The College of Integrative Sciences (CIS) aims to equip students with the creative and quantitative skills needed to address current and emerging global challenges in science and technology. These challenges are multifaceted, requiring problem-solving approaches that integrate expertise from multiple perspectives.

The CIS promotes an interdisciplinary and integrative approach to scholarship and learning across mathematics and the life, physical, and behavioral sciences. By encouraging creative synergies among faculty and students of disparate disciplines, the CIS academic structure complements existing departments and has the flexibility to evolve with the needs of an ever-changing world.

Research is key to the CIS. With a faculty mentor, student researchers pursue inquiry-based learning that explores open questions and provides new perspectives. They develop the necessary problem-solving skills and build expertise at the frontiers of science. Through research, students are transformed from consumers into creators of knowledge.

Students interested in the CIS are advised to follow a course of study that emphasizes a core science background, achieved by pursuing a major in one of the departments or programs in natural science and mathematics (NSM). The linked major offered by the CIS combines the intellectual depth in one area (the major) with breadth achieved through courses and research in the linked major.

**FACULTY**

**Manju Hingorani**  
BS, University of Bombay; PHD, Ohio State University  
Professor of Molecular Biology and Biochemistry; Professor, Integrative Sciences

**Barbara Jean Juhasz**  
BA, Binghamton University; MA, University Mass Amherst; PHD, University of Massachusetts Amherst  
Associate Professor of Psychology; Associate Professor, Integrative Sciences; Associate Professor, Neuroscience and Behavior; Coordinator, Civic Engagement

**Daniel Krizanc**  
BS, University of Toronto; PHD, Harvard University  
Professor of Computer Science; Vice-Chair, Mathematics and Computer Science; Professor, Environmental Studies; Professor, Integrative Sciences; Co-Coordinator, Informatics and Modeling

**Daniel Moller**  
MS, Louisiana Technical University; PHD, Louisiana Technical University  
Assistant Professor of the Practice in Integrative Sciences

**Edward C. Moran**  
BS, Pennsylvania State University; MA, Columbia University; MPHIL, Columbia University; PHD, Columbia University  
Professor of Astronomy; Director, Van Vleck Observatory; Professor, Integrative Sciences; Co-Coordinator, Planetary Science

**Ishita Mukerji**  
AB, Bryn Mawr College; PHD, University of California, Berkeley  
Fisk Professor of Natural Science; Professor of Molecular Biology and Biochemistry; Professor, Integrative Sciences; Coordinator, Health Studies; Co-Coordinator, Molecular Biophysics

**Michelle Louise Personick**  
BA, Middlebury College; PHD, Northwestern University  
Assistant Professor of Chemistry; Assistant Professor, Integrative Sciences

**Dana Royer**  
BA, University of Pennsylvania; PHD, Yale University  
Professor of Earth and Environmental Sciences; Chair, Earth and Environmental Sciences; Professor, Integrative Sciences; Professor, Environmental Studies

**Francis W. Starr**  
BS, Carnegie Mellon University; MS, Boston University; PHD, Boston University  
Professor of Physics; Director, College of Integrative Sciences; Professor, Integrative Sciences; Professor, Molecular Biology and Biochemistry; Coordinator, Integrated Design, Engineering and Applied Science

**Ellen Thomas**  
BS, University of Utrecht; MS, University of Utrecht; PHD, University of Utrecht  
Harold T. Stearns Professor of Integrative Sciences; University Professor in the College of Integrative Sciences; Research Professor, Earth and Environmental Sciences

**Greg A. Voth**  
BS, Wheaton College; MS, Cornell University; PHD, Cornell University  
Professor of Physics; Chair, Physics; Professor, Integrative Sciences

**Michael P. Weir**  
BS, University of Sussex; PHD, University of Pennsylvania  
Professor of Biology; Professor, Integrative Sciences; Co-Coordinator, Informatics and Modeling

**AFFILIATED FACULTY**

**Gloster B. Aaron**  
BA, Oberlin College; PHD, University of Pennsylvania  
Associate Professor of Biology; Chair, Neuroscience and Behavior; Associate Professor, Neuroscience and Behavior; Associate Professor, Integrative Sciences

**Christopher James Chenier**  
BA, Bard College; MA, University of Delaware  
Digital Design Technologist; Visiting Assistant Professor, College of Integrative Sciences; Visiting Assistant Professor of Art

**Frederick M. Cohan**  
BS, Stanford University; PHD, Harvard University  
Professor of Biology; Professor, Environmental Studies; Professor, Integrative Sciences

**Karen L. Collins**  
BA, Smith College; PHD, Massachusetts Institute of Technology  
Edward Burr Van Vleck Professor of Mathematics; Professor of Mathematics; Professor, Integrative Sciences

**Joseph David Coolon**  
BS, Kansas State University; PHD, Kansas State University  
Assistant Professor of Biology; Assistant Professor, Integrative Sciences

**William Herbst**  
BA, Princeton University; MAA, Wesleyan University; MSC, University of Toronto; PHD, University of Toronto  
John Monroe Van Vleck Professor of Astronomy; Professor of Astronomy; Professor, Integrative Sciences

**Scott G. Holmes**  
BS, College of William and Mary; PHD, University of Virginia
Professor of Molecular Biology and Biochemistry; Professor, Integrative Sciences

Meredith Hughes
BS, Yale University; PHD, Harvard University
Assistant Professor of Astronomy; Assistant Professor, Integrative Sciences

Ruth Ineke Johnson
BS, University of Witwatersrand; PHD, Cambridge University
Assistant Professor of Biology; Assistant Professor, Integrative Sciences

Tsampikos Kottos
BA, University of Crete; MS, University of Crete; PHD, University of Crete
Professor of Physics; Professor, Integrative Sciences; Professor, Mathematics

Timothy C.W. Ku
BS, University of Rochester; MS, University of Michigan; PHD, University of Michigan
Associate Professor of Earth and Environmental Sciences; Associate Professor, Integrative Sciences

Psye Loui
BS, Duke University; PHD, University of California, Berkeley
Assistant Professor of Psychology; Assistant Professor, Neuroscience and Behavior; Assistant Professor, Integrative Sciences

Michael A. McAlear
BS, McGill University; PHD, McGill University
Associate Professor of Molecular Biology and Biochemistry; Associate Professor, Integrative Sciences

Brian Hale Northrop
BA, Middlebury College; PHD, University of California LA
Associate Professor of Chemistry; Associate Professor, Integrative Sciences

Stewart E. Novick
BS, SUNY at Stony Brook; MA, Harvard University; MAA, Wesleyan University; PHD, Harvard University
Joshua Boger University Professor of the Sciences and Mathematics; Professor of Chemistry; Professor, Integrative Sciences

Donald B. Oliver
BS, Brandeis University; MAA, Wesleyan University; PHD, Tufts University
Daniel Ayres Professor of Biology; Professor of Molecular Biology and Biochemistry; Professor, Integrative Sciences

Rich Olson
BA, Cornell University; PHD, Columbia University
Associate Professor of Molecular Biology and Biochemistry; Associate Professor, Integrative Sciences

Seth Redfield
BM, New Eng Consv Music; BS, Tufts University; MS, University of Colorado Boulder; PHD, University of Colorado Boulder
Associate Professor of Astronomy; Chair, Astronomy Department; Associate Professor, Integrative Sciences; Co-Coordinator, Planetary Science

Mike Robinson
BS, University of Sussex; MS, McGill University; PHD, McGill University
Assistant Professor of Psychology; Assistant Professor, Neuroscience and Behavior; Assistant Professor, Integrative Sciences

Irina M. Russu
BS, University of Bucharest; MAA, Wesleyan University; PHD, University of Pittsburgh
E. B. Nye Professor of Chemistry; Professor of Chemistry; Professor, Integrative Sciences

Meng-ju Renee Sher
BA, Wesleyan University; MA, Harvard University; PHD, Harvard University
Assistant Professor of Physics; Assistant Professor, Integrative Sciences

Colin A. Smith
BA, New York University; PHD, University of California, San Francisco
Assistant Professor of Chemistry; Assistant Professor, Molecular Biology and Biochemistry; Assistant Professor, Integrative Sciences

Erika A. Taylor
BS, University of Michigan; PHD, University of Illinois Urbana
Associate Professor of Chemistry; Associate Professor, Environmental Studies; Associate Professor, Integrative Sciences

T. David Westmoreland
BS, Massachusetts Institute of Technology; PHD, University of North Carolina at Chapel Hill
Associate Professor of Chemistry; Chair, Chemistry; Associate Professor, Integrative Sciences

VISITING FACULTY

Christopher S. Weaver
BS, Hobart College; CAS, Wesleyan University; MALS, Wesleyan University; SM, Massachusetts Institute of Technology
Distinguished Professor of Computational Media in the College of Integrative Sciences

CIS115 Experiential Design and Application
This course, co-taught with Director of Physical Plant Operations Mike Conte, will allow students to work directly with Facilities employees to design and execute modifications and repairs to existing Wesleyan spaces. The specific projects will change from semester to semester, but could include designing and building informal learning spaces, and planning and carrying out repairs and modifications to mechanical and plumbing systems. Students will learn design and engineering by carrying out projects to improve Wesleyan’s facilities. Students must be willing to work with tools and machinery with supervision. The grading in this quarter-credit repeatable course will be based primarily on active participation, and the class meetings will be held on location and at times built around participants’ schedules.
Offering: Host
Grading: Cr/U
Credits: 0.25
Gen Ed Area: NSM-CIS
Prereq: None

CIS116 Designing Books
This intensive course will help students to understand how books are physically designed and created. Students will learn to use the book format in their work as a means of expanding, preserving, and restructuring ideas. After a visit to Special Collections and Archives to look at examples of artists’ books and a review of 1200 years of Eastern and Western book binding types, students will make at least eight books, including an accordion book, a long-stitch book, a Coptic stitch book, side-sewn bindings including a Japanese four-hole stitch books,
variations on pamphlet binding and a map fold book, as well as a simple box. The properties of bookbinding materials will be discussed in detail. No prior experience is necessary.

Offering: Host
Grading: Cr/U
Credits: 0.50
Gen Ed Area: NSM-CIS
Prereq: None

CIS121 Wesleyan Mathematics and Science Scholars Colloquium I
This weekly colloquium of participants in the Wesleyan Mathematics and Science Scholars (WesMaSS) Program will provide participants with a framework for taking full advantage of the educational opportunities in the natural sciences and mathematics available at Wesleyan. Class sessions and assignments are designed to help students to develop effective individual and group study skills, to promote cohort-building, and to navigate the "hidden curriculum" in higher education.

Offering: Host
Grading: Cr/U
Credits: 0.25
Gen Ed Area: NSM-CIS
Prereq: None

CIS122 Wesleyan Mathematics and Science Scholars Colloquium II
This weekly colloquium of participants in the Wesleyan Mathematics and Science Scholars (WesMaSS) Program will be focused on strategies for success in science and math higher education.

Offering: Host
Grading: Cr/U
Credits: 0.25
Gen Ed Area: NSM-CIS
Prereq: None

CIS135 Mindfulness
During this course, students will be introduced to various techniques of mindfulness practice and awareness, including sitting meditation and yoga. These modalities are designed to aid in stress and anxiety reduction and, when practiced diligently, may also offer opportunities for greater self-awareness and personal development. The goal is to give students not only a peer community but also a contemplative toolbox that is portable, replicable, and sustainable. Students will gain an understanding of the roles these practices can play in leading a happier, healthier, and more fulfilling life.

Offering: Host
Grading: Cr/U
Credits: 0.25
Gen Ed Area: SBS-CIS
Prereq: None

CIS150 The Science Behind Popular Scientific Literature
The Science Behind Popular Scientific Literature. This course focuses on academic STEM writing and is an exploration of the scientific literature in the reference list of Elizabeth Kolbert’s "The Sixth Extinction." Assignments will consist of numerous low-stakes writing prompts with extensive peer and instructor feedback, and a term project paper constructed along the lines of a STEM review paper. This course fulfills a key need in developing science literacy and teaching students how to find and use reliable sources to critically evaluate popular science writing.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CIS
Identical With: WRCT150
Prereq: None

CIS150F The Science Behind Popular Scientific Literature (FYS)
The Science Behind Popular Scientific Literature. This course focuses on how to present material to a scientific audience and is an exploration of the scientific literature in the reference lists of Rachel Carson’s "Silent Spring." Assignments will consist of numerous low-stakes writing assignments with extensive peer and instructor feedback, and a term project paper constructed along the lines of a STEM review paper. This course fulfills a key need in developing science literacy and teaching students how to find and use reliable sources to critically evaluate popular science writing.

Offering: Host
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-CIS
Identical With: WRCT150F
Prereq: None

CIS160 Life in the Oceans in the Anthropocene and Beyond
Little is known about life in the deep sea, the largest habitat on Earth, even about the largest animals living there, such as the giant squid. Humans, however, are severely affecting even these most remote areas of our planet, and wildlife populations in the oceans have been badly damaged by human activity. We will look at the amazing diversity of ocean life and the disparate building plans of its animals, and see how oceanic ecosystems are fundamentally different from land ecosystems. Then we will explore how human actions are affecting oceanic ecosystems directly, for instance by overfishing (especially of large predators and filter feeders), addition of nutrients (eutrophication) and pollutants, and the spread of invasive species, as well as indirectly, through emission of carbon compounds into the atmosphere. Rising atmospheric CO2 levels lead to ocean acidification and global warming, affecting the all-important metabolic rates of ocean life, as well as oceanic oxygen levels and stratification, thus productivity. We will try to predict the composition of future ecosystems by looking at ecosystem changes during periods of rapid warming in the geological past and see whether future ecosystems will become dominated by jellyfish, as they were 600 million years ago.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-EE5
Identical With: E&ES160
Prereq: None

CIS170 Introduction to Design and Engineering
This course will provide a hands-on introduction to design and engineering. Students will engage in individual and team projects in a studio environment where we seek to develop a shared practice and understanding of the engineering design process. We will study biological organisms to find inspiration for design of hoppers, swimmers, and climbers. Students will build skills using computer-aided design (CAD) software and using tools for fabrication and prototyping including laser cutting and 3D printing. We will also hone skills in identifying which scientific and engineering principles need to be understood to achieve design goals.

Offering: Crosslisting
Grading: Cr/U
Credits: 1.00
Gen Ed Area: NSM-CIS
Identical With: PHYS170, IDEA170
Prereq: None

CIS173 Introduction to Sensors, Measurement, and Data Analysis
This course is an engineering fundamentals course supporting the Integrated Design, Engineering, and Applied Science (IDEAS) minor. It will involve a sequence of hands-on projects that introduce students to basic measurement devices and data analysis techniques using inexpensive modern sensors, a microprocessing platform (Arduino), and a computational software package
The course will provide foundational knowledge of available resources and techniques that allow students to more confidently implement measurement systems in subsequent courses of the IDEAS minor and better understand experimental devices used in scientific research activities.

**Offering: Crosslisting**
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CIS
Identical With: IDEA175
Prereq: None

**CIS175 Principles of Engineering**
Students will learn about engineering mechanics, electronic control systems, and physical actuators (e.g., for movement) using a microprocessor platform, sensors and motors. The final project will require a student team to ideate, design, analyze, and optimize a mechatronic system. This course will allow students to better understand components, methods, and challenges in mechatronics systems commonly found in automation and robotics. This course fulfills the project-based Design & Engineering course requirement for the Integrated Design, Engineering and Applied Science (IDEAS) minor degree program.

**Offering: Crosslisting**
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CIS
Identical With: IDEA175
Prereq: None

**CIS221 Research Frontiers in the Sciences I**
This seminar is designed to introduce students to interdisciplinary research projects in the sciences. Each week, a faculty member and his or her research group will present a broadly accessible overview of research work, including a description of methodologies, problem-solving activities, and future directions.

**Offering: Host**
Grading: Cr/U
Credits: 0.50
Gen Ed Area: NSM-CIS
Prereq: None

**CIS222 Research Frontiers in the Sciences II**
This seminar is designed to introduce students to interdisciplinary research projects in the sciences. Each week, a faculty member and his or her research group will present a broadly accessible overview of research work, including a description of methodologies, problem-solving activities, and future directions.

**Offering: Host**
Grading: Cr/U
Credits: 0.50
Gen Ed Area: NSM-CIS
Prereq: None

**CIS231 Modeling and Data Analysis: From Molecules to Markets**
The development of models to describe physical or social phenomena has a long history in several disciplines, including physics, chemistry, economics, and sociology. With the emergence of ubiquitous computing resources, model building is becoming increasingly important across all disciplines. This course will examine how to apply modeling and computational thinking skills to a range of problems. Using examples drawn from physics, biology, economics, and social networks, we will discuss how to create models for complex systems that are both descriptive and predictive. The course will include significant computational work. No previous programming experience is required, but a willingness to learn simple programming methods is essential.

**Offering: Crosslisting**
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-PHYS

**CIS239 Proseminar: Web Scraping**
Using Python and R programming tools, "Scraping the Web" is an introduction to the collection, measurement and management of publicly available information (data) from the World Wide Web.

**Offering: Crosslisting**
Grading: OPT
Credits: 0.50
Gen Ed Area: None
Identical With: QAC239
Prereq: COMP112 OR QAC155 OR QAC156

**CIS241 Introduction to Network Analysis**
This is an interdisciplinary hands-on course examining the application of network analysis in various fields. It will introduce students to the formalism of networks, software for network analysis, and applications from a range of disciplines (history, sociology, public health, business, political science). We will review the main concepts in network analysis and learn how to use the software (e.g., network analysis and GIS libraries in R) and will work through practice problems involving data from several sources (Twitter, Facebook, airlines, medical innovation, historical data). Upon completion of the course, students will be able to conduct independent research in their fields using network analysis tools.

**Offering: Crosslisting**
Grading: A-F
Credits: 1.00
Gen Ed Area: SBS-QAC
Identical With: QAC241
Prereq: None

**CIS250 Computational Media: Videogame Design and Development**
This course examines the interplay of art and science in the development of contemporary video games using “game tool” applications to achieve a variety of purposes. It combines a detailed understanding of computational media, including legal and commercial aspects, with hands-on experience in the creative process. There will be discussions with invited industry leaders in various subject areas. Students will have the opportunity to work as part of development teams and create working prototypes to understand the challenges and rewards of producing video games in a professional context.

**Offering: Crosslisting**
Grading: A-F
Credits: 2.00
Gen Ed Area: NSM-IDEA
Identical With: IDEA250, FILM250, COMP350
Prereq: None

**CIS251 Data Visualization: An Introduction**
This course will introduce students to the principles and tools necessary to present quantitative information in a visual way. While tables and graphs are widely used in our daily lives, it takes skill to deconstruct what story is being told. It also takes a perceptive eye to know when information is being misrepresented with particular graphics. The main goals of the course are for students to learn how to present information efficiently and accurately so that we enhance our understanding of complex quantitative information and to become proficient with data visualization tools. Beginning with basic graphing tools, we will work our way up to constructing map visualizations and interactive graphs. This course will require a substantial amount of computation in R. No prior programming experience is necessary, but learning does require willingness and time.

**Offering: Crosslisting**
Grading: A-F
Credits: 1.00
Gen Ed Area: SBS-QAC, NSM-QAC

**CIS253 Introduction to Computational Media**
This course will introduce students to the principles and tools necessary to present quantitative information in a visual way. While tables and graphs are widely used in our daily lives, it takes skill to deconstruct what story is being told. It also takes a perceptive eye to know when information is being misrepresented with particular graphics. The main goals of the course are for students to learn how to present information efficiently and accurately so that we enhance our understanding of complex quantitative information and to become proficient with data visualization tools. Beginning with basic graphing tools, we will work our way up to constructing map visualizations and interactive graphs. This course will require a substantial amount of computation in R. No prior programming experience is necessary, but learning does require willingness and time.

**Offering: Crosslisting**
Grading: A-F
Credits: 1.00
Gen Ed Area: SBS-QAC, NSM-QAC

**CIS254 Game Tool Development**
This course will introduce students to the principles and tools necessary to present quantitative information in a visual way. While tables and graphs are widely used in our daily lives, it takes skill to deconstruct what story is being told. It also takes a perceptive eye to know when information is being misrepresented with particular graphics. The main goals of the course are for students to learn how to present information efficiently and accurately so that we enhance our understanding of complex quantitative information and to become proficient with data visualization tools. Beginning with basic graphing tools, we will work our way up to constructing map visualizations and interactive graphs. This course will require a substantial amount of computation in R. No prior programming experience is necessary, but learning does require willingness and time.

**Offering: Crosslisting**
Grading: A-F
Credits: 1.00
Gen Ed Area: SBS-QAC, NSM-QAC

**CIS261 Introduction to Computational Media**
This course will introduce students to the principles and tools necessary to present quantitative information in a visual way. While tables and graphs are widely used in our daily lives, it takes skill to deconstruct what story is being told. It also takes a perceptive eye to know when information is being misrepresented with particular graphics. The main goals of the course are for students to learn how to present information efficiently and accurately so that we enhance our understanding of complex quantitative information and to become proficient with data visualization tools. Beginning with basic graphing tools, we will work our way up to constructing map visualizations and interactive graphs. This course will require a substantial amount of computation in R. No prior programming experience is necessary, but learning does require willingness and time.

**Offering: Crosslisting**
Grading: A-F
Credits: 1.00
Gen Ed Area: SBS-QAC, NSM-QAC
Identical With: QAC251
Prereq: None

CIS265 Bioinformatics Programming
This course is an introduction to bioinformatics and programming for students with interest in the life sciences. It introduces problem areas and conceptual frameworks in bioinformatics. The course assumes little or no prior programming experience and will introduce the fundamental concepts and mechanisms of computer programs and examples (e.g., sequence matching and manipulation, database access, output parsing, dynamic programming) frequently encountered in the field of bioinformatics.
Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: COMP113, MB&B265, BIOL265
Prereq: [MB&B181 or BIOL181]

CIS266 Bioinformatics
This course is an introduction to bioinformatics for students with interest in the life sciences. The course is similar to BIOL265 but only meets in the second half of the semester (with BIOL265) and is designed for students with programming background, ideally in Python. The course introduces problem areas and conceptual frameworks in bioinformatics and discusses programming approaches used in bioinformatics such as sequence matching and manipulation algorithms using dynamic programming, clustering analysis of gene expression data, analysis of genetic nets using Object Oriented Programming, and sequence analysis using Hidden Markov Models, Regular Expressions, and information theory.
Offering: Crosslisting
Grading: A-F
Credits: 0.50
Gen Ed Area: NSM-BIOL
Identical With: MB&B266, COMP266, BIOL266
Prereq: [MB&B181 OR BIOL181]

CIS284 Data, Art, and Visual Communication
This course looks at the ways the digital arts--broadly defined--can be used to explore the intersections of research, data, design, and art. Following a creative software “bootcamp,” students will execute projects intended to help them generate, manipulate, and remix data for the purposes of visual communication and art. Students will use Adobe Creative Suite and Processing, an open source programming language, and integrated development environment (IDE) built for electronic arts, new media, and visual design. In addition to working in the studio, seminars, readings, and student presentations will explore the role of data visualization, “big data,” and the web in culture and society today. No prior software knowledge or coding skills are required. Students working in STEM, humanities, and social sciences are encouraged to enroll.
Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: HA-ART
Identical With: ARST484
Prereq: None

CIS285 Generative Art, Computational Media, and Creative Coding
In this course, students will learn to use computers and software as platforms for creative expression. Following a series of intensive coding workshops, students will learn to execute projects involving chance operations, rule-based systems, simulated autonomy, and interactivity. These projects will emerge as animations, drawings, prints, and screen-based artworks. Students will work primarily with the creative coding applications Processing and Grasshopper. These are coding environments designed by artists to facilitate the use of data, mathematics, and computation in visual practice. In addition to learning to program, students will translate their code into physical artifacts using computer-driven hardware such as a CNC router, a laser cutter, and Arduinos. Additionally, students will be exposed to the history and practice of generative and computational art through lectures and student presentations. This conceptual work will emphasize the formal and critical paradigms of computational media and design beginning in the 1960s.
Offering: Crosslisting
Grading: OPT
Credits: 1.00
Gen Ed Area: HA-ART
Identical With: ARST285
Prereq: ARST131

CIS307 Experimental Design and Causal Inference
The course provides the foundations and statistical thinking to design, collect, and analyze experimental data and introduces appropriate techniques for observational data when causal inference is the objective of the analysis. Throughout the course, we introduce and compare various experimental designs. We will discuss sample size and power calculations as well as the advantages and disadvantages of each of these designs. With observational data, we will explore difference-in-difference models, propensity score matching techniques, regression discontinuity designs. This course gives students the opportunity to develop further their computational skills as we learn how to describe, interpret, control, and draw inferences from experimental and observational data.
Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: SBS-QAC, NSM-QAC
Identical With: QAC307
Prereq: QAC201 OR PSYC200 OR MATH132 OR ECON300

CIS310 Genomics Analysis
This course is an introduction to genomics and analysis for students with interest in life sciences. It introduces current applications of genomics techniques, covers how to build a genomics workflow, and introduces statistical analyses in R programming language. This course assumes little or no prior programming experience and will provide hands-on experience in taking raw next-generation sequencing data through a custom workflow and ending with analyses in R statistical software.
Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: MB&B311, BIOL310
Prereq: [MB&B181 or BIOL181]

CIS320 Advanced Academic Writing
This course is designed to help students master the skills needed for thesis-level academic writing. The course uses an example-driven approach emphasizing an iterative revision process, with an emphasis on expository writing skills appropriate for publishable literature. Students will be encouraged to focus on their own independent research work as subject matter of writing exercises.
Offering: Crosslisting
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-CIS
Identical With: CIS520
Prereq: None

CIS321 Senior Colloquium I: Integrative Sciences
This colloquium provides students the opportunity to discuss and present their research to their peers and mentors, as well as explore current topics of interest to the group. A key goal will be developing students’ presentation skills because this is the primary means of promoting research. Faculty and peers will provide
CIS323 Bayesian Data Analysis: A Primer

This course introduces the applied principles of Bayesian statistical analysis. The Bayesian paradigm is particularly appealing in research where prior research and historical data are available on parameters of interest. This course will teach students appropriate techniques for analyzing data of this nature as well as broaden computational skills in R. The course will lay the foundation for Bayesian data analysis that students can use to further develop skills in decision making.

Offering: Host
Grading: A-F
Credits: 0.50
Gen Ed Area: NSM-CIS
Prereq: None

CIS323 Evolutionary and Ecological Bioinformatics

Bioinformatic analysis of gene sequences and gene expression patterns has added enormously to our understanding of ecology and evolution. For example, through bioinformatic analysis of gene sequences, we can now reconstruct the evolutionary history of physiology, even though no traces of physiology exist in the fossil record. We can determine the adaptive history of one gene and all the gene’s descendants. We can now construct the evolutionary tree of all of life. Bioinformatics is particularly promising for analysis of the ecology and biodiversity of microbial communities, since well over 99 percent of microorganisms cannot be cultured; our only knowledge of these organisms is through analysis of their gene sequences and gene expression patterns. For example, even when we cannot culture most of a microbial community, we can determine which metabolic pathways are of greatest significance through analysis of community-level gene expression. All these research programs are made accessible not only by breakthroughs in molecular technology but also by innovation in the design of computer algorithms. This course, team-taught by an evolutionary biologist and a computer scientist, will present how bioinformatics is revolutionizing evolutionary and ecological investigation and will present the design and construction of bioinformatic computer algorithms underlying the revolution in biology. Students will learn algorithms for reconstructing phylogeny, for sequence alignment, and for analysis of genomes, and students will have an opportunity to create their own algorithms.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: COMP527, BIOL527, COMP327, BIOL327

CIS3277 Mass Extinctions in the Oceans: Animal Origins to Anthropocene

Geoscientists are debating whether we are living in the Anthropocene, defined as a period during which humans are having a significant effect on atmospheric, geologic, hydrologic, and biospheric earth system processes. There is considerable discussion whether we are indeed affecting the biosphere to such an extent that life on Earth will suffer an extinction similar in magnitude to these that have occurred during earth history. Studies of the fossil record provide unique evidence that is used to evaluate the large extinctions of the past and compare them to ongoing extinction processes, extinctions rates and patterns, and magnitude. Organisms with hard skeletons are most easily and most abundantly preserved in the rock record. Many of these are invertebrates that lived in the oceans (e.g., clams, sea urchins, corals). In the first part of this course, students will become familiar with the nature of the fossil record, the most abundantly preserved in the rock record. Many of these are invertebrates that lived in the oceans (e.g., clams, sea urchins, corals). In the first part of this course, students will become familiar with the nature of the fossil record, the most common marine animals in the fossil record, and their evolution and diversification. Lectures will be combined with studying fossils. In the second part of this course, students will be familiar with the nature of the fossil record, the most common marine animals in the fossil record, and their evolution and diversification. Lectures will be combined with studying fossils. In the second part of the course, possible causes for mass extinction will be considered, together with their specific effects on environments and biota, and these predicted effects will be compared to what has been observed. Potential causes include asteroid and comet impacts, large volcanic eruptions, “hypercanes,” and “methane ocean eruptions,” and more exotic processes. Students will present in class on these topics, and we will compare rates and magnitude of environmental change with severity and patterns of extinction.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-EES
CIS540 Professional Development and Graduate School Preparation Seminar
The objectives of this course are (1) to build a supportive cohort that will help students sustain their goals when they enter graduate school and (2) to provide students with skills they will need to succeed in graduate school. Students will work on writing, presentation, and discussion skills. This will be done by reading classic books on writing, critiquing the ability of different figures and graphs to convey information, reading and discussing scientific papers, and giving research presentations.
Offering: Host
Grading: A-F
Credits: 0.50
Gen Ed Area: NSM-EES
Identical With: PSYC400, MB&B400, PHYS400, NS&B400
Prereq: None

CIS401 Individual Tutorial, Undergraduate
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CIS402 Individual Tutorial, Undergraduate
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CIS411 Group Tutorial, Undergraduate
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CIS412 Group Tutorial, Undergraduate
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CIS420 Student Forum
Student-run group tutorial, sponsored by a faculty member and approved by the chair of a department or program.
Offering: Host
Grading: Cr/U

CIS423 Advanced Research Seminar, Undergraduate
Advanced research tutorial; project to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CIS424 Advanced Research Seminar, Undergraduate
Advanced research tutorial; project to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CIS492 Teaching Apprentice Tutorial
The teaching apprentice program offers undergraduate students the opportunity to assist in teaching a faculty member’s course for academic credit.
Offering: Host
Grading: OPT

CIS520 Advanced Academic Writing
This course is designed to help students master the skills needed for thesis-level academic writing. The course uses an example-driven approach emphasizing an iterative revision process, with an emphasis on expository writing skills appropriate for publishable literature. Students will be encouraged to focus on their own independent research work as subject matter of writing exercises.
Offering: Host
Grading: OPT

Credits: 1.00
Gen Ed Area: NSM-CIS
Identical With: CIS320
Prereq: None

CIS540 STEM Equity and Inclusion
This course is open to all students at Wesleyan interested in learning about equity and inclusion in STEM. A weekly seminar will provide an overview of topics related to STEM equity, including the demographics of STEM fields, relevant sociology/psychology research (implicit bias, stereotype threat, impostor syndrome, mindset, etc.), ethics, social justice, and best practices for inclusive departments and programs. Students will be required to develop and evaluate proposals for activities to increase STEM equity and inclusion at Wesleyan, using the information provided during the seminar component of the course.
Offering: Crosslisting
Grading: Cr/U
Credits: 0.50
Gen Ed Area: None
Identical With: CIS40
Prereq: None

IDEA170 Introduction to Design and Engineering
This course will provide a hands-on introduction to design and engineering. Students will engage in individual and team projects in a studio environment where we seek to develop a shared practice and understanding of the engineering design process. We will study biological organisms to find inspiration for design of hoppers, swimmers, and climbers. Students will build skills using computer-aided design (CAD) software and using tools for fabrication and prototyping including laser cutting and 3D printing. We will also hone skills in identifying which scientific and engineering principles need to be understood to achieve design goals.
Offering: Host
Grading: Cr/U
Credits: 1.00
Gen Ed Area: NSM-CIS
Identical With: PHYS170, CIS170
Prereq: None

IDEA173 Introduction to Sensors, Measurement, and Data Analysis
This course is an engineering fundamentals course supporting the Integrated Design, Engineering, and Applied Science (IDEAS) minor. It will involve a sequence of hands-on projects that introduce students to basic measurement devices and data analysis techniques using inexpensive modern sensors, a microprocessing platform (Arduino), and a computational software package (Matlab). The course will provide foundational knowledge of available resources and techniques that allow students to more confidently implement measurement systems in subsequent courses of the IDEAS minor and better understand experimental devices used in scientific research activities.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CIS
Identical With: PHYS170, CIS170
Prereq: None

IDEA175 Principles of Engineering
Students will learn about engineering mechanics, electronic control systems, and physical actuators (e.g., for movement) using a microprocessor platform, sensors and motors. The final project will require a student team to ideate, design, analyze, and optimize a mechatronic system. This course will allow students to better understand components, methods, and challenges in mechatronics systems commonly found in automation and robotics. This course fulfills the
project-based Design & Engineering course requirement for the Integrated Design, Engineering and Applied Science (IDEAS) minor degree program.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CIS
Identical With: CIS175
Prereq: None

IDEA190 Digital Art
This course introduces students to the digital arts: a diverse mix of ideas and techniques brought together by a shared interest in the use of computation and software in creative production. Emphasis is placed on the development of students' ability to problem solve, experiment, and iterate using computers. Assignments and lectures will consider questions of skill, authorship, and information in the digital age while engaging with the history and critique of digital and electronic media in the arts. Students will use Adobe Creative Suite, Rhinoceros 3D, and other tools to complete projects.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: HA-ART
Identical With: ARST190
Prereq: None

IDEA233 Studies in Computer-based Modelling and Digital Fabrication
This course operates at the intersection of design and production, introducing students to digital tools critical to contemporary architecture and design. Throughout the semester, students will develop a series of projects that fluidly transition between design, representation, and fabrication with an emphasis on understanding how conceptual design interfaces with material properties. The course will offer a platform for students to research, experiment, and, ultimately, leverage the potential of digital tools toward a wide array of fields and disciplines. Students will be expected to utilize the Digital Design Studio's resources, including 3D printers, laser cutter, and 4-Axis CNC mill, as well a selection of fabrication equipment housed in the school's metal and wood shops to represent, model, and realize a series of design projects.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: HA-ART
Identical With: ARST233
Prereq: None

IDEA250 Computational Media: Videogame Design and Development
This course examines the interplay of art and science in the development of contemporary video games using "game tool" applications to achieve a variety of purposes. It combines a detailed understanding of computational media, including legal and commercial aspects, with hands-on experience in the creative process. There will be discussions with invited industry leaders in various subject areas. Students will have the opportunity to work as part of development teams and create working prototypes to understand the challenges and rewards of producing video games in a professional context.

Offering: Host
Grading: A-F
Credits: 2.00
Gen Ed Area: NSM-IDEA
Identical With: FILM250, CIS250, COMP350
Prereq: None

IDEA283 Physical Computing in Art and Design
This course aims to extend students' notions of the potential for the use of computers in the artist's studio by exploring opportunities in technology and art beyond familiar mouse, keyboard, and screen interactions. Moving away from these restrictions, students will learn basic electronics and programming using a microcontroller. The size of a postage stamp, these single-chip computers will provide students a window into the creative uses of computers in interactive, kinetic, and installation art. Combining microcontrollers with sensors placed on bodies, in physical objects, or in the environment, weekly projects will provide students with basic skills cumulatively leading to application in individual or collaborative projects. Through readings, discussions, and design of individual and collaborative work, students are expected to develop and articulate a theoretical basis for conceptualizing and discussing works presented in class, as well as their own creative projects. Students will maintain rigorous documentation of their process and progress in this course using blogs. No previous skills or software experience is required.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: HA-ART
Identical With: ARST283
Prereq: ARST131

IDEA492 Teaching Apprentice Tutorial
The teaching apprentice program offers undergraduate students the opportunity to assist in teaching a faculty member's course for academic credit.

Offering: Host
Grading: OPT