NATURAL HISTORY OF NEW YORK CITY

Professor: Mercer R. Brugler, Ph.D.
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Website: https://mbrugler.wixsite.com/blackcoral
Course Title: Natural History of New York City (SCNC1-UC 3290-001), 2 Credits
Semester: Fall 2017
Class Location: 7 East 12th Street, Room LL33
Class Meeting Time: Saturdays from 3:15-4:30PM
Extended classes until 5:00PM on Oct 7 & 28 and Nov 4, 11 & 18
No class on Saturday, November 25 and Saturday, December 16
Midweek class on Tuesday, December 12 or Wednesday, December 13
Office hours are by appointment

COURSE DESCRIPTION
Natural History of New York City leads students on a broad exploration of the Tree of Life (bacteria, viruses, protists [primarily microscopic and unicellular organisms], fungi [molds, mushrooms and yeasts], plants, and animals [including humans]) in New York City and the surrounding boroughs. Students will be actively engaged in scientific observation in a variety of venues, including museums, zoos, aquariums, botanic gardens, food markets, and, most importantly, in the field. Field trips will be supplemented with readings from Sean Carroll’s Remarkable Creatures, a book that tells the stories of some of the most dramatic adventures and important discoveries in two centuries of natural history – from epic journeys of pioneering naturalists to expeditions making headlines today – and how they inspired and have expanded one of the greatest ideas of modern science: evolution. Students will also examine the history of human evolution, including the appearance of our species (Homo sapiens) approximately 300,000 years ago. The semester will conclude with an introduction to cutting edge technologies that are leading to personalized medicine (genomics and transcriptomics) and potential cures for genetic-based diseases (CRISPR).

COURSE PREREQUISITES
Acceptance into the NYU-SPS Access Program

COURSE STRUCTURE
The course delivery format is in-person at various locations around New York City and the surrounding boroughs. Students are expected to check their NYU email account and NYU Classes daily for course assignments and/or other course-related correspondence. Class will not be held on November 25 due to Thanksgiving Recess. Class time will be extended until 5:00pm on the following dates: Week 5 (Oct 7), Week 8 (Oct 28), Week 9 (Nov 4), Week 10 (Nov 11), and Week 11 (Nov 18).

COURSE LEARNING OUTCOMES
By the end of this course, students will be able to:

● Discuss the contribution of disciplines such as systematics and taxonomy to the organization of living organisms and list the various criteria used when classifying and naming an organism.
● Identify prokaryotic organisms (Bacteria and Archaea) and distinguish them from eukaryotes depending on their cellular characteristics. Explain the differences between prokaryotes and viruses and list the reasons why viruses are not categorized as living organisms.
● List and explain the characteristics of the kingdoms Protista, Fungi, Plantae and Animalia and become familiar with the variety of organisms that belong to each.
● With regard to kingdom Plantae, explain the concept of ‘Alternation of Generations.’ Describe the differences between various plant tissues and their purpose within the plant. Analyze the main kinds of plant organs (roots, stems and leaves) and their contribution to the life cycle of plants.
● Describe vital processes including hemolymph/blood circulation, gas exchange, food digestion and nutrient absorption, and body fluid regulation, and establish a comparison of how they are carried out in invertebrates versus vertebrates and, in particular, humans.
● Outline the main events and questions in human evolution.
Over the course of the semester, students will also develop the following skills that are important in both science and professional life: observation, active and critical reading, written communication skills, project management and coordination, synthesis of information, and collaboration with peers.

COMMUNICATION POLICY
Students must use their NYU email account (or NYU Classes course-mail) to communicate with the professor. Office hours are by appointment only. An ideal time to schedule an appointment with the professor is in-person during the subway commute to/from the venue. Outside of class, please contact your professor by email first with any questions or concerns. If necessary, your professor will schedule a time to talk on the phone or via Skype (username: mercer_r_brugler). The professor will make every effort to respond to all email inquiries within 24 hours.

REQUIRED COURSE TEXTBOOK

Two chapters will be provided from Carl Zimmer’s The Tangled Bank - An Introduction to Evolution, 2nd Edition (Roberts and Company, 2014). You do not need to purchase The Tangled Bank. PDFs will be posted on the course website on NYU Classes.

TECHNOLOGY
During Weeks 4 & 5, students will use apps on their smartphones to help identify fungi and plants.

LECTURE SLIDES
Students are expected to print out the lecture slides, or download them to a laptop or tablet, prior to each class. The professor will begin each field trip with a 15-20 minute lecture.

COURSE EXPECTATIONS

FORUM POSTS (NYU CLASSES)
Every week, using the Forum tool in NYC Classes, students will be expected to post a link to a current event and summarize its findings in 2-4 sentences. Please include your name, the date, and the time that you uploaded your post. Here is a list of websites to locate current events:
www.sciencedaily.com/news/plants_animals/evolution/, life.mcmaster.ca/brian/evoldir.html,

ONLINE QUIZZES (NYU CLASSES)
Weekly quizzes will test your understanding of material presented in Sean Carroll’s Remarkable Creatures, Carl Zimmer’s The Tangled Bank (includes only two chapters; see Week 1 & 13 for details), the lecture slides, as well as organisms we observed the week before. Quizzes will be uploaded to NYU Classes on Saturday (immediately after class) and are due by Wednesday at 11:59pm. Please do not discuss the questions or answers with your peers. Cheating will not be tolerated. Your two lowest quiz grades will be dropped.

PAPER
Each student must write a 2-5 page paper on one of the following topics:

Topic 1: Select a species of interest from the AMNH’s special exhibit entitled Opulent Oceans (http://www.amnh.org/exhibitions/opulent-oceans/) and write about it from an evolutionary perspective. For example: What is the classification hierarchy of your organism (Domain, Kingdom, Phylum, Class, Order, Family, Genus, Species)? What is its scientific name (Genus + Species), and what does its scientific name allude to? Where in the Tree of Life does it fit? Which species or group of species is it most closely related to (hint: that would be the next branch on the tree with which it shares a common node)? Did its relationship to any of its evolutionary relatives surprise you, and if so, in what way? Where does your organism live? How is it adapted to its environment? Does your organism form a symbiotic relationship with another organism? Do humans use this organism – or components/extracts of this
organism – for the benefit of our species? Is your organism being affected by global climate change? Etc. *Opulent Oceans* contains 46 different reproductions. You need to visit the exhibit during Weeks 1, 2 or 3 as the exhibit closes on October 1, 2017.

**Topic 2:** Select an evolutionary biologist and write about his/her contribution(s) to the field. Also include where this person worked, or where they are currently working. And, what is/was the impact of their contribution to the field and/or our society? Caveat: You must select an evolutionary biologist that meets one of the following criteria: is 1) female, or 2) a minority, or 3) a person with disabilities. For a definition of what is meant by minority, please see the following document (in particular, see the bottom of Page 3 – under the heading *Individuals*) produced by the National Science Foundation (NSF – link here).

If you choose Topic 2, you must obtain written approval from your professor prior to proceeding. Email the name of the evolutionary biologist to your professor by Week 4 (September 30). The paper is due on Week 12 (December 2) at 3:15pm. You must submit a hardcopy and digital copy; the latter will be scanned for plagiarism using TurnItIn. Evaluation criteria and specifications regarding font type and size, line spacing, margins, etc. will be provided on Week 5 (October 7). Late term papers will not be accepted, and points for that assignment lost, unless special circumstances are discussed and special arrangements are agreed upon in advance of the deadline with your professor. A detailed grading rubric is available on NYU Classes / Lessons.

**SHOWCASE PRESENTATION**
During Week 15, each of you will deliver a 10-minute PowerPoint (or similar)-based oral presentation on any organism of your choosing based on what you observed in/around NYC during the course of the semester (i.e., bacteria, virus, protist, fungi, plant, or animal). The organism cannot be the same one you chose for the term paper. You must select an organism by November 20 (please email your choice to mercer.brugler@nyu.edu). The first 8 minutes of the presentation are reserved for the presentation itself while the last 2 minutes will be dedicated to questions. All presentations must include a brief discussion on the impact of humans (i.e., NYC) on your organism of interest (including any past or present conservation efforts) and conclude with a resources cited slide.

**ASSESSMENT STRATEGY**
Timeliness: 5 points (5% of the final grade)
In-person participation: 15 points (15% of the final grade)
Forum posts: 15 points (15% of the final grade)
Quizzes: 25 points (25% of the final grade)
Paper: 15 points (15% of the final grade)
Showcase presentation: 25 points (25% of the final grade)

**TIMELINESS**
Prompt arrival to all venues is mandatory. If you arrive late to a venue, you are responsible for locating the class (please text/call your peers and/or professor for their location). During Week 2 (September 16), we will meet at NYU-SPS (7 East 12th Street, New York, NY 10003) and commute to the AMNH together as a class. Beginning on Week 3 (September 23) and continuing throughout the remainder of the semester, we will meet at the designated venue for the week. Locations can be found in the week-to-week schedule and in NYU Classes. If you are late due to MTA-related delays, you must provide proof by completing an MTA Subway Delay Verification form, which can be found here: http://enterprise.mtanyct.info/DelayVerify/delayRequest.aspx.

**PARTICIPATION**
All students are required to attend and actively participate in every field trip with questions and comments about what is being observed. Students are also required to take field notes and (in many cases) draw what is being observed. Field trips are an opportunity to engage in one-on-one exchanges with your professor, tour guides, and peers. This course places a high premium on sustained, high-quality participation. A penalty of up to 10 points may be assessed against the final grade of a student who inappropriately disrupts or hinders activities in the field.
Positive qualities of participation

- You are alert, engaged, and courteous. You take notes and generate field drawings.
- You ask thoughtful questions. Thoughtful questions show that you are prepared (e.g., non-thoughtful question: “I don’t understand anything that we are doing / seeing today.” What is it that you don’t understand? Do you have a specific example of something that is confusing? What is your interpretation of what we are seeing?)

Factors that affect participation negatively

- You are attending the field trip, but you are not engaged. You tune out, check your phone, or disappear from a venue or tour. You have a casual conversation (verbal or text) with your neighbor that is unrelated to the field trip.
- You don’t make eye contact with the professor or designated tour guide
- Your try to dominate the discussion and/or are dismissive
- You attempt to scare away the animals that your peers are trying to observe / draw

Attendance vs. Participation

- Attendance is a necessary condition for participation. If you miss a field trip, arrive late or leave early, you will not receive full participation points, no matter how stellar you are in class.

ATTENDANCE POLICY

Attendance to all venues is mandatory. If you are absent from a field trip, you are responsible for all material discussed and observed during that session (please consult with your peers first, and then with your professor). If you plan to miss any field trips for religious observance, please let your professor know the dates before the second class meeting. Your professor will not penalize you for these absences, but will require you to submit the forum post and take the quiz either in advance or immediately after the excused absence(s).

If you have more than two absences, your course grade will drop by one-third of a letter grade, on a progressive scale. For example, if your course grade was “B+”, with three absences, it will be dropped to a “B”. A course grade of “B+”, with four absences, will be dropped to a “B-”, etc. Late arrival to a venue (more than 10 minutes late) and early departure from a venue count as absences.

If you miss a field trip for medical reasons, you are required to notify your professor of your absence and will need to produce a doctor’s note in the next class in order for the absence to be excused. There will be no exceptions to the attendance requirements.

EXTRA CREDIT

Extra credit is not offered in this course. In lieu of extra credit, your two lowest quiz grades are dropped.

TUTORING

If you need extra academic support in certain subject areas, the Division of Applied Undergraduate Studies Tutoring Service offers complimentary, one-on-one tutoring in writing, math, accounting, economics, and statistics. Tutors act as learning partners who support your academic progress, and are available at times that fit your busy schedule. I encourage you to take advantage of our expert tutors who will help you to get started, will work through assignments with you as well as help clarify and review material covered in class. Students can sign up for tutoring appointments either by calling (212) 992-9055 or online at https://nyusps.mywconline.com/.

PLAGIARISM

Plagiarism involves borrowing or using information from other sources without proper and full credit. Students are expected to quote accurately and identify the origin of citations from others, as well as to acknowledge when ideas are dependent upon concepts developed from other sources. This process of attribution and referencing allows each individual to demonstrate how his or her understanding and ideas relate to an existing body of knowledge - and add to them. It demonstrates the values of academic integrity, and systematic reflection and intellectual development. To do otherwise and not reveal sources constitutes plagiarism. And plagiarism is a form of academic dishonesty. The following link provides additional information on plagiarism, as well as what constitutes 1) an offense of plagiarism and 2) an offense against academic integrity:
All required assignments in this course will be checked for plagiarism using Turnitin.

Penalties for plagiarism and/or failing to maintain academic integrity range from a failing grade for a given assignment to dismissal from the university.

SCHOOL GRADING POLICIES

NYU-SPS Undergraduate

SPS GRADING SCALE

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<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>93 and above (there is no A+)</td>
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<td>A-</td>
<td>90-92</td>
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<td>C-</td>
<td>70-73</td>
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<td>D</td>
<td>60-69 (there is no D+; nor is there a D-)</td>
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<td>F</td>
<td>59 and below</td>
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INCOMPLETES

NYU-SPS no longer awards IF (Incomplete Fail) and IP (Incomplete Pass). There is only one 'Incomplete' option (I). Incompletes are rarely granted, and only under the most extenuating of circumstances. Responsibility for seeking an incomplete grade lies with the student. A request must be made prior to the end of the semester. The student must complete the necessary work by the date specified by the instructor: this date can be no later than the end of classes in the following full term (i.e., by the end of the spring term for a fall or January course; or by the end of the fall term for a spring or summer course). If the required work is not completed within one semester, the temporary grade of "I" automatically converts to "F". Only students who complete >50% of coursework are eligible for an incomplete.

NYU-SPS POLICIES

NYU-SPS policies regarding the Family Educational Rights and Privacy Act (FERPA), Academic Integrity and Plagiarism, Students with Disabilities Statement, and Standards of Classroom Behavior among others can be found on the NYU Classes Academic Policies tab for all course sites as well as on the University and NYU-SPS websites. Every student is responsible for reading, understanding, and complying with all of these policies.

The full list of policies can be found at the web links below:
• University: http://www.nyu.edu/about/policies-guidelines-compliance.html
• NYU-SPS: http://sps.nyu.edu/academics/academic-policies-and-procedures.html

COURSE OUTLINE

Week 1, September 9: The Evolution of Whales
Location: NYU-SPS Classroom (7 East 12th Street, Fairchild Building, Room LL33)
Special exhibit (optional but encouraged): Humpback Whale IMAX at the American Museum of Natural History’s LeFrak Theater (ends September 14, 2017; showing hourly from 10:30am to 4:30pm; http://www.amnh.org/exhibitions/3d-and-2d-films/humpback-whales)
Admission: Free (Prof Brugler will provide each student with a free all-access pass to the AMNH)
Objective: Use the fossil record to trace the history of cetaceans back to wolf-sized land mammals with four legs
Reading (complete by Sept 9): Zimmer (The Tangled Bank), Chapter 1: Walking Whales
Week 2, September 16: Bacteria and Viruses
Location: American Museum of Natural History (http://www.amnh.org; RGGS Lecture Hall)
Commute time from 7 E 12th St: 32 minutes
Special exhibit: Inside You, located in the AMNH’s Akeley Gallery (http://www.amnh.org/exhibitions/inside-you)
Admission: Free (Prof Brugler will provide each student with a free all-access pass to the AMNH)
Objective: Learn about the invisible world and how these living (bacteria) and non-living (virus) entities can impact your health and wellbeing
Reading (complete by Sept 16): Carroll (Remarkable Creatures), Chapter 1: Introduction: Humboldt’s Gifts (pages 1-9)

Week 3, September 23: Protists*
Location: American Museum of Natural History (Invertebrate Zoology [IZ] classroom)
Commute time from 7 E 12th St: 32 minutes
Fieldtrip: Central Park (to collect pond water to view under a microscope in the IZ classroom)
Admission: Free (Prof Brugler will provide each student with a free all-access pass to the AMNH)
Objective: Draw a variety of protists
Reading (complete by Sept 23): Carroll (Remarkable Creatures), Chapter 2: Reverend Darwin’s Detour (pages 17-45)
*Primarily microscopic and unicellular organisms (https://www.livescience.com/54242-protists.html)

Week 4, September 30: Fungi*
Location: Central Park (tour will be led by the NY Mycological Society; http://newyorkmyc.org/)
Commute time from 7 E 12th St: 32 minutes
Special Requirements: Prof Brugler will provide you with nitrile gloves for use when handling mushrooms
Caution: Never lick, taste or eat wild mushrooms
Admission: Free
Objective: Determine the proportion of edible vs. poisonous species; different teams will focus on toadstools, shelf fungi, and fairy rings.
Deliverables: With regard to the term paper, select a species of interest from the AMNH’s Opulent Oceans exhibit or an evolutionary biologist and email your selection to your professor
Reading (complete by Sept 30): Carroll (Remarkable Creatures), Chapter 3: Drawing a Line between Monkeys & Kangaroos (Pgs 47-59)
*Mushrooms, molds, yeast, lichens, and mycorrhizae

Week 5, October 7: Plants*
Location: Brooklyn Botanic Garden (https://www.bbg.org; open until 6:00pm)
Commute time from 7 E 12th St: 37 minutes
Reminder: Class time will be extended until 5:00pm
Admission: $8 per student (must bring and present your NYU Student ID)
Smartphone Downloads (Free): LeafSnap (http://leafsnap.com/) and Garden Answers Plant Identification (http://www.gardenanswers.com/)
Objective: Determine the proportion of native vs. invasive (exotic) species as well as which species are commercially important and/or edible
Reading (complete by Oct 7): Carroll (Remarkable Creatures), Chapter 4: Life Imitates Life (pages 61-71)
*Mosses, ferns, seed plants, and flowering plants

Week 6, October 14: Biology as Food
Location: Smorgasburg (https://www.smorgasburg.com/saturday-williamsburg; open until 6:00pm)
Commute time from 7 E 12th St: 20 minutes
Admission: Free
Objective: Examine the mechanical, chemical and anatomical components involved in human digestion
Reading (complete by Oct 14): Carroll (Remarkable Creatures), Chapter 5: Java Man (pages 81-99)
**Week 7, October 21: Invertebrates**
**Location:** Lobster Place Seafood Market (https://lobsterplace.com/)
Commute time from 7 E 12th St: 20 minutes (same time to take subway or walk)
**Admission:** Free
**Objective:** Examine the diversity of spineless animals that humans consume and note unique adaptations of each group to their environment (arthropods [e.g., shrimp, lobster, crab], echinoderms [e.g., sea urchin, sea cucumber], molluscs [e.g., clams, oysters, scallops, mussels, squid])
**Reading (complete by Oct 21):** Carroll (*Remarkable Creatures*), Chapter 6: To the Big Bang, on Horseback (pages 101-121)
*Animals without a backbone; account for >95% of all animals (https://en.wikipedia.org/wiki/Invertebrate)*

**Week 8, October 28: Vertebrates**
**Location:** Bronx Zoo (https://bronxzoo.com/; open until 5:30pm)
Commute time from 7 E 12th St: 55 minutes
**Reminder:** Class time will be extended until 5:00pm
**Admission:** Free (the Bronx Zoo offers complimentary General Admission to NYC undergraduate college students; must bring and present your NYU Student ID)
**Objective:** Examine key adaptations in terms of life transitioning from the sea to land; i.e., the transition from fish to amphibians to reptiles to mammals
**Reading (complete by Oct 28):** Carroll (*Remarkable Creatures*), Chapter 7: Where the Dragon Laid Her Eggs (pages 123-141)
*Animals with a backbone or spinal column*

**Week 9, November 4: Introduction to Native Animals and Habitats**
**Location:** Jamaica Bay Wildlife Refuge (http://www.nyharborparks.org/visit/jaba.html; visitor center open until 5:00pm)
Commute time from 7 E 12th St: 1 hour and 16 minutes
**Reminder:** Class time will be extended until 5:00pm
**Admission:** Free
**Objective:** Examine native fauna (reptiles, amphibians, small mammals, birds, butterflies, and one of the largest populations of horseshoe crabs in the Northeast) and habitats (salt marsh, upland field and woods, fresh and brackish water ponds, open expanse of bay) while on a nature walk through the East and West Pond Trails. Also investigate the continuing human impact on the nature of the bay.
**Reading (complete by Nov 4):** Carroll (*Remarkable Creatures*), Chapter 8: The Day the Mesozoic Died (pages 143-159)

**Week 10, November 11: Biology in Art**
**Location:** The Brooklyn Museum (https://www.brooklynmuseum.org/: open until 6:00pm)
Commute time from 7 E 12th St: 36 minutes
**Reminder:** Class time will be extended until 5:00pm
**Admission:** $10 per student (must bring and present your NYU Student ID)
**Objective:** Examine and identify biology in art in the Visible Storage Study Center (https://www.brooklynmuseum.org/exhibitions/luce); reproduce (draw) your favorite biological art piece
**Reading (complete by Nov 11):** Carroll (*Remarkable Creatures*), Chapter 9: Dinosaurs of a Feather (pages 161-179)

**Week 11, November 18: Respiration and Body Fluid Regulation**
**Location:** NY Aquarium (https://nyaquarium.com/: open until 6:00pm)
Commute time from 7 E 12th St: 1 hour
**Reminder:** Class time will be extended until 5:00pm
**Admission:** $11.95 per student (advanced group tickets; student rates only applicable for grades K-12)
**Objective:** Examine adaptations (particularly related to balancing salt gain/loss) of freshwater and saltwater fish to their environments and learn how different organisms obtain oxygen
**Deliverables (November 20):** With regard to the showcase presentation, select a species of interest from your adventures around NYC and email your selection to your professor (mercer.brugler@nyu.edu)
**Reading (complete by Nov 18):** Carroll (*Remarkable Creatures*), Ch 10: It’s a Fishapod! (pages 181-197)
November 25
Thanksgiving Recess – No Classes Scheduled

Week 12, December 2: The Human Body Reveals the Story of Life
Location: NYU-SPS Classroom (7 East 12th Street, Fairchild Building, Room LL33)
FIlms: Your Inner Fish (54:10 minutes) & Your Inner Monkey (54:10 minutes)
Details: Your Inner Fish – a 3-part series by Neil Shubin (premiered on 04/09/2014 on PBS). Have you ever wondered why the human body looks the way it does? Why our hands have five fingers instead of six? Why we walk on two legs instead of four? It took more than 350 million years for the human body to take shape. How did it become the complicated, quirky, amazing machine it is today? Your Inner Fish delves into the past to answer these questions and reveals that hidden within the human body is a story of life on Earth. See http://www.pbs.org/your-inner-fish/about/overview/.
Objective: Your Inner Fish connects our limbs, necks and lungs to a fish with limbs while Your Inner Monkey tracks our hands, feet, color vision, spine and upright gait to our primate and hominid progenitors
Deliverables: The term paper is due at 3:15pm.
Reading (complete by Dec 2): Carroll (Remarkable Creatures), Chapter 11: Journey to the Stone Age (pages 207-235)

Week 13, December 9: History of Human Evolution
Location: American Museum of Natural History (Hall of Human Origins)
Commute time from 7 E 12th St: 32 minutes
Admission: Free (Prof Brugler will provide each student with a free all-access pass to the AMNH)
Objective: Link discoveries in the fossil record with the latest genomic science to explore the most profound mysteries of humankind: who we are, where we came from, and what is in store for the future of our species. Explore human biology and anatomy, trace the path of human evolution, and examine the origins of human creativity.
Reading (complete by Dec 9): Zimmer (The Tangled Bank), Chapter 14: A New Kind of Ape

Week 14, Tuesday Dec 12 or Wednesday Dec 13: Genomics, Transcriptomics & Proteomics*
Location: New York Genome Center (http://www.nygenome.org/)
Commute time from 7 E 12th St: 18 minutes
Admission: Free (Prof Brugler’s contact: dbetts@nygenome.org)
Timing: Per the NYGC, the best times to schedule a behind-the-scenes tour are 11am, 12pm or 1pm
Notes: This tour will substitute for our regularly-scheduled meeting on Saturday, December 16
Objective: Learn how genomics, transcriptomics and proteomics are transforming biomedical research and clinical care
Reading (complete by Dec 16): Carroll (Remarkable Creatures), Chapter 13: CSI: Neander Valley (pages 259-276)

Week 15, Date TBD: Wrap Up + NYU-SPS Access Program Fall Showcase Presentations
Location: TBD (will be assigned by the Registrar or Dean Billie Gastic)

The contents of this syllabus are subject to change. Your professor will announce all changes via email (mercer.brugler@nyu.edu) so please check your NYU email account daily for updates.