

Science Forward Online

Macaulay Honors College Seminar 3

Welcome to the sample syllabus for an asynchronous online Science Forward course intended to be taught as a Macaulay Honors seminar. This course was originally taught in 2017. There will be a revised version of this syllabus coming soon (Summer 2020), but for immediate use as a guide, we updated the following in May 2020:

- The third season of SF videos (produced in 2018) were added to the Weekly Schedule.
- Deadlines were shifted to Fridays to reflect a needed improvement over the 2017 course.
- “Weekly Status Reports” which appeared mid-semester in 2017 are now an ungraded assignment in all weeks.

Instructor Information

Professor: Dr. Kelly O'Donnell – kelly.odonnell@mhc.cuny.edu

Office Hours: Send an email to make an appointment

Course Description

Science Forward is a skills-based course that focuses on scientific thinking in the context of a variety of different fields of science. We will focus on the specific skills that allow one to have good Science Sense. These skills fall into broad categories: Number Sense, Data Sense, and Knowledge Sense.

Science Sense is...

- being able to distinguish science from non-science.
- the ability to recognize how people collect and process facts into knowledge.
- the ability to recognize how a collection of facts becomes knowledge.
- being able to question and evaluate information that is presented as scientific.
- being an informed consumer, evaluator, and practitioner of science.

Student Learning Outcomes

- Students will hone their Science Sense during this course, specifically:
 - o Students will acquire a proper sense of scale and be able to make order of magnitude estimates with reasonable assumptions.
 - o Students will understand and get experience with measurement and data collection through activities in the field (including a BioBlitz common event) and be able to create and communicate their results using graphs and basic statistics.
 - o Students will become familiar with proper experimental design and the practice of scientific inquiry.
 - o Students will understand that science makes progress and changes through time based upon newly available evidence.
- Students will practice their critical thinking skills and employ reasonable skepticism.
- Students will learn how to communicate science to different audiences through three projects.
- Students will leave this course with an appreciation for the similar set of skills employed by scientists in seemingly disparate fields of scientific inquiry.
- Students will recognize that these skills are not only applicable to their coursework, but also to their daily lives.

Course Mechanics

This course is fully online and asynchronous and it is organized into weeks that follow a particular sequence. This means that you will need to do specific activities each week and that you cannot choose the order in which the weeks are completed. You will be working both individually and in groups that are set up by me. You can think of the course site as our classroom – this is where much of your interaction with your classmates will take place. It is strongly recommended that you set aside a little time each day of the week to work on this course (see the recommended personal schedule below). Don't save all your work for the end of the week when assignments are due.

Our course site has an individual page for each week with all the links you need to complete the required tasks. You can also visit the Discussion and Assignment Submission areas directly through the top menu bar. If you have a question about how the course works, feel free to use our "Q&A" discussion forum. If you found something fun and science related that you want to share with your classmates, make a post in the "Ten Forward" discussion forum.

Week Schedule

The specific fields of science that we explore each week will be the context for our Science Sense training. We roughly follow a scale order from large (studying the cosmos) to small (studying the individual):

Week	Field of Scientific Inquiry
1	What is Science?
2	Astronomy
3	Geology
4	Climate Change
5	Urban Ecology
6	Evolution
7	Agricultural Science
8	Water
9	Energy
10	Genetics
11	Medicine
12	Neuroscience
13	Poster Practice
14	Intelligence
15	What have we learned?

Attendance

This course is online, so we have no regular meeting time. However, there are two events you must attend: the BioBlitz and the STEAM Festival. For both, you will get to choose a shift of approximately 2-5 hours during one of the days of the event. There will be a grade deduction if you are absent from your chosen shift at these events. Absence from the events can be excused for religious observances, academic conferences (with documentation), university athletics, or illness, however the following conditions **MUST BE MET**: 1) the student sends email notification at least one week in advance (or if ill, before the shift begins) and 2) the student requests and completes a make-up assignment. I will not chase these requirements down, **YOU** must provide them. Your final grade will be reduced if you miss these events and do not do a make-up assignment.

There will be two other times when I will attempt to get the whole class to meet: at the start of the semester and to practice poster presentations in November. We will choose these dates via online poll based on when I can get the most students at one time. If you cannot attend these meetings, you will be given a make-up assignment.

What You Can Expect From Me

Like you, I will be making time each day to pop into the course site and monitor activity. Every Monday, I will send you an email summarizing the week that includes an intro video from me. If you have questions about an assignment, try the Q&A forum first. If you have specific questions about your progress that you don't want to share with the class, the best way to get a hold of me is via email. Please put the name of our course (MHC 255) in the subject line along with your name. I will respond to emails within 24 hours (48 if it is over the weekend).

Required Text

O'Donnell KL, LA Brundage, and J Ugoretz (executive producers). 2018. Science Forward Video Series. 2018. URL: <http://cuny.is/scienceforward>. These freely available videos serve as the backbone content for the course (they are labeled as “**SF video**” in the reading list below). We will also be using chapters from free online textbooks, primary scientific literature available in the CUNY libraries and/or popular press articles and videos. No book needs to be purchased for this course.

Required Assignments

Detailed instructions for the major assignments (essay, video, poster) and rubrics for all assignments can be found on the course site.

ASSIGNMENTS	Percent of Final Grade
Self-Assessment (weekly, individual)	5
Status Report (weekly, individual)	5
Discussion Forum (weekly, individual)	10
Activity Report (weekly, individual)	15
Science in the City Assignment (once, individual)	5
News Essay (once, individual)	10
Video Project (once, group)	20
Semester Research Project (once, group)	30

Weekly Self-Assessments: These are 5 question quizzes that you are required to complete, but are ungraded. You will get credit for doing all of these on time, regardless of what you “score” on them.. These assessments are for you to make sure you've understood the main points of the week. If you haven't, you should go back and make sure that you do.

Weekly Status Report: These are ungraded 1-2 question forms that you are required to complete. They are a way for you to check in with me every week to let me know if anything was particularly challenging that week. There will always the option to choose “Nothing to report” in the form. These will become especially useful when you are doing group work. You should let me know if there are some group dynamics that you need help with.

Weekly Discussion Forum: Each week, students will be required to post in the Discussion Forum and respond to your classmates' posts (you must make at least TWO substantive comments each week).

Occasionally, there will be two discussion prompts (1A and 1B, for example) and both will contribute to that week's discussion grade. Please complete the self-assessment first before entering the discussion on the Discussion Forum. Your post(s) plus your comments will be assessed on a 3-point scale.

Weekly Activity Reports: Each week, students will engage in some sort of activity and be required to report on it. The activities may be online simulations, data analysis, blog posts, etc. Activity Reports will be uploaded to the course site. Instructions for each week's activity can be found on the week's page. Activities will be assessed on a 3-point scale.

Science in the City Assignment: This assignment is a one-time blog post after you attend a free public science activity somewhere off campus at any time before the last day of class. These may be lectures, book talks, citizen science events, etc. I will have a list on our site for options and you can also propose events that you happen to find as long as they are off campus, free, and about science. If you choose an event not on our list, it MUST be approved by me BEFORE you go. Your SitC post will be assessed on a 3-point scale.

News Essay: Your first major assignment is an essay that reports on a scientific finding as if you were writing for a newspaper. You will choose one peer-reviewed science article from the past two years and write it up as the latest news for the Science section of this newspaper. You cannot choose an article that has already been covered heavily in the popular press (including blogs). The word count should be between 400-500 words and the assignment will be graded on a 4-point scale.

Video Project: For this group project, you will create a video in the style of one of our Science Forward custom videos. These won't be as long as ours, but your goal would be similar – explain a single scientific concept and an important science skill needed to study that concept. You will need to choose a topic not already covered by one of our videos. This will be graded on a 4-point scale.

Semester Research (Poster) Project: The semester research project is the largest portion of your grade. You and your group are to come up with a research question about the BioBlitz and test it using BioBlitz data and/or additional data that you collect during the semester. The final output is a research poster to be presented at the end of semester conference. This project will be a large undertaking and so it is broken down into smaller parts that are due throughout the semester. The project will be graded on a 4-point scale.

Grading Policy

No late assignments will be accepted. Most assignments are scored on a 3 or 4 point scale and rubrics for every assignment will be made available to the student from the beginning of the semester. You will earn a letter grade (A through F) for your final grade based on the scores you earn on these assignments.

Online Etiquette and Anti-Harassment Policy

The University strictly prohibits the use of University online resources or facilities, including our course site, for the purpose of harassment of any individual or for the posting of any material that is scandalous, libelous, offensive or otherwise against the University's policies. We will follow the CUNY School of Professional Studies guide to an online academic setting available here:

<http://catalog.sps.cuny.edu/content.php?catoid=2&navoid=205>

Academic Integrity

Academic dishonesty is unacceptable and will not be tolerated. Cheating, forgery, plagiarism and collusion in dishonest acts undermine the educational mission of the City University of New York and the students' personal and intellectual growth. You are expected to know and follow the guidelines put forth in the Macaulay Honors Pledge (available here:

<http://macaulay.cuny.edu/community/handbook/policies/honors-integrity/>).

Personal Schedule

Each week will have a detailed page on the course site. All weekly deadlines are on Fridays at 5pm with the exception of comments on your classmates' posts in the Discussion Forum, which are due on Mondays at 5pm. The comments are due on Mondays because I realize that, once or twice, you may not get the discussion in until right before the deadline and I want to give your classmates a chance to engage in a conversation with your posts. Before we get into the specific weekly topics, you may find it helpful to follow this personal schedule below. You can adjust this to suit your needs, but I highly recommend setting up a schedule similar to this one as soon as you can when the semester starts. Online courses, especially asynchronous ones, require you to be very good at managing your own time.

Recommended Personal Schedule

Monday/Tuesday – Read/watch required papers and videos

Wednesday – Review notes from readings/videos, take the self-assessment, make a discussion post

Thursday – Work on Assignments (including activities and major assignments)

Friday – Complete the assignments for the week

Saturday/Sunday – Read your classmates' posts and make your (at least) two comments.

Weekly Schedule of Topics and Assignments

Readings may be changed, but you will be notified at least two weeks in advance of any changes. Links in this syllabus are active, but some of your readings will require you to go to the course site and enter a password.

Week	Weekly Deadline	Topic	Video/Reading	Assignment
0	Friday 8/25/17	Course Intro & Orientation	1. Reading: The course syllabus	<ul style="list-style-type: none"> • Self-Assessment 0 • Discussion 0
1	Friday 9/1/17	Philosophy of Science	<ol style="list-style-type: none"> 1. SF video: What is Science? 2. SF video: The Science Senses 3. SF video: Science and Ethics 4. Reading: The University of California Museum of Paleontology, and the Regents of the University of California. 2017. "Nature of Science" chapter in <i>Understanding Evolution</i> OER. (There are 7 pages to click through) 	<ul style="list-style-type: none"> • Self-Assessment 1 • Status Report 1 • Discussion 1A and 1B • Activity 1 • ESSAY: Citation due

Week	Dates	Topic	Video/Reading	Assignment
2	Friday 9/8/17	Astronomy	<ol style="list-style-type: none"> 1. SF video: Tools of Seeing 2. SF video: Astronomy 3. Reading: Ch 1: Science and the Universe: A Brief Tour <i>from</i> OpenStax, Astronomy. 13 Oct 2016. 4. Reading: Billings. 2014. Astronomers Search for Moons Circling Distant Exoplanets. <i>Scientific American</i>. 310(1). 5. OPTIONAL Reading: Chapter 2: Numbers and Physical Reality <i>from</i> White and Dennin. 2008. Science Appreciation: Introduction to Science Literacy. READ ONLY sections 2-A and 2-B (pgs. 17-38). 	<ul style="list-style-type: none"> • Self-Assessment 2 • Status Report 2 • Discussion 2 • Activity 2
3	Friday 9/15/17	Geology	<ol style="list-style-type: none"> 1. SF video: Geology 2. Reading: Cleland C. 2001. Historical science, experimental science, and the scientific method. <i>Geology</i>. 29(11):987-990. 3. Reading: Valley JW. 2005. A Cool Early Earth? <i>Scientific American</i> 	<ul style="list-style-type: none"> • Self-Assessment 3 • Status Report 3 • Discussion 3A and 3B • Activity 3 • ESSAY: worksheet
4	Friday 9/22/17	Climate Change	<ol style="list-style-type: none"> 1. SF video: Climate Change 2. SF video: Scientific Uncertainty 3. Reading: Riebeek. 2011. The Carbon Cycle. <i>NASA Earth Observatory</i>. https://earthobservatory.nasa.gov/Features/CarbonCycle/ 4. Reading: Ch 19: Climate Change <i>from</i> Earle. 2015. Physical Geology. https://opentextbc.ca/geology/chapter/chapter-19-climate-change/ 5. Reading: Hansen et al. 2012. Perception of climate change. <i>PNAS</i>. E2415-E2423. 6. OPTIONAL Reading: Cox et al. 2000. Acceleration of global warming due to carbon-cycle feedbacks in a coupled climate model. <i>Nature</i>. 408:184-187. 7. OPTIONAL Reading: Hansen. 2004. Defusing the Global Warming Time Bomb. <i>Scientific American</i>. 	<ul style="list-style-type: none"> • Self-Assessment 4 • Status Report 4 • Discussion 4A and 4B • Activity 4 • POSTER: question

Week	Dates	Topic	Video/Reading	Assignment
5	Friday 9/29/17	Urban Ecology	<ol style="list-style-type: none"> 1. SF video: Urban Ecology 2. Video: Bozeman Science: Biodiversity. 3. Video: TED talk: Sukhdev - What is the price of nature? 4. Video: SciShow: The Times and Troubles of the Scientific Method 5. Reading: Chapter 44: Ecology and the Biosphere <i>from</i> OpenStax, <i>Biology</i>. OpenStax. 21 October 2016. 6. CHOOSE ONE Reading: Helden and Leather. 2004. Biodiversity on urban roundabouts—Hemiptera, management and the species–area relationship. <i>Basic and Applied Ecology</i>. 5:367-377. 7. CHOOSE ONE Reading: Cheptou PO, O Carrue, S Rouifed & A Cantarel. 2008. Rapid evolution of seed dispersal in an urban environment in the weed <i>Crepis sancta</i>. <i>PNAS</i>. 105(10):3796-3799. 8. OPTIONAL Reading: Costanza et al. 1997. The value of the world's ecosystem services and natural capital. <i>Nature</i>. 387:253-260. 9. OPTIONAL Reading: Cardinale et al. 2012. Biodiversity loss and its impact on humanity. <i>Nature</i>. 486:59-67. 	<ul style="list-style-type: none"> • Self-Assessment 5 • Status Report 5 • Discussion 5 • Activity 5 • ESSAY: Final essay due
6	Friday 10/6/17	Evolution	<ol style="list-style-type: none"> 1. SF video: Evolution 2. Reading: Darwin 1859. Selections from the first four chapters of the Origin 1859. 3. Reading: Palumbi, SR. 2001. Humans as the world's greatest evolutionary force. <i>Science</i>. 293(5536):1786-1790. 4. Reading: Harris M, G Taylor, & J Taylor. 2007. <i>CatchUp Math and Statistics for the Life Sciences</i>. New York: WH Freeman and Company. Ch. 28 and 29. 5. OPTIONAL Reading: Ch 7: Science in the Courtroom <i>from</i> Pigliucci M. 2010. Nonsense on Stilts: How to Tell Science from Bunk. University of Chicago Press. 	<ul style="list-style-type: none"> • Self-Assessment 6 • Status Report 6 • Discussion 6 • Activity 6 • POSTER: Proposal due
7	Friday 10/13/ 17	Agriculture	<ol style="list-style-type: none"> 1. SF video: The Challenge of Food 2. Reading: Godfray <i>et al.</i> 2010. The challenge of feeding 9 billion people. <i>Science</i>. 3. Video: Jonathan Foley TED talk: The other inconvenient truth 4. Reading: Freedman, DH. 2013. Are engineered foods evil? <i>Scientific American</i>. Pgs. 80-85 	<ul style="list-style-type: none"> • Self-Assessment 7 • Status Report 7 • Discussion 7 • Activity 7 • VIDEO: Outline due

Week	Dates	Topic	Video/Reading	Assignment
8	Friday 10/20/ 17	Water	<ol style="list-style-type: none"> 1. SF video: Water 2. Reading: Chapter 13: Water Availability and Use <i>from</i> Doršner. 2015. Essentials of Environmental Science. 3. Reading: Chapter 2: Descriptive Statistics <i>from</i> OpenStax. Introductory Statistics. OpenStax. 19 July 2013. 4. OPTIONAL Reading: NYC DEP. 2015. New York City 2015 Drinking Water Supply and Quality Report. 5. OPTIONAL Video: Science 360: Sustainability: Water Series The Ogallala Aquifer and Los Angeles and Water Imports. 6. OPTIONAL Reading: Pimentel et al. 1997. Water Resources: agriculture, the environment, and society. <i>BioScience</i>. 47(2):97-106. 	<ul style="list-style-type: none"> • Self-Assessment 8 • Status Report 8 • Discussion 8 • Activity 8 • POSTER: Annotated Bibliography due • ESSAY: Revision 1 Due
9	Friday 10/27/ 17	Energy	<ol style="list-style-type: none"> 1. SF video: Energy 2. Video: SciShow: Facts About Fracking 3. Harris M, G Taylor, & J Taylor. 2007. <i>CatchUp Math and Statistics for the Life Sciences</i>. New York: WH Freeman and Company. Ch. 33 and 34. 4. CHOOSE ONE Video: Green Revolution: Hydrogen 5. CHOOSE ONE Video: Green Revolution: Biomass 6. CHOOSE ONE Video: Green Revolution: Wind Power 7. CHOOSE ONE Video: Green Revolution: Solar Power 8. CHOOSE ONE Video: Green Revolution: Microbes 	<ul style="list-style-type: none"> • Self-Assessment 9 • Status Report 9 • Discussion 9 • Activity 9 • POSTER: Figures and Main Results due
10	Friday 11/3/17	Drug Discovery & Devo.	<ol style="list-style-type: none"> 1. SF video: Drug Discovery and Development. 2. SF video: Cancer 3. Video: TED talk: Collins – We need better drugs now. 4. Reading: Gorson and Holford. 2016. Small Packages, Big Returns: Uncovering the Venom Diversity of Small Invertebrate Conoidean Snails. <i>Integrative and Comparative Biology</i>. 56(5):962-972. 5. Reading: FDA Drug Review Process website. Be sure to look at both the text on these two pages and the infographic. Go to Page 1 AND Page 2 	<ul style="list-style-type: none"> • Self-Assessment 10 • Status Report 10 • Discussion 10 • Activity 10 • VIDEO: Video due

Week	Dates	Topic	Video/Reading	Assignment
11	Friday 11/10/ 17	Fake Medicine	<ol style="list-style-type: none"> Video: Science360: 21st Century Scientists: Facundo Fernandez Video: Placebos & Nocebos: How Your Brain Heals and Hurts You Video: A clip from the short, Here Be Dragons (2008) by Michael Dunning. Find the video here http://herebedragonsmovie.com and watch from timestamp 26:59 – 29:21 Reading: Chapter 12 from Demon Haunted World by Carl Sagan. http://www.inf.fu-berlin.de/lehre/pmo/eng/Sagan-Baloney.pdf Reading: Chapter 26 from Bad Medicine by Christopher Wanjek 	<ul style="list-style-type: none"> • Self-Assessment 11 • Status Report 11 • Discussion 11 • Activity 11 • Poster: Draft due
12	Friday 11/17/ 17	Neurosci.	<ol style="list-style-type: none"> SF video: Animal Communication. Reading: ArriagaZhouJarvis2012 “Of Mice, Birds, and Men: The Mouse Ultrasonic Song System Has Some Features Similar to Humans and Song- Learning Birds” Video: Science360: Mind Mappers. Reading: Neuroimagine: Visualizing Brain Structure and Function (Read sections 2, 3, 4.2 and 4.3) from the OER <i>Neuroethics</i> by Haberfeld <i>et al.</i> Link here <ol style="list-style-type: none"> Reading: Chapter 35: The Nervous System from OpenStax, <i>Biology</i>. OpenStax. 21 October 2016. 	<ul style="list-style-type: none"> • Self-Assessment 12 • Status Report 12 • Discussion 12 • Activity 12 • ESSAY: final revision due • VIDEO: final revision due
13	Friday 11/24/ 17	POSTER PRACTICE	<i>No readings. Instead of Activity and Discussion this week, you will be presenting your poster virtually to a subset of the class.</i>	<ul style="list-style-type: none"> • Self-Assessment 13 • Status Report 13 • POSTER: Second draft due
14	Friday 12/1/17	Intelligence	<ol style="list-style-type: none"> SF video: Artificial Intelligence. Reading: Levesque. 2013. On our best behavior. From the IJCAI-13 Conference. Reading: Folger T. 2012. Can we keep getting smarter? <i>Scientific American</i> Reading: Chapter 7: Thinking and Intelligence from OpenStax, <i>Psychology</i>. OpenStax. 14 February 2014. <ol style="list-style-type: none"> Reading: Pavlus. 2012. Machines of the Infinite. <i>Scientific American</i>. Sept. 	<ul style="list-style-type: none"> • Self-Assessment 14 • Status Report 14 • Discussion 14 • Activity 14 • POSTER: Final poster due

Week	Dates	Topic	Video/Reading	Assignment
15	Friday 12/8/17	Science and Society	1. Reading: Castelvechi. 2012. Questions for the next million years. <i>Scientific American</i> . Sept.	<ul style="list-style-type: none">• Self-Assessment 15• Status Report 15• Discussion 15• Activity 15
