

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

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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 (<https://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**

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 and metacognitive 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**

Identical With: **CSPL135**

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**

CIS154 Working with MATLAB

The content of this course focuses on learning the basics of utilizing MATLAB to program and solve basic problems. We will operate on the assumption that students have no prior experience with programming. The goals of the course will be to develop algorithmic thinking, problem solving, and quantitative skills within the context of MATLAB. The course will cover essential mechanics of programming, many of which are common to all programming languages, as well as some selected advanced topics. With the expectation that students with a broad background with various motivating factors lead them to enroll in the course, students will be invited to apply the skills learned in the course to completing the culminating final project related to their specific interests.

Offering: **Crosslisting**

Grading: **OPT**

Credits: **0.50**

Gen Ed Area: **NSM-QAC, SBS-QAC**

Identical With: **QAC154, IDEA154**

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-EES**

Identical With: **E&ES160, BIOL160**

Prereq: **None**

CIS170 Introduction to Mechanical 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: **OPT**

Credits: **1.00**

Gen Ed Area: **NSM-CIS**

Identical With: **IDEA170, PHYS170**

Prereq: **None**

CIS170Z 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: **OPT**

Credits: **1.00**

Gen Ed Area: **NSM-CIS**

Identical With: **IDEA170Z, PHYS170Z**

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**

Grading: **OPT**

Credits: **1.00**

Gen Ed Area: **NSM-CIS**

Identical With: **IDEA173**

Prereq: **None**

CIS175 Introduction to Electrical Design & 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: **Cr/U**

Credits: **1.00**

Gen Ed Area: **NSM-CIS**

Identical With: **IDEA175**

Prereq: **None**

CIS210 How Things Fail: Mechanics and Materials

This lab/lecture engineering course is a foundational cornerstone of structural analysis and mechanical design. It will provide students with a theoretical and practical understanding of static equilibrium force systems, material response to loading, and analysis of failure modes for each of the fundamental types of stress and strain (axial, flexural, and torsional). These skills are vital for students from a range of disciplines, including mechanical engineering and architecture. The final project will require the design, implementation, and performance testing of an optimized structural system model, such as a truss bridge, building, or other structure.

Offering: **Crosslisting**

Grading: **OPT**

Credits: **1.00**

Gen Ed Area: **NSM-IDEA**

Identical With: **IDEA210**

Prereq: **IDEA170 AND (PHYS111 OR PHYS113)**

CIS221 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 programming 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 Audio and Video Analysis

In this course, students are introduced to machine learning techniques to analyze image, audio, and video data. The course is organized in three parts, and in each part we will first introduce how these nontraditional data can be converted into appropriate (mathematical) objects suitable for computer processing, and, particularly, for the application of machine learning techniques. Students then will learn and work with a number of machine learning algorithms and deep learning methods that are effective for image and audio analysis. We will also explore major applications of these techniques such as object detection, face recognition, image classification, audio classification, speaker detection, and speech recognition.

Offering: **Crosslisting**

Grading: **A-F**

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**

CIS251Z 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: **QAC251Z**

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: **HA-ART**

Identical With: **IDEA285**

Prereq: **None**

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. This course emphasizes hands-on computational methodology, bioinformatics data analysis, and interpretation of quantitative information. The primary method of evaluation is through written work and the course will increase students skill in scientific writing and scholarship. Due to the ongoing pandemic, in the Fall of 2020 the course will be all online with both synchronous and asynchronous instruction, discussion groups and cloud based computational projects designed to train transferable skills in big data analysis.

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, 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. 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 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: **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 MBB208**

CIS350 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: **Crosslisting**

Grading: **OPT**

Credits: **2.00**

Gen Ed Area: **NSM-IDEA**

Identical With: **IDEA350, FILM250, COMP350**

Prereq: **None**

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-EES**

Identical With: **E&ES376**

Prereq: **E&ES101 OR E&ES115 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**

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: **CIS340**

Prereq: **None**

IDEA154 Working with MATLAB

The content of this course focuses on learning the basics of utilizing MATLAB to program and solve basic problems. We will operate on the assumption that students have no prior experience with programming. The goals of the course will be to develop algorithmic thinking, problem solving, and quantitative skills within the context of MATLAB. The course will cover essential mechanics of programming, many of which are common to all programming languages, as well as some selected advanced topics. With the expectation that students with a broad background with various motivating factors lead them to enroll in the course, students will be invited to apply the skills learned in the course to completing the culminating final project related to their specific interests.

Offering: **Crosslisting**

Grading: **OPT**

Credits: **0.50**

Gen Ed Area: **NSM-QAC, SBS-QAC**

Identical With: **QAC154, CIS154**

Prereq: **None**

IDEA170 Introduction to Mechanical 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: **OPT**

Credits: **1.00**

Gen Ed Area: **NSM-CIS**

Identical With: **PHYS170, CIS170**

Prereq: **None**

IDEA170Z 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: **OPT**

Credits: **1.00**

Gen Ed Area: **NSM-CIS**

Identical With: **CIS170Z, PHYS170Z**

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: **OPT**

Credits: **1.00**

Gen Ed Area: **NSM-CIS**

Identical With: **CIS173**

Prereq: **None**

IDEA175 Introduction to Electrical Design & 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: **Cr/U**

Credits: **1.00**

Gen Ed Area: **NSM-CIS**

Identical With: **CIS175**

Prereq: **None**

IDEA180 Design in Context: Case Studies in Design, Engineering, and Technology

This course examines the human dimensions of engineering and design by looking at the ways artifacts are designed, produced, circulated, and used in context. Rather than a comprehensive survey of movements or paradigms in the history of design, this course employs a thematic approach to understanding the ways objects can articulate and reflect social and cultural concerns. Through a series of readings, projects, lectures, and seminars, we will study the surprising ways everyday objects influence and articulate our identities, desires, biases, and experiences.

This course is intended to support students in developing a critical toolkit for use as designers, users, consumers, and citizens. Throughout the term we will

seek to challenge our assumptions about the politics of design and interrogate the ways its products mediate and are changed through human activity. We will write about and visualize these relationships, thinking critically how objects are made, what makes them relevant, and whether things have the power to change our economic, environmental, and social realities.

Offering: **Host**

Grading: **A-F**

Credits: **1.00**

Gen Ed Area: **NSM-IDEA**

Prereq: **None**

IDEA190 Digital Foundations

This course explores the relationship between digital fabrication tools and contemporary artistic practice. Students will be guided through the process of using 3D printers, laser cutters, and power tools in a studio environment. The class has a theoretical focus on machine use within the process of design. Lectures and hands-on activities are supplemented by 2D vector-based programs, digital photography software, and 3D modeling programs. Students will learn how to use the computer as both a design tool and as a tool for fabrication. This course will also discuss the ethical dilemmas involved with 3D printing.

Offering: **Crosslisting**

Grading: **OPT**

Credits: **1.00**

Gen Ed Area: **HA-ART**

Identical With: **ARST190**

Prereq: **None**

IDEA190Z Digital Foundations

This introduction to the digital studio engages software and electronic media as an expanded field of creative production in contemporary art and design. Through a sequence of workshops, exercises, and hands-on digital projects, students will develop their critical and creative toolkits and learn to conceive, refine, and present original work. Open to all skill levels, this course prioritizes sustained and rigorous engagement with digital practice as well as conceptual and formal problem-solving.

Workshops in image manipulation, compositing, motion graphics, and visual communication will be led synchronously online by the instructor. This will be complemented with weekly online studio sessions, discussions, screenings, and reviews. Students will be provided access to all course materials using Google Drive and other digital platforms. Access to Adobe Creative Cloud software will be provided by Wesleyan, but individual licensing is also encouraged. Course assistants will offer peer mentoring and technical support in person through the DDS and online through Zoom.

Offering: **Crosslisting**

Grading: **OPT**

Credits: **1.00**

Gen Ed Area: **HA-ART**

Identical With: **ARST190Z**

Prereq: **None**

IDEA209 Educational Gaming Lab: Project-Based, Game-Based Pedagogy Approaches

In the past two decades, crowdfunding and renewed interest in games (board games, role-playing games, digital games, and instructional games) have created an increased and diverse gaming production, which has become the subject of several studies, articles, and projects related to all areas of education, from hard sciences to language learning and the arts. In an effort to explore how a game-informed pedagogy can work in various types of courses and to highlight analog and/or digital gaming approaches that have worked inside and outside the language classroom, this course will explore the basics of (Video) Game-Based Learning (VGBL or GBL) applied to several disciplines, as well as present a selection of classroom projects informed by its principles.

Educational Gaming Lab is designed as a project-based gaming laboratory that will focus on why and how analog and/or digital games can be effective tools for pedagogy; examples will include video games, board games, and role-playing games. Participants will discuss the application of gaming principles to various subjects and types of classrooms; then, they will engage in a final project in which they will either adapt existing games for a specific discipline or create brand new educational games.

The course will be conducted in English, and games will be created in English (or in the relevant target language, if the game is for language learning).

Offering: **Crosslisting**

Grading: **OPT**

Credits: **0.50**

Gen Ed Area: **SBS-EDST**

Identical With: **EDST210**

Prereq: **None**

IDEA210 How Things Fail: Mechanics and Materials

This lab/lecture engineering course is a foundational cornerstone of structural analysis and mechanical design. It will provide students with a theoretical and practical understanding of static equilibrium force systems, material response to loading, and analysis of failure modes for each of the fundamental types of stress and strain (axial, flexural, and torsional). These skills are vital for students from a range of disciplines, including mechanical engineering and architecture. The final project will require the design, implementation, and performance testing of an optimized structural system model, such as a truss bridge, building, or other structure.

Offering: **Host**

Grading: **OPT**

Credits: **1.00**

Gen Ed Area: **NSM-IDEA**

Identical With: **CIS210**

Prereq: **IDEA170 AND (PHYS111 OR PHYS113)**

IDEA215 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: **OPT**

Credits: **1.00**

Gen Ed Area: **NSM-CIS**

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 as 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: **OPT**

Credits: **1.00**

Gen Ed Area: **HA-ART**

Identical With: **ARST233**

Prereq: **None**

IDEA243 Graphic Design

This course is an introduction to graphic design with an emphasis on typography. Typography is the practice of giving written language a visual form, material, and method of distribution. Starting with type, we'll investigate how graphic design organizes, mediates, and transmits context across a range of media.

In class, we will talk about and practice fundamentals of type including typefaces, leading, kerning, grids, hierarchy, and color. This will serve as an entry into broader discussions of composition, sequencing, and text-image relationships and design systems, as applied to conceptual projects. We'll cover design software and print production. A sequence of readings and lectures will situate our work among historical and contemporary examples.

Offering: **Crosslisting**

Grading: **OPT**

Credits: **1.00**

Gen Ed Area: **HA-ART**

Identical With: **ARST243**

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**

Identical With: **BIOL161, ENV5261**

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**

IDEA285 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: **Host**

Grading: **OPT**

Credits: **1.00**

Gen Ed Area: **HA-ART**

Identical With: **CIS285**

Prereq: **None**

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: **OPT**

Credits: **2.00**

Gen Ed Area: **NSM-IDEA**

Identical With: **FILM250, COMP350, CIS350**

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**