

# SCIENCE (SC)

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## SC 100: Introduction to Research

### 1 Credits

Introduces essential elements of laboratory safety, laboratory techniques, research ethics, and scientific communication skills. Especially for undergraduate research students. SC 100 Introduction to Research (1) The main objective of the course is to prepare students for a fulfilling and successful learning experience in the research laboratory. Students who engage in undergraduate research often continue to project for four to six semesters. This course provides students with the necessary introductory information to the undergraduate research experience so that the entire experience is more satisfying and productive for the students. A corollary goal is to introduce research students to other, like-minded students. Several in-class activities will involve group work combined with an explicit discussion of productive group dynamics. The course will cover four major issues associated with a sustained research project: safety, techniques, ethics, and communication. The course will make students more cognizant of the importance of each of these areas and will provide justification for the importance of each activity in the research enterprise. Students will be evaluated via a series of assignments in which the students reflect on the components of each area and the importance of that area to the continuation of scientific knowledge. Students will be quizzed on safe laboratory practices, usually with a laboratory practical on safety. Students will be assessed on the satisfactory performance common laboratory techniques such as using a pipette, using an analytical balance, using a power source, and proper handling of large equipment like super speed centrifuges. Ethics will be assessed via assignments that require students to contemplate a variety of ethical issues. As part of ethical conduct students will be expected to learn the proper composition of a laboratory notebook. The notebook will provide a segue between ethics and communication skills. Students will examine several recent scientific research articles and discuss the way in which the article is written. They will be assessed on their ability to summarize and critique the article in writing. A book on scientific writing could be assigned for this portion of the course because a student would find use of such a resource as they progress on an independent research project. The laboratory technicians or laboratory managers might assist the faculty member who is teaching the course.

## SC 101: Job Placement Skills and Strategies

### 1 Credits

Strategies and skills designed to identify career/life goals and implement career decisions.

Cross-listed with: AG 100

## SC 103N: When Data Meets Design

### 3 Credits

The student will become an effective generator and consumer of the data visualizations that saturate public and professional discourse. The student will examine the rules of design and how they can be used to construct compelling visualizations of data. The student will use this knowledge to critique data visualizations from the media and their peers. The student will produce data visualizations of their own using data sets that they generate and analyze. Though the focus throughout the course will be on natural science, we will also consider data relevant

to areas such as business, science, history, education, and politics.

The student will emerge from this course with an appreciation of how data visualizations influence their life, as well as the skill set to craft persuasive visualizations to support issues of interest to them. For the purposes of this course no prior knowledge is assumed in science, data handling, or design. We will build the knowledge and vocabulary needed in order to pair these two domains and equip you with a lifelong tool for creating persuasive data-driven explanations.

**Enforced Prerequisite at Enrollment:** Completion or placement beyond MATH 21.

General Education: Arts (GA)

General Education: Natural Sciences (GN)

General Education - Integrative: Interdomain

GenEd Learning Objective: Effective Communication

GenEd Learning Objective: Crit and Analytical Think

GenEd Learning Objective: Integrative Thinking

## SC 142N: Science in Literature

### 3 Credits

The course explores two streams in parallel. Students will examine selected historic landmarks in science (e.g. evolution, atomic energy/ weapons, climate change, biotechnology), with a focus on common misconceptions about the facts and practice of science. The course will also examine the development of literary and popular portrayals of science and scientists in their political, economic, social and cultural contexts, paired to these particular scientific developments. By considering past and current scientific problems, students will refine their quantitative and analytical skills. By considering scientific writing, novels, short stories, graphic novels, cinema, poetry, and other forms, students will refine their critical and reflective writing and speaking about both the rhetorical and discursive practices of science writing, and the social and cultural impact of literature in popular understandings of science.

Cross-listed with: ENGL 142N

General Education: Humanities (GH)

General Education: Natural Sciences (GN)

General Education - Integrative: Interdomain

GenEd Learning Objective: Effective Communication

GenEd Learning Objective: Crit and Analytical Think

GenEd Learning Objective: Integrative Thinking

GenEd Learning Objective: Key Literacies

## SC 200: Science in Our World: Certainty and Controversy

### 3 Credits

A science appreciation course, aimed at making non-scientists more informed consumers of science. SC 200 Science in Our World: Certainty and Controversy (3) (GN) Science is frequently in the news. That's because it affects our everyday lives, shapes our view of the world and our place in it, and will have a profound impact on our future. This course teaches an appreciation of science and scientific thinking. It is aimed at making non-scientists more informed consumers of science by improving their ability to distinguish good science from bad science, and science from non-science. The course assumes no background knowledge. It is not for scientists. Teaching is delivered by case studies of controversies within science and/or the public domain, some of which are resolved, some of which are not. The first section of the course illustrates general principles by studying arguments now largely resolved,

but which still resonate, such as child health and IQ, smoking, and why the peacock has such a ridiculous tail. The second section focuses on unresolved scientific controversies which might include climate change, personalized genetic medicine, passive smoking, nanotechnology, the scientific evaluation of the healing power of prayer, or deer management in Pennsylvania. The third section evaluates unresolved scientific issues in the contemporary media: why it is in the news, what are the scientists involved actually doing and arguing about, and how is the media handling the science? This will be likely focused on real time analysis of media reaction to a scientific paper published by PSU faculty during the course. The fourth section will discuss paradigm shifts which have occurred during the students' lifetimes, particularly those involving our view of ourselves and our universe, and end by speculating on the paradigm shifts that could occur in the next twenty years. The course will draw on experts from within and outside of PSU. Throughout, the focus is on the nature of the debates, looking at how scientists evaluate problems, and why that can generate controversy within science and beyond science — but at the same time, generate knowledge which profoundly affects our well being and our understanding of ourselves.

General Education: Natural Sciences (GN)

SC 201: Medical Professions

1 Credits

Learn about the different medical professions and related subjects. SC 201 Medical Professions (1) The purpose of this course is to provide students with general information on the different health professions and various related subjects as potential career options. Many students come to the university with an interest in pursuing a health profession but do not have a clear idea of what kind of work is involved in the particular profession of their choice. Moreover, students often are not aware that there are other health career options available. This one-credit course is targeted to all students that have a general interest in health and science, and may include students in the following majors: premedicine, science, biology, chemistry, biochemistry and molecular biology, forensic science, nursing, kinesiology, nutrition, and biobehavioral health. Some of the professions discussed are: allopathic and osteopathic medicine, physical therapy, occupational therapy, physician assistant, nurse practitioner, dentistry, maxillo-facial surgery, optometry, audiology, genetic counseling, nursing, podiatry, and pharmacy. In addition to describing the professions, time is spent talking about academic preparation for specific professions and the application process for admission to health profession schools. Furthermore, the nature of various health profession training programs are described, as well as how students obtain tuition funds for payment of such programs. One week's topic generally focuses on health profession training outside the United States (e.g., foreign medical schools). This course is structured as a seminar course; all lectures are given by invited speakers. The speakers talk about the profession in general and may give specific information about the particular school they attend or currently work at. Students are encouraged to ask questions about the health careers and also to interact with the speakers after the class, where they might ask specific questions pertaining to their suitability as an applicant. The course will meet in the evenings, for one hour, one day a week, for 15 weeks. The students that enroll in this course receive a satisfactory or unsatisfactory grade based on attendance only (there are no exams, quizzes or written reports). Students may miss up to three classes during the fifteen week session. Therefore, students that attend twelve of the fifteen lectures will receive a satisfactory grade. If a student needs to miss class due to an evening exam, they will need to fill out an Excused Absence Form, which

can be obtained from the instructor (no other activities are excusable except for athletic competitions for students in varsity teams).

SC 205N: Identifying Bias and Falsehood

3 Credits

The course will consider the ways statements are used for aims other than to convey accurate information. This disregard for truth results in the increasingly difficult task of identifying bias and falsehood in the age of information. There are three areas most corrosive to knowledge: language, science, and statistics. The course will examine the appeal of rhetorical arguments and the role of bias in assessing claims; various ways evidence fails to support a conclusion; and the manipulation of data to make information appear more compelling than it is. Students will learn to evaluate the truth of arguments based on philosophical and scientific criteria, and use a variety of skills to identify bias and falsehood in the media.

Bachelor of Arts: Humanities

Bachelor of Arts: Natural Sciences

General Education: Humanities (GH)

General Education: Natural Sciences (GN)

General Education - Integrative: Interdomain

GenEd Learning Objective: Crit and Analytical Think

GenEd Learning Objective: Key Literacies

SC 210: Sophomore Science Seminar

2 Credits

Covers topics related to success in upper level courses including critical thinking, library resources, reading primary literature, and communication skills. SC 210 Sophomore Science Seminar (2) The main objective of this course is to serve as a bridge between the first two years of a science program and the last two years. Sophomore students need to understand that upper-level coursework in the sciences requires higher order cognitive skills as well as an intellectual maturity that enables the student to meet the challenge of upper level coursework. Students also require an ability to access the multitude of scientific information available on the web and in library databases therefore students will be expected to demonstrate their ability to retrieve information. Sophomore students are faced with many exciting possibilities that they should be aware of including undergraduate research and cooperative education. This course will enable students to make more informed decisions about how to best structure their own educational needs while meeting the demands of upper level coursework. Students will be assessed via a variety of methods including participation in discussion, actively seeking information from seminar guest speakers (in the form of questions), written reports (interview with faculty member, summary of scientific article, synthesis of newspaper reports about recent discoveries, individually selected research topic), and oral presentations (critique of recent science information in newspapers, independent topic, interview with faculty member).

SC 220: Principles and Strategies for Effective STEM Learning I

1 Credits/Maximum of 1

This course is designed to prepare undergraduate peer-learning mentors for their role in facilitating student centered learning activities. This course is designed to prepare peer-learning mentors for their role in facilitating student centered learning activities. The course content includes a blend of strategies for effective teaching and learning coupled

with the opportunity to practice strategies of effective mentorship and feedback to peers and faculty. Through selected readings and course discussions students are introduced to the basic tenants of learning: the role of prior knowledge, the organization of knowledge into networks, the role motivation plays in learning, tools for the development of gaining mastery, effective practice and feedback, the importance of course climate, and the role metacognition plays in achieving self-regulated learning. Each of these topics is covered in one of the seven class periods. The students who have completed this course will be able to understand:

- How prior knowledge affects learning and suggest alternate examples to help peers see the information through another perspective
- How the organization of knowledge affects long term learning and share with peers the knowledge networks most commonly utilized in STEM disciplines
- Factors that motivate student learning and apply this knowledge to assist faculty in motivating student engagement
- How students develop mastery and assist peers to engage in activities that promote mastery through directed practice
- How practice and feedback enhance learning and provide effective feedback when working with their peers
- How course climate affects learning and provide faculty with valuable feedback in regard to the climate of their course learning spaces
- How learners develop stronger metacognitive skills to be able to reflect on their own learning experiences and share this with their peers.

Student mastery of the material is typically assessed through weekly written reflection assignments based on the readings and in class discussions. These reflections are graded and feedback is provided to assist students in growth in becoming effective learning facilitators. A final reflection assignment is typically given in which the students are asked to describe how these course topics will be put to use in the assignment as a learning assistant.

SC 240: Learning Assistant Experience

1-2 Credits/Maximum of 8

This course is experiential training in facilitating collaborative active learning in science. The students in this experiential learning course are selected by the course instructors to participate as a part of their instructional team to facilitate active learning activities in their classroom and or laboratory courses. Students engaged in this experience must have demonstrated mastery of the course material covered in the course they are facilitating. These students encourage and guide group work, lead problem solving sessions, and provide faculty with student feedback. They are required to attend all laboratory or course sessions as well as attend weekly team meetings to debrief on the week's activities and prepare for upcoming activities.

**Enforced Prerequisite Concurrent at Enrollment:** SC 220

SC 294: Research Project Courses

1-12 Credits/Maximum of 12

Supervised student activities on research projects identified on an individual or small-group basis.

SC 295: Science Co-op Work Experience I

1-3 Credits/Maximum of 3

A supervised work experience where the student is employed in a scientific position. To be offered for SA/UN grading.

**Prerequisite:** acceptance into the Eberly College of Science co-op program

Full-Time Equivalent Course

SC 296: Independent Studies

1-18 Credits/Maximum of 18

Creative projects, including research and design, that are supervised on an individual basis and that fall outside the scope of formal courses.

SC 297: Special Topics

1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject that may be topical or of special interest.

SC 297E: Special Topics - InterDomain

3 Credits

Formal course given on a topical or special interest subject offered infrequently; several different topics may be taught in one year or semester. This Special Topics is an Inter-Domain GH/GN GenEd course

General Education: Humanities (GH)

General Education: Natural Sciences (GN)

General Education - Integrative: Interdomain

SC 395: Science Co-op Work Experience II

1-3 Credits/Maximum of 3

A supervised work experience where the student is employed in a scientific position. To be offered for SA/UN grading.

**Enforced Prerequisite at Enrollment:** SC 295

Full-Time Equivalent Course

SC 400: Consequences of Science

1 Credits

A series of lecture/discussions in which science faculty members show the social implications of their research specialty.

SC 401: Basic Science and Disease

1 Credits

Clinical aspects of various disease and how basic scientific information contributes towards understanding and treating disease. SC 401 Basic Science and Disease (1)The purpose of this course is to provide students with some general background on the symptoms, risk factors, prevention, and treatment of various diseases. Along with the clinical aspects of the diseases, we examine how basic scientific research studies contribute information towards helping to understand the mechanisms underlying disease development and control. This one-credit course is targeted to all students that have a general interest in health and science, and may include students in the following majors: premedicine, science, biology, chemistry, biochemistry and molecular biology, forensic science, biobehavioral health nursing, kinesiology and nutrition. Enrollment priority is given to students with fourth semester or above status. Examples of topics discussed are: Hypertension, Osteoporosis, Infectious Diseases, Asthma, Chronic Obstructive Pulmonary Disease, Cancer, Diabetes, Sickle Cell Anemia/Anemia, Blood Disorders, Hypercoagulability, Coronary Artery Disease, Alcoholism/Alcohol Poisoning, HIV/AIDS, Tuberculosis,

Irritable Bowel Syndrome, Hepatitis, Thyroid Disease, Congestive Heart Failure, Parkinson's Disease, and Arthritis This course is structured as a seminar. Most lectures are powerpoint presentations by invited speakers, which usually will be local physicians sometimes paired with Penn State research faculty. The speakers introduce the disease topic by discussing the basic anatomy and physiology of the system or body part most affected by the disease. (e.g. lungs, heart, kidneys, etc). Once the foundation is established the pathophysiology is discussed. Risk factors and prevention are also highlighted. One important goal of each seminar is to indicate to students how advances in basic science research can impact the understanding and treatment of disease. Students are encouraged to ask questions after the lecture. The speaker(s) remain afterwards to allow students to ask more specific questions about the disease topic. On occasion, speaker physicians also talk about their medical school training and/or life as a practicing physician. The students that enroll in this course receive a letter grade based on attendance (students must attend 9 out of 10 classes), quizzes and a 2-3 page reaction paper on one of the disease topics. Random short-answer quizzes are sometimes administered at the end of a seminar, testing on information presented during the seminar. Also, reading assignments are sometimes given prior to a seminar, or information handout materials are provided during the seminar. If a student needs to miss class due to an evening exam they need to fill out an Excused Absence Form, which can be obtained from the instructor (no other activities are excusable except for athletic competitions for students in varsity sports).

**Enforced Prerequisite at Enrollment:** 4th semester standing or higher

SC 402: Science-Related Employment: Corporate Organization, Opportunities, and Expectations

1-3 Credits/Maximum of 3

Present undergraduate and graduate students with information and skills necessary for success in science-related job positions available in industry.

**Enforced Prerequisite at Enrollment:** 5th semester standing or permission of program

SC 476: Human Dimensions of Health Care

3 Credits

Field experience in five or more medical settings; complementary exposure to the scientific literature; weekly discussions. SC 476 Human Dimensions of Health Care (3) This course, delivered jointly by Penn State and the local medical community, is designed to provide field experience for students with plans for a future in the health professions. The course is structured around rotations through multiple no less than five medical settings, which may include Community Medicine, Dentistry, Emergency Room, Family Medicine, Hospice Care, Oncology, Optometry, Palliative Care, Pediatrics, Physical Therapy, Senior Services, Wound Care, and other specialties. The first four weeks consist of an introduction and orientation to the goals each setting. The purpose of these sessions is to acquaint the students with the requirements of the course as well as expectations for the on-site rotations. During this time, the students become familiar with the health care issues associated with each setting through literature specific to particular medical settings. At the end of these sessions the students write a course plan, in which they review the major issues common to each setting, and project how they expect to gain and how they expect to contribute in each setting. During the next nine weeks, the students rotate through the medical settings, spending two afternoons per week in rotation. Students are

scheduled to assignments with one of the medical settings for the afternoon. At these times the students are under direct supervision of the setting's staff. Where feasible, students may also sit in on physicians's staff meetings, attend lectures, or receive other forms of special instruction provided by medical staff. All students will maintain a logbook of activities during the rotations. Weekly meetings on campus are devoted to reports of experiences by each of the students, discussions based on the questions developed during the orientation period, and resolution of issues which may arise. In this way, students assigned to each rotation inform those students who will later enter that setting.

**Prerequisite:** 5th semester standing; BIOL 230W and BIOL 240W or equivalent; approval of health sciences committee or coordinator

SC 494: Research Project Courses

1-12 Credits/Maximum of 12

Supervised student activities on research projects identified on an individual or small-group basis.

SC 494H: Research Project Courses

1-12 Credits/Maximum of 12

Supervised student activities on research projects identified on an individual or small-group basis.

Honors

SC 495: Science Co-op Work Experience III

1-3 Credits/Maximum of 3

A supervised work experience where the student is employed in a scientific position. To be offered for SA/UN grading.

**Enforced Prerequisite at Enrollment:** SC 395

Full-Time Equivalent Course

SC 497: Special Topics

1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject that may be topical or of special interest.