College of Integrative Sciences

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

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

Kelly Marie Thayer
BA, Regis College; PhD, Wesleyan University
Assistant Professor of the Practice in Integrative Sciences

Ellen Thomas
BS, University of Utrecht; MS, University of Utrecht; PhD, University of Utrecht
Harold T. Stearns Professor of Integrative Sciences; Smith Curator of Paleontology of the Joe Webb Peoples Museum of Natural History; University Professor in the College of Integrative Sciences; Research Professor, Earth and Environmental Sciences

Affiliated Faculty

Gloster B. Aaron
BA, Oberlin College; PhD, University of Pennsylvania
Associate Professor of Biology; Director, WesMASS; Associate Professor, Neuroscience and Behavior; Associate Professor, Integrative Sciences

Michael A. Calter
BS, University of Vermont; PhD, Harvard University
Professor of Chemistry; Chair, Chemistry; Professor, Integrative Sciences

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

Frederick M. Cohan
BS, Stanford University; PhD, Harvard University
Huffington Foundation Professor in the College of the Environment; 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; Chair, Mathematics and Computer Science; Professor, Integrative Sciences

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

Candice M Eton
BA, New York University; BFA, New York University; PhD, Harvard University
Assistant Professor of Physics; Assistant Professor, Chemistry; Assistant Professor, Integrative Sciences; Assistant Professor, Molecular Biology and Biochemistry

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

Cameron Donnay Hill
BA, Yale University; PhD, University of California, Berkeley
Assistant Professor of Mathematics; Assistant 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

Mark A. Hovey
BS, Ohio State University; PhD, Massachusetts Institute of Technology
Associate Provost; Professor of Mathematics; Professor, Integrative Sciences

Meredith Hughes
BS, Yale University; PhD, Harvard University
Associate Professor of Astronomy; Associate Professor, Integrative Sciences

Ruth Ineke Johnson
BS, University of Witwatersrand; PhD, Cambridge University
Associate Professor of Biology; Associate Professor, Integrative Sciences

Barbara Jean Juhasz
BA, Binghamton University; MA, University of Massachusetts Amherst; PhD, University of Massachusetts Amherst
Jeffrey L. Shames Professor of Civic Engagement; Associate Professor of Psychology; Chair, Neuroscience and Behavior; Associate Professor, Integrative Sciences; Associate Professor, Neuroscience and Behavior; Coordinator, Civic Engagement

Roy E. Kilgard
BA, Valdosta St University; PhD, University of Leicester
Associate Professor of the Practice in Astronomy; Associate Professor of the Practice, Integrative Sciences

Tsampikos Kottos
BA, University of Crete; MS, University of Crete; PhD, University of Crete
Lauren B. Dachs Professor of Science and Society; Professor of Physics; Professor, Integrative Sciences; Professor, Mathematics

Daniel Krizanc
BS, University of Toronto; PHD, Harvard University
Edward Burr Van Vleck Professor of Computer Science; Professor of Computer Science; Professor, Integrative Sciences; Professor, Environmental Studies; Co-Coordinator, Informatics and Modeling

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

Robert P. Lane
BA, Colgate University; PHD, California Institute Tech
Associate Professor of Molecular Biology and Biochemistry; Chair, Molecular Biology and Biochemistry; Associate Professor, Integrative Sciences

James Lipton
BS, U Nebraska Lincoln; MSC, Cornell University; PHD, Cornell University
Professor of Computer Science; Professor, Integrative Sciences

Amy MacQueen
BA, Columbia University; PHD, Stanford University
Associate Professor of Molecular Biology and Biochemistry; Associate Professor, Integrative Sciences

Alexis May
BA, Wesleyan University; MA, University British Columbia; PHD, University British Columbia
Assistant Professor of Psychology; Assistant Professor, Integrative Sciences

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

Laverne Melon
BA, Middlebury College; MS, SUNY at Binghamton University; PHD, Purdue University W Lafyte
Assistant Professor of Biology; Assistant Professor, Neuroscience and Behavior; Assistant Professor, 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; Director, College of Integrative Sciences; Professor, Integrative Sciences; Professor, Environmental Studies; Co-Coordinator, Molecular Biophysics; Coordinator, Health Studies

Janice R. Naegele
BA, Mount Holyoke College; PhD, Massachusetts Institute of Technology
Alan M. Dachs Professor of Science; Professor of Biology; Professor, Neuroscience and Behavior; Professor, Integrative Sciences

Brian Hale Northrop
BA, Middlebury College; PhD, University of California, Los Angeles
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

Suzanne B. O’Connell
BA, Oberlin College; MS, SUNY at Albany; PHD, Columbia University
Professor of Earth and Environmental Sciences; Professor, Integrative Sciences

Alison L. O’Neil
BS, Binghamton University; PHD, Montana State University
Assistant Professor of Chemistry; Assistant Professor, Neuroscience and Behavior; Assistant 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

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

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

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

Brian A. Stewart
BS, Stanford University; PHD, Massachusetts Institute of Technology
Offering:

experience is necessary. The properties of bookbinding materials will be discussed in detail. No prior

stitch book, side-sewn bindings including a Japanese four-hole stitch books, at least eight books, including an accordion book, a long-stitch book, a Coptic

1200 years of Eastern and Western book binding types, students will make

a means of expanding, preserving, and restructuring ideas. After a visit to Special
designed and created. Students will learn to use the book format in their work as

CIS116 Designing Books
Prereq: None
Gen Ed Area: NSM-CIS

VISITING FACULTY

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

- Undergraduate College of Integrative Sciences Major (catalog.wesleyan.edu/ departments/cis/ugrd-cis)

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

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 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: 0.50
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: 0.50
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

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

Greg A. Voth
BS, Wheaton College; MS, Cornell University; PHD, Cornell University
Professor of 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

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

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

VISITING FACULTY
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

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
design engineering 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: A-F
Credits: 0.50
Gen Ed Area: NSM-CIS
Identical With: IDEA170, PHYS170
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
(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: Crosslisting

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CIS
Identical With: IDEA173
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

CIS211 Research Frontiers in the Sciences I
This seminar is designed to introduce students to the exciting and cutting-edge
research activity at Wesleyan across all the sciences and mathematics, and to
introduce faculty with active research labs to students interested in working in a
lab. The course showcases what research at the college level actually entails, and
which projects Wesleyan faculty are actively researching. CIS 221 is scheduled in
the fall, CIS 222 in the spring. Both are gateway classes to admission into the CIS,
but also recommended to students broadly interested in the sciences who have
not yet decided on a major. There is no overlap in speakers between CIS 221 and
CIS 222, and students may take both.
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 the exciting and cutting-edge
research activity at Wesleyan across all the sciences and mathematics, and to
introduce faculty with active research labs to students interested in working in a
lab. The course showcases what research at the college level actually entails, and
which projects Wesleyan faculty are actively researching. CIS 221 is scheduled in
the fall, CIS 222 in the spring. Both are gateway classes to admission into the CIS,
but also recommended to students broadly interested in the sciences who have
not yet decided on a major. There is no overlap in speakers between CIS 221 and
CIS 222, and students may take both.
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 programing methods is essential.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-PHYS
Identical With: PHYS221, QAC221
Prereq: None

CIS239 Proseminar: Machine Learning Methods for Text, Audio and Video Analysis
In this course, students will learn machine learning techniques to analyze text, audio, and video data. The course consists of three parts: text analysis, audio analysis and video analysis. Each part will first introduce how these non-traditional data can be converted into mathematical objects suitable for computer processing and, particularly, for the application of machine learning techniques. Then students will learn a selection of supervised and unsupervised learning algorithms that are effective for text, audio/image/video analysis. Finally, students will explore major applications of these techniques such as sentiment analysis, speech emotion recognition, face recognition, pedestrian detection, keyframe extraction.

Offering: Crosslisting
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-QAC
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

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: NSM-QAC, SBS-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: BIOL265, MB&B265, COMP113
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: BIOL266, COMP266, MB&B266
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 Form And Code
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: NSM-CIS
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: NSM-QAC, SBS-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: BIOL310, MB&B311
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 Special Topics in Integrative Sciences
This course is open to all Wesleyan students interested in learning about equity and inclusion in STEM. The first half of the semester will focus on providing an overview of topics related to STEM equity, including the demographics of STEM fields, relevant sociology/psychology research (implicit bias, stereotype threat, imposter 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. In the second half of the course, we will discuss science topics with the goal of developing an integrative perspective of each topic. Initial discussions will focus on the Drake equation, an equation developed to understand the probability of finding intelligent life on another planet, and will move on to discuss other topics of interest. Classes will include guest lectures from faculty members who will discuss aspects of the Drake equation from the point of view of their own expertise. Students will also work on their presentation skills, oral and written, as this is a primary means for scientists to communicate with their peers and the public.

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

CIS322 Senior Colloquium II: 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 insights and advice. Mentors from the primary department or programs will also be invited.

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

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: Crosslisting
Grading: A-F
Credits: 0.50
Gen Ed Area: NSM-QAC, SBS-QAC
Identical With: QAC323
Prereq: MATH132 OR ECON300 OR [GOVT367 or QAC302]

CIS327 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 analyzing 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: BIOL327, COMP327, BIOL527, COMP527
Prereq: [BIOL182 or MB&B182] OR [BIOL196 or MBB196] OR COMP112 OR COMP211

CIS331 Video Games as/and the Moving Image: Art, Aesthetics, and Design
Video games are a mess. As a relatively new medium available on a range of platforms and in contexts ranging from the living room to the line for the bathroom, video games make new but confusing contributions to the meaning and possibilities of the moving image. We will work to understand what games are, what they can do, and how successful games do what they do best. Students will complete game design exercises, create rapid prototypes, playtest their games, and iteratively improve their games with play and their players in mind. They will complete analyses of games and game design projects both alone and in groups and participate in studio-style critiques of one another’s work.

Experience with computer programming is helpful but not essential.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: HA-FILM
Identical With: FILM331
Prereq: None

CIS340 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: Host
Grading: Cr/U
Credits: 0.50
Gen Ed Area: None
Identical With: CIS540
Prereq: None

CIS342 Molecules to Medicine
This course will explore the process of drug development, including target selection, lead discovery using computer-based methods and combinatorial chemistry/high-throughput screening, organic synthesis, bioavailability, clinical trials, and other factors (some economics and politics) involved in bringing a drug to the marketplace. Critical consideration of the variables to contend with at each step will be described and discussed, including aspects of research ethics and patent law. The basic science of molecular recognition, computer-aided drug design, and the role of factors from synthetic chemistry to toxicology will be presented. Case studies of the development of drugs recently successful in making the journey from molecule to medicine will be discussed, as well as the story of some that did not, and why. Emerging new design strategies such as fusion-protein therapies, crisper technology, and enhanced use of rational design and combinatorial methods will be emphasized, and how pharmaceutical research is evolving in the postgenomic era, particularly with biologics. Job opportunities in the pharmaceutical industry will be discussed.

Offering: Crosslisting
Grading: A-F

Credits: 1.00
Gen Ed Area: NSM-CHEM
Identical With: CHEM342, BIOL342, MB&B342
Prereq: CHEM252 OR MB&B208

CIS375 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 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-EE5
Identical With: E&ES236
Prereq: E&ES101 OR E&ES115 OR E&ES199 OR ASTR155 OR MB&B181

CIS400 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: None
Identical With: None
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
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

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: CIS340
Prereq: None

CIS550 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: CIS340
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: CIS173
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
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

IDEA1902 Digital Art
Please note: Some readings and assignments will be due during winter break, prior to arriving on campus for Winter Session. Please visit the Winter Session website for the full syllabus: http://www.wesleyan.edu/wintersession. This foundations-style course engages core topics in the production and critique of digital and electronic art. Project development, creative problem solving, and experimentation are taught through a series of assignments combining the software and tools most frequently employed in the digital studio. Students will learn to use Adobe Photoshop and Illustrator in conjunction with cameras, inkjet printers, scanners, and a laser cutter. While developing a range of procedural skills such as compositing, animation, and projection, students will search for new ways to employ digital tools across the visual arts.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: HA-ART
Identical With: ARST190Z
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

IDEA261 Science Materials For a Malagasy Classroom
Students will design and produce a variety of educational science materials to be used in a fifth grade classroom in Madagascar. These items include a science logo, bookmarks, educational science games, posters, and a comic book with conservation themes for children. Students who are interested in design and natural history as a means through which to communicate science themes on wildlife endemism, evolution, and climate change would be appropriate for this course. All students will need to conduct independent research into science topics, distill down the salient features, and use that information to design elementary school materials. Working both individually and in teams, students will conceive, design, critique, and move into product production (MakerSpace). In addition, prototypes of the materials will be reviewed and rated by fifth graders in a Middletown elementary school for feedback.

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

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

IDEA350 Computational Media: Videogame 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, COMP350
Prereq: None

IDEA401 Individual Tutorial, Undergraduate
Topic to be arranged in consultation with the tutor.

Offering: Host
Grading: OPT

IDEA402 Individual Tutorial, Undergraduate
Topic to be arranged in consultation with the tutor.

Offering: Host
Grading: OPT

IDEA429 Senior Thesis Tutorial

Offering: Host
Grading: OPT

IDEA491 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

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