depth methods in behavioral, field, observational, lab- and cloud-based studies, actual collection of data/advanced analyses, presentation of the research results in a formal venue at OSU.

Prerequisites: Biology 1114 or 1114H, or permission of instructor.

EEOB 3420 Behavioral Ecology (4 cr) (AU) - Comparative study of animal behaviors, and analysis of their adaptive value, physiological mechanisms, development, and evolution, within their ecological and social context.

Prerequisites: Biology 1114 or 1114H, or permission of instructor.

EEOB 4430 Ecological Methods I (2 cr) (SU alternating) - Hands-on course for learning basic field and quantitative methods for ecological studies.

Prerequisites: EEOB 3410. Repeatable to a maximum of 8 cr hrs or 4 completions.

EEOB 5360: Biodiversity Informatics (3 cr) (AU). Focus on practical skills to access, manage, analyze, and utilize biodiversity data for scientific research and conservation efforts.

Prerequisites: EEOB 3410, EEOB 3310, or permission of instructor

EEOB 2260: Discovering Biodiversity using Integrative Research (4 cr) (AU). Science literacy and critical thinking skills. Focuses on ecological relationships and the conservation of biodiversity. Students will develop proficiencies and content knowledge about the origins and evolution of local and global natural systems.

GE theme origins and evolution course

ANIMSCI 3420 - Animal Laboratory Research Methods (0.5 cr) (SP) - Laboratory format demonstrating the applications of animal research. Covers common laboratory techniques, such reagent preparation, protein and nucleic acid purification and downstream analysis, including immunochemical assay development and optimization.

Prerequisites: 2200.01 or 2300H, and 2200.02 or AnmlTec 2200.02T. Prereq or concur: 3140 or MeatSci 3110. Not open to students with credit for 3200.

ANIMSCI 3480 - Animal Welfare Laboratory (0.5 cr) (SP). Laboratory experience exploring aspects of animal welfare, including biological functioning, affective state, and natural living. Course activities provide core concepts primarily in applied animal welfare and behavior with focus on food animal species.

Prerequisites permission of instructor; EEOB 3420 could serve as a prerequisite.

AGSYSMT 5560: UAS and Remote Sensing (3 cr) (SP): Introduction to the fundamentals of remote sensing within the framework of Geographic Information Systems (GIS) and Unmanned Aerial Systems (UAS), and their applications in production agriculture.

Prerequisites: HCS 2260, AnimSci 2260, ENR 2000, AEDEcon 2005, ComLdr 3537, or Stat 1450; and Sr or Grad standing; or permission of instructor. Not open to students with credit for 3580.

AGSYSMT 5580: Data Analytics in Production Agriculture (3 cr) (AU): Overview of the principles of data management and analytics in support of field crop production, including exposure to common data generation and collection methodologies, and modeling approaches that support actionable spatial and temporal management recommendations at a sub-field level.

Prerequisites: Senior standing, or permission of instructor.

ENR 4345 Methods in Aquatic Ecology (4 cr) (AU) - Introduction to experimental designs, field and laboratory techniques, and statistical methods commonly used to study aquatic ecosystems.

Prerequisites: 2100, or permission of instructor. Not open to students with credit for 5345.

ENR 5362 Wildlife Ecology Methods (3 cr) (SP) - Methods used by wildlife ecologists to measure population characteristics and habitat quality for wild terrestrial vertebrates. 1-2 Sat and 1 full weekend field trips required.

Prerequisites: 2000, 3300, Stat 1450, or Grad standing. Not open to students with credit for 662.

GEOG 3980 - Biogeography: An Introduction to Life on Earth (3 cr) (SP). The patterns and processes responsible for the global distribution of Earth's flora and fauna; the inter-relationship between biota and soils; climate and topography will be emphasized.

Prerequisites: Not open to students with credit for 490.

GEOG 5210 – Fundamentals of GIS (3 cr) (AU/SP) - Basic principles of geographic and land information systems and their use in spatial analysis and information management.

Prerequisites: Not open to students with credit for 5220 (607), CRPlan 5001 (607), or CivilEn 5001(607).

HCS 3420 - Seed Science (3 cr) (SP) - Overview of the topics that define seed science, including seed formation and development, seed identification, seed processing, seed testing (germination, vigor, dormancy), and seed production practices.

Prerequisites: HCS 2201 or 2202.

MICRO 4140 – Molecular Microbiology Laboratory (3 cr) (AU/SP) - Advanced laboratory covering structure, maintenance, expression and exchange of genetic materials in microbial cells and methods in immunobiology.

Prereq or Concur: Micrbio 4130 (Micrbiol 581.01). Not open to students with credit for Micrbiol 581.02.

MICRO 5161 – Introduction to Computational Genomics (3 cr) (SP) - Application of computational tools to the analysis of microbial genomes and their gene products. Recommended background in basic molecular biology, genetics, or biochemistry.

Prerequisites: Recommended courses include Micro 4130, MolGen 4500, MolGen 4606, and Biochem 4511.

MOLGEN 5601 – Eukaryotic Molecular Genetics Lab (3-4 cr) (SP) - Current laboratory techniques used in the genetic, cellular, and molecular analyses of yeast, Drosophila, and other model systems.

Prerequisites: 4500 or 4606, or permission of instructor. Not open to students with credit for 601.

MOLGEN 5602 – Eukaryotic Cell and Developmental Biology Laboratory (3-4 cr) (AU, possibly SU) - Laboratory course emphasizing techniques and methods central to cell and developmental biology of eukaryotes.

Prerequisites: 4500 or 4606, or permission of instructor. Not open to students with credit for 602.

PLNTPH 5006 – Practical Computing Skills for Omics Data (3 cr) (SP) - This course is designed to provide students with foundational training in computing skills for reproducible research. At the end of this course, students will be

able to start applying these skills and the associated tools in their own research, and will also have a firm understanding of how this will make their research more robust, reproducible, and efficient.

Prerequisites: None.

Total Credit Hours: 12-15 cr hrs depending on the electives, Certificate Category 1.b embedded

III. Enrollment, Implementation, and Assessment

We anticipate an initial enrollment of about 15 students for the first year of the program. This is consistent with the class capacity of our core courses for the certificate. All courses in the current proposal have already been approved by OAA. Therefore, we propose that the certificate program start in Spring 2025. Students who have already taken the proposed courses prior to that date can retroactively count them towards the certificate.

We expect that the completion of the program will take no more than 2 years. Because we will allow a 100% course overlap with the major, we anticipate adequate student demand to justify the certificate offering. Additionally, the skills gained in the program will be useful for academic and professional career opportunities without putting extra burden on students to earn this certificate. We know of no similar programs in Ohio, likely increasing the demand for such a certificate. Also, to our knowledge, there are no nationwide programs that offer a certificate in interdisciplinary research methods such as ours in biological sciences. Moreover, we expect no additional financial burden concerning the staffing for the courses or facilities, nor do we need further university resources, including advisors and libraries to implement the certificate.

Course-Based Assessment: The implementation of the program will involve a robust assessment system engrained into the core course structure. Specifically, *EEOB 3496: Career Exploration in Ecology and Evolution* & *EEOB 3494: Entering Independent Research* have assignments where students submit a scientific research proposal and a research statement in the form of self-reflection for potential academic and professional opportunities. These will showcase the skills they have gained during coursework. Both classes will now use the online platform *PebblePad*⁹. This platform is an electronic portfolio system for recording achievements to provide evidence for various competencies and receive feedback. Students can then share their e-portfolios with researchers, instructors, and potential employers. It is expected that most students will already have access to the e-portfolio through the GE program at OSU. Our university has adapted *PebblePad* for digital learning and integrated it into *Carmen Canvas*, our primary learning management tool. Therefore, with two access points during the implementation of the program, *PebblePad* will serve as a crucial assessment tool in the following fashion:

The research statement and self-reflection assignment will be completed on the e-portfolio and have sections that will ask students their research interests, a brief summary of the prior and current research conducted, relevant courses taken, declared major and minor, relevant paid or volunteer positions, expected and realized outcomes (e.g. poster presentation, placement in a lab, funding received, etc.), and their research skills. These assignments will be evaluated by course instructors. Because the two core courses are not offered during the same semesters, students will have a chance to update their e-portfolio at two separate time points.

It is our hope that through this course-based assessment tool, we will be able to evaluate whether the students have been able to plan and report findings from independent research and communicate the relevant skills they have gained throughout the program to prospective employers in line with the learning goals of the certificate.

In addition, the assignments and teacher evaluation based on grades in *EEOB 3495 - Research Ethics and Protocols in Behavior, Ecology, and Evolution* will serve another assessment tool to understand whether the students have been able to understand ethics and risk management in research as outlined in program goals.

Exit Surveys: During the last semester of the certificate program, each student will receive an exit survey that will have a section with questions on their e-portfolios. The survey will be designed to match program goals with student experiences throughout the program. Specifically, students will review and share their e-portfolios with their academic advisor during the survey. They will also answer the following sample questions on a 5-point Extent Likert Scale (5 *To a great extent* – 4 *To a large extent* – 3 *Somewhat* – 2 *Little* – 1 *Not at all*).

To what extent do you feel you can

- a. plan, conduct, and report findings from independent research?*
- b. assess the ethical issues related to human and nonhuman subjects?*
- c. assess the ethical issues on utilizing and sharing data collected from research studies?*
- d. communicate the skills you gained in the certificate program to potential employers, graduate, or professional schools?*

A secondary assessment tool will also be developed by reaching out to ASC Career Success and ASC Alumni Society Board at OSU. The engagement with the two units has already been incorporated into the *EEOB 3495: Career Exploration* course activities involving guest speakers. Working with these units, our program will seek to gather additional data on student outcomes and placements after graduation.

Analysis and Reporting of Data

The data gathered from exit surveys, e-portfolio, and alumni information will be kept in our advisory board repository with student identifications removed. Each student will be assigned a participant number. Our department will organize student data according to the major, time to complete the program, specialized skill based on the electives and e-portfolio entries, tangible research outcomes (e.g. posters, papers), and placements. This information will then be tied to exit surveys and self-reflection statements. Specifically, we will ask whether:

- a. Skills gained from the program match placements.*
- b. Students' confidence in achieving program goals is satisfactory.*
- c. Students can finish the program in a timely manner.*
- d. A particular major has better program outcomes compared to the others.*
- e. Certain skills fare better than the others in placements and student satisfaction.*

For the first two years during the implementation period, data will be gathered from all participants to the extent possible. After two years, in the event the data collected exceeds our ability to process it, a random sampling method will be utilized to select a sufficient number of participants to render enough statistical power to make inferences about our program success. The implementation, including the recruitment and assessment of the program will be conducted by the *Certificate Advisory Board*. The Vice Chair for Undergraduate Studies will serve as the chair of the Board. A faculty representative from the EEOB curriculum committee and major advisors will serve as members.

Criteria for Program Success

Our criteria for the success of the certificate will be a retention rate of over 50%. Following a minimum C- grade from the courses listed and a minimum 2.00 cumulative GPA average, if over 50% of participants to the program graduate from their major with the certificate in hand, we will deem the program successful. In addition, the majority of participants must report satisfaction with the certificate for the program to be successful.

The data gathered from e-portfolios, exit surveys, and alumni records will also serve us to evaluate the program and student success. For example, if certain skills fare better than the others in placements after graduation, we may adjust our coursework seeking curriculum modifications and the subsequent approval from the ASC curriculum committee.

ASC certificate advising and completion sheets, a semester-by-semester program, and advising sheets for current *Evolution & Ecology and Zoology* majors are provided below.

IV. Certificate Advising Sheet

The Ohio State University College of Arts and Sciences Undergraduate Certificate of Research Methods in Biological Sciences - Type 1b

Advising Contacts: Sue Ellen Dehority
Undergraduate Advisor, Department of Evolution,
Ecology, & Organismal Biology, 388 Aronoff Lab
dehority.2@osu.edu, 614-292-0596

Faculty Contact: Ian Hamilton, Professor
Vice Chair for Undergraduate Studies
Department of Evolution, Ecology, & Organismal
Biology, 390 Aronoff Lab. hamilton@598.osu.edu
614-292-9147

The certificate program aims to train students in logical and quantitative reasoning, research design, data collection, and statistical analyses commonly used in ecology and evolutionary biology. All aspects of the research process are covered in this program, including methods, ethics, protocols, grant writing, dissemination of results, and exploring career opportunities that require research skills in biological sciences.

The Research in the Biological Sciences certificate requires a minimum of 12 credits as follows:

Three core courses (all required):

EEOB 3494 - Entering Independent Research (3 cr)
EEOB 3495 - Research Ethics and Protocols (2 cr)
EEOB 3496 - Career Exploration in Research in
Biological Sciences (2 cr)

Electives - Methods and Practical

Applications (select 2 courses, min 5 cr):

EEOB 3498 - Applied Undergraduate Research in
Behavioral Ecology (4 cr)
EEOB 3420 - Behavioral Ecology (4 cr)
EEOB 4430 - Ecological Methods I (2 cr)
EEOB 5360 - Biodiversity Informatics (3 cr)
EEOB 2260 - Discovering Biodiversity (4 cr)
ANIMSCI 3480: Animal Welfare Laboratory (0.5 cr)
ANIMSCI 3420: Animal Lab Res Methods (0.5 cr)
AGSYSMT 5560: UAS and Remote Sensing (3 cr)

AGSYSMT 5580: Data Analytics in Production Agriculture
(3 cr)
ENR 4345- Methods in Aquatic Ecology (4 cr)
ENR 5362 - Wildlife Ecology Methods (3 cr)
GEOG 3980 -Biogeography (3 cr)
GEOG 5210 - Fundamentals of GIS (3 cr)
HCS 3420 - Seed Science (3 cr)
MICRO 4140 - Molecular Microbiology Lab (3 cr)
MICRO 5161 - Introduction to Computational
Genomics (3cr)
MOLGEN 5601 - Eukaryotic Molecular Genetics
Lab (3-4 cr)
MOLGEN 5602 - Eukaryotic Cell and
Developmental Biology Laboratory (3-4 cr)
PLNTPH 5006 - Practical Computing Skills
for Omics Data (3 cr)

Research Certificate Program Guidelines

Credit hours required: A minimum of 12.

Overlap with degree program: A student is permitted to overlap up to 100% of credit hours between other degree programs (major, minor, other certificate, or general education) and the certificate program.

Grades required: Min C- for a course to be counted on the certificate.

Minimum 2.00 cumulative GPA for all certificate coursework.

Certificate approval: The certificate must be approved by the Department of Evolution, Ecology, and Organismal Biology.

Consult with advisor for filing deadlines, for changes or exceptions to a certificate plan.

College of Arts and Sciences
Curriculum and Assessment Services
306 Dulles Hall, 230 Annie & John Glenn Ave.
<http://artsandsciences.osu.edu/>

V. Semester-by-Semester Sample Implementation Plan

	Spring	Summer	Autumn
YEAR 1	EEOB 3494 Entering Independent Research (3 cr)	EEOB 3495 Research Ethics and Protocols (2 cr)	ENR 4345 Methods in Aquatic Ecology (4 cr)
YEAR 2	GEOG 5210 Fundamentals of GIS (3 cr)		EEOB 3496 Career Exploration in Ecology and Evolution (2 cr)

VI. Research Certificate in Biological Sciences

CERTIFICATE COMPLETION SHEET

Name:	
Email:	
Primary program:	

Course number and name	Course grade	Semester completed
EEOB 3494: <i>Entering Independent Research</i>		
EEOB 3495: <i>Research Ethics & Protocols in Behavior, Ecology, & Evolution</i>		
EEOB 3496: <i>Career Exploration in Ecology & Evolution</i>		
Two elective courses in Methods and Applications (min 5 credit hours)		

Total credits (12 – 15): _____

Certificate advisor name and signature: _____

Date: _____

April 1, 2024

Re: Chair Support Letter for Undergraduate Research Certificate

Dear Members of the College of Arts and Sciences Curriculum Committee,

I am writing to strongly support the proposed *Certificate of Research Methods in Biological Sciences*. The Category 1.b program offered by the *Department of Evolution, Ecology, and Organismal Biology* aims to widen research and future career opportunities for undergraduates at OSU. After successful completion of the certificate, the students will be well equipped to conduct independent research in natural sciences, understand the importance of research ethics and risk management, and communicate the relevance of skills gained to prospective employers in a range of fields.

The certificate proposal is the result of a thoughtful assessment of the curriculum and student interests. It was reviewed and endorsed by the *EEOB Curriculum Committee* on March 29, 2024. Our department plays a critical role in undergraduate research with committed faculty. As department chair, I can also attest to the existence of adequate infrastructure and course selection in EEOB that will make the implementation of the program a success.

Should you require further information, please do not hesitate to contact me.

Sincerely,



Bryan C. Carstens

Professor & Chair, Department of Evolution, Ecology, and Organismal Biology
Head of the Tetrapod Collection, Museum of Biological Diversity
Founding Editor, Bulletin of the Society of Systematic Biology

Dear Ian,

I have received feedback from the academic units in the College of Food, Agricultural, and Environmental Sciences, and I am pleased to let you know that the CFAES supports this new embedded undergraduate certificate in Research Methods in Biological Sciences. There are some suggestions from the various units for your consideration:

- Animal Sciences (contact Maurice Eastridge.1) – consider:
 - ANIMSCI 3420, Animal Laboratory Research Methods (0.5 cr): Laboratory format demonstrating the applications of animal research. Students will perform experiments using common research techniques associated with food animals, including experimental designs, commonly used laboratory techniques including reagent preparation, protein and nucleic acid purification and downstream analysis, including immunochemical assay development and optimization.
 - ANIMSCI 3480, Animal Welfare Laboratory (0.5 cr hr; with permission of instructor, EEOB 3420 could serve as a prerequisite): Laboratory experience exploring aspects of animal welfare, including biological functioning, affective state, and natural living. Course activities provide core concepts primarily in the area of applied animal welfare and behavior, with focus on food animal species.
- Entomology (contact Ellen Klinger.80) – consider:
 - ENTMLGY 2400H, Evaluating Evidence in Biology and Medicine: Explores information and scientific literacies in biology and medicine, with emphasis on science as reported in the media and the use of insects and other organisms as model systems. We use evolutionary theory as the unifying framework for all life on earth. The ability to scrutinize science as reported in popular sources and to procure additional, credible information is emphasized. Prereq: Honors standing. GE nat sci bio course. <https://entomology.osu.edu/courses/entmlgy-2400h>
 - ENTMLGY 5610, Greenhouse Plant Health and Pest Management: Overview of the principles of plant health and pest management applied to the production of plants and other commodities in controlled environments, including greenhouses, urban vertical agriculture, high tunnels, hydroponic systems, and interiorscapes. Prereq: Sr standing or above. <https://entomology.osu.edu/courses/entmlgy-5610>
- Food, Agricultural and Biological Engineering (contact Sami Khanal.3) – consider:
 - AGSYSMT 2580, Introduction to Digital Agriculture (2 cr): This course is designed to provide an overview of the emergence of data-driven processes and management within the agricultural sector, including coverage of sensor platforms in agriculture; data ownership, privacy and security concerns; and implications for profitability and environmental sustainability. This course has no prerequisites and is currently being offered.
 - AGSYSMT 5560, UAS and Remote Sensing (3 cr): This course provides an introduction to the fundamentals of remote sensing within the framework of Geographic Information Systems (GIS) and Unmanned Aerial Systems (UAS), and their applications in production agriculture. Lectures will focus on basic concepts on the use of satellite and UAS for data acquisition, image and GIS data processing, analysis, and interpretation. A variety of topics including remote sensing (satellite and UAS) technologies, Federal Aviation Administration (FAA) regulations and rulemaking for UAS, UAS types, mission planning, image collection, processing and interpretation, and their applications in agriculture will be covered. Laboratory exercises are designed to help students gain hands-on

experiences in the use of UAS, processing, and analyses of UAS-acquired images and their application in agriculture.

- AGSYSMT 5580, Data Analytics in Production Agriculture (3 cr): This course provides an overview of the principles of data management and analytics in support of field crop production, including exposure to common data generation and collection methodologies, and modeling approaches that support actionable spatial and temporal management recommendations at a sub-field level. Data errors, cleaning, and analytic techniques will be discussed. This course is being revised to include no prerequisites beyond senior standing; OR permission of instructor; OR Grad standing.
- Horticulture and Crop Sciences (contact Dave Barker.169 or Alex Lindsey.227) – consider:
 - HCS 3420, Seed Science
 - HCS 5887, Introduction to Experimental Design: Introduction to experimental design, including selection and layout of plots, data analysis software, and data interpretation. Prereq: 2260 or Stat 1450, or equiv; or Grad standing. In-person and online options.
- Plant Pathology (contact Monica Lewandowski.52)
 - Note – the course catalog code is PLNTPTH, not PLANTPATH
 - PLNTPTH 3002 requires PLNTPTH 3001 concurrently
- School of Environment and Natural Resources (contact Lauren Pintor.6) – remove:
 - REMOVE ENR 5358, Applied Vertebrate Physiological Ecology – Dr. Gray, the instructor of the course, notes that this is not a methods course and likely does not meet the objectives of the certificate.

Thank you for giving the CFAES the opportunity to review this proposal and provide feedback. Please let me know if you have any questions or need additional information.

Sincerely,

Jeanne



Jeanne M. Osborne | Pronouns: She, Her, Hers

Assistant Dean for Academic Affairs
College of Food, Agricultural, and Environmental Sciences
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'Unexpected kindness is the most powerful, least costly, and most underrated agent of human change' (Bob Kerrey)

From: Hamilton, Ian <hamilton.598@osu.edu>

Sent: Monday, February 26, 2024 10:32 AM

To: Osborne, Jeanne <osborne.2@osu.edu>

Subject: Proposed certificate in research methods in biological sciences

Dear Dean Osborne,

Instructors from the Department of Evolution, Ecology, and Organismal Biology have been developing a proposed Category 1.b embedded undergraduate certificate in Research Methods in Biological Sciences. This certificate would tie together several recently developed and existing EEOB courses on research design, ethics, and career prospects with methods courses that address student interests. We are proposing 100% overlap with student majors.

The goals of the certificate are that, after successful completion, students will be well equipped to conduct independent research in natural sciences, understand the importance of research ethics and risk management, and communicate the relevance of skills gained to prospective employers in a range of fields. To address these goals, the certificate program consists of three EEOB core courses and two electives. One of the EEOB core courses, EEOB 3496, Career Exploration in Ecology and Evolution, can be substituted with similar coursework from other departments.

The electives will provide students with a broad range of research methods based on interest and future goals. We have that suggested *ENR 4345 Methods in Aquatic Ecology*, *ENR 5358 Applied Vertebrate Physiological Ecology*, and *ENR 5362 Wildlife Ecology Methods* as candidates for the elective courses, but we would appreciate any feedback on ENR courses that would be appropriate.

A draft of this proposal is attached. We would appreciate any feedback, questions, or concerns you may have with this proposal, including suggestions for additional courses to include or courses to remove from our list of electives. Our goal is to submit this proposal to the Arts & Sciences Curriculum Committee this semester, so feedback by March 22, if possible, would be appreciated.

Thank you very much,
Ian



Ian Hamilton

Professor

Vice Chair of Undergraduate Studies, EEOB

College of Arts & Sciences

Department of Evolution, Ecology and Organismal Biology & Department of Mathematics

390 Aronoff Laboratory, 318 W 12th Ave, Columbus, OH 43210

hamilton.598@osu.edu

Pronouns: he/him/his

Ian,

I think this proposal looks great. It is well thought out and I have no concerns with moving forward.

As you know, one of the ongoing issues the CLSE has been trying to address is how to get more of the Biology majors research opportunities given the disparity between the number of our majors and the available faculty / opportunities. A version of what you've proposed here specific for the Biology major would potentially open additional opportunities for students. At your convenience, I'd love the opportunity to discuss that possibility of the CLSE mirroring a similar proposal. We certainly don't want to do anything that would take away from EEOB enrollments, so we could direct students to many of the EEOB courses, to the extent enrollment capacities allow.

What you've proposed here is a brilliant direction and a great opportunity for students. We wholehearted support the proposal.

Regards,
Adam



Adam L. Andrews

Assistant Director for Curriculum & Instruction
College of Arts and Sciences | Center for Life Sciences Education

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From: Hamilton, Ian <hamilton.598@osu.edu>

Date: Monday, February 26, 2024 at 10:17 AM

To: Fisk, Harold <fisk.13@osu.edu>, Andrews, Adam <andrews.171@osu.edu>

Subject: Proposed Certificate in Research Methods in Biological Sciences

Dear Harold and Adam,

Instructors from the Department of Evolution, Ecology, and Organismal Biology have been developing a proposed Category 1.b embedded undergraduate certificate in Research Methods in Biological Sciences. This certificate would tie together several recently developed and existing EEOB courses on research design, ethics, and career prospects with methods courses that address student interests. We are proposing 100% overlap with student majors.

The goals of the certificate are that, after successful completion, students will be well equipped to conduct independent research in natural sciences, understand the importance of research ethics and risk management, and communicate the relevance of skills gained to prospective employers in a range of fields. To address these goals, the certificate program consists of three EEOB core courses and two electives. One of the EEOB core courses, EEOB 3496, Career Exploration in Ecology and Evolution, can be substituted with similar coursework from other departments. The electives will provide students with a broad range of research methods based on interest and future goals.

A draft of this proposal is attached. We would appreciate any feedback, questions, or concerns you may have with this proposal, including suggestions for additional courses to include or courses to remove from our list of electives. Our goal is to submit this proposal to the ASCC this semester, so feedback by March 22, if possible, would be appreciated.

Thank you very much,
Ian



Ian Hamilton

Professor

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Hello Ian,

I am responding to your certificate proposal as the Director of Undergrad Studies for Geography.

We believe that the proposed certificate sounds like a great idea for your students and concur with the offering.

We would like to make one suggestion and that is to include GEOG 3980: Biogeography: And introduction to life on Earth as one of the electives as well. We believe the course content is in nice alignment with the topics and other courses being offered as electives. Please refer to <https://geography.osu.edu/courses/geog-3980> for a syllabus.

Thanks for your consideration!

Let me know if you have any additional questions!

-Jana



Dr. Jana Houser
Director of Undergraduate Studies
Associate Professor of Meteorology
Atmospheric Sciences Program
Department of Geography
The Ohio State University
Columbus, OH

From: Coleman, Mat <coleman.373@osu.edu>

Sent: Monday, February 26, 2024 10:45 AM

To: Houser, Jana <houser.262@osu.edu>

Subject: FW: Proposed certificate in research methods in biological sciences

Hi Jana—

This is a concurrence request, even though that wasn't explicitly noted.

The proposal is narrowly focused on biological research methods, and I believe we should concur. One point is their inclusion of GEOG 5210 9Fundamentals of GIS), which is great. But I wonder if we shouldn't also alert them to Al's GEOG 3980 (Biogeography: An Introduction to Life on Earth). See the most recent syllabus at: <https://geography.osu.edu/courses/geog-3980> Methodologically it is focused on how to

know the distribution of Earth's biological diversity. I believe this would make for an excellent elective for the certificate.

Can I leave this to you to handle?

Mat



Mat Coleman

Professor and Department Chair

Department of Geography, College of Social and Behavioral Sciences

<http://u.osu.edu/coleman.373/>

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The Ohio State University occupies land that is the ancestral and contemporary territory of the Shawnee, Potawatomi, Delaware, Miami, Peoria, Seneca, Wyandotte, Ojibwe and Cherokee peoples. The university resides on land ceded in the 1795 Treaty of Greenville and the forced removal of tribes through the Indian Removal Act of 1830.

The Ohio State University is a land grant institution. Land grants nationwide received funding through the 1862 Morrill Act, which gave so-called 'public' land taken from tribal nations to states to seed institutions of higher education. The Ohio State University was funded through the sale of 630,000 acres of 'public' land, carefully documented at <https://www.landgrabu.org/universities>

From: Hamilton, Ian <hamilton.598@osu.edu>

Date: Monday, February 26, 2024 at 10:33 AM

To: Coleman, Mat <coleman.373@osu.edu>

Subject: Proposed certificate in research methods in biological sciences

Dear Prof. Coleman,

Instructors from the Department of Evolution, Ecology, and Organismal Biology have been developing a proposed Category 1.b embedded undergraduate certificate in Research Methods in Biological Sciences. This certificate would tie together several recently developed and existing EEOB courses on research design, ethics, and career prospects with methods courses that address student interests. We are proposing 100% overlap with student majors.

The goals of the certificate are that, after successful completion, students will be well equipped to conduct independent research in natural sciences, understand the importance of research ethics and risk management, and communicate the relevance of skills gained to prospective employers in a range of fields. To address these goals, the certificate program consists of three EEOB core courses and two

electives. One of the EEOB core courses, EEOB 3496, Career Exploration in Ecology and Evolution, can be substituted with similar coursework from other departments.

The electives will provide students with a broad range of research methods based on interest and future goals. We have suggested *GEOG 5210 – Fundamentals of GIS* as an elective courses, but we would appreciate any feedback on Geography courses that would be appropriate.

A draft of this proposal is attached. We would appreciate any feedback, questions, or concerns you may have with this proposal, including suggestions for additional courses to include or courses to remove from our list of electives. Our goal is to submit this proposal to the ASCC this semester, so feedback by March 22, if possible, would be appreciated.

Thank you very much,
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Ian Hamilton

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