

# Neuroethics

Weds 1:30-4:10 PM, Music/Theater Building 1008

NEUR461/NEUR612/PHIL694

INSTRUCTOR: N KABBANI (nkabbani@gmu.edu) Krasnow Building 233

**COURSE SUMMARY:** Neuroethics is a burgeoning field that explores the implications of new developments in basic and clinical neuroscience on society. In particular, advances in functional neuroimaging, psychopharmacology, and brain-machine technologies raise important social, legal, and ethical questions. The course will examine a series of key topics, ranging from genetics to artificial intelligence, through an understanding of the science and an exploration of its ethical and social implications. The course encourages academic and intellectual growth through interdisciplinary education at the interface of science and humanities.

**LEARNING OBJECTIVES:** The course is developed around *student-centered learning* where students work with one another to promote a space for knowledge acquisition and synthesis. This course is designed to provide students the opportunity to practice critical skills such as communication, creativity, and collaboration. Through reading, writing, and discussion the student will gain new knowledge and augment their understanding of neuroscience. In addition, the course enables students to learn to communicate on issues at the interface of science and society through weekly practice in oral presentation and writing. The various assignments are designed to promote application of what is being learned in a “real world” scenario. By the end of the course, the student will have gained strong knowledge on the science, technology, and the ethical implications.

**TEXT:** Weekly reading will be posted on Blackboard.

**ATTENDANCE:** Attendance and participation are mandatory. Students are expected to arrive on time, having read the weekly articles, and ready to engage in discussion. Students are reminded to be respectful of others.

**GRADING:** Your grades are based on participation in all aspects of the course. You will be assessed on the presentation (25%), written assignments (50%), attendance (10%), and active participation (15%). You will be graded as a group for the presentations and written assignments. In order to satisfy the participation criteria you must demonstrate knowledge on the reading through engagement in class.

**CLASS FORMAT:** The lecture will be divided into two parts each for about an hour and a half with time for Q&A, discussion, and a short break.

**Lecture part 1.** Will consist of a 45 min presentation by the assigned group on the weekly topic. The group will present the topic from both the NEURO and the ETHICAL dimensions as examined by the weekly reading but you may also cite other sources of information. Presenters are encouraged to engage others through a clear summary and a discussion of the main ideas. For example, consider practical scenarios on the science or the policy and posit such questions to the class.

**Lecture part 2.** Each group will provide a 10 min presentation on the weekly assignment. Q&A and discussion by the class at the end of each presentation will provide an opportunity for feedback and elaboration. A written (2-3 page) report on the weekly assignment is to accompany the presentation by each group. Please email this assignment to me prior to class. You will be graded as a group for both the presentation and the assignment.

**WORKING GROUPS & INTERACTION WITH OTHERS:** This course brings together a diverse cohort of students from neuroscience and philosophy (graduate and undergraduate levels). Interaction across disciplines provides an opportunity to learn from one another. During the first lecture, you will be assigned a course partner that you will work with throughout the semester. Your success will depend on your ability to collaborate so plan how to approach the work. During the first lecture, each group will also be assigned a topic.

**TOPIC PRESENTATION:** You will be responsible for a 45 min presentation on an assigned topic. The goal is to enhance your ability to communicate, analyze, and discuss an important issue in neuroethics. The presentation should build on the assigned reading however you are free to use other sources of information. As you prepare for the presentation think of relevant questions and ideas that you want to bring up and ways you can engage others on the science or the ethics. You may use tools (such as videos or handouts). Consider your presentation as not only a summary of what you have read but a demonstration on your ability to discuss and elaborate on the concepts.

Presentation Grading Rubric:  
Accuracy and thoroughness (50%)  
Delivery and clarity (50%)

**WEEKLY ASSIGNMENTS:** A written report on the assignment must be submitted to me one day prior to class at the latest. During the second part of the lecture each group will have 10 min to summarize their assignment response and another 5 min to address questions with the class. Here are some suggestions on the written report:

- Unless otherwise noted, reports should be 2-3 pages in length, double-spaced, with standard margins and font.
- Include the names of the individuals in the group and the date.
- Write in complete sentences, organize your ideas into logical paragraphs, and proofread.
- You must cite a source when you use a direct quotation, paraphrase another author, or reference an idea that is not your own. Failure to do so is an Honor Code violation.

### Semester Schedule (SPRING 2020)

Week 1 Jan 22: Introductions and Assignments
Week 2 Jan 29: Artificial Intelligence (assignment 1 due)
Week 3 Feb 5: Trip to Natural Museum of American History**
Week 4 Feb 12: No class
Week 5 Feb 19: Alzheimer's Disease (assignment 2 due)
Week 6 Feb 27: Drug Development (assignment 3 due)
Week 7 March 5: Invited Speaker Presentation (TBA)
Week 8 Mar 12: Spring Break
Week 9 Mar 19: Gene Editing/Genomics (assignment 4 due)
Week 10 Mar 26: Stem Cells (assignment 5 due)
Week 11 April 2: Addiction (assignment 6 due)
Week 12 Apr 9: Consciousness (assignment 7 due)
Week 13 Apr 16: Synthetic Biology (assignment 8 due)
Week 14 April 23: Memory (assignment 9 due)

## **\*\*Exhibits at the Natural Museum of American History**

Location: 1300 Constitution Avenue (14th Street and Constitution Avenue), NW, Washington, DC  
Metro: Federal Triangle (Orange/Blue Line)  
Hours: 10AM-5:30PM

### **1. My Computing Devices** (August 28, 2019 – February 2020)

1st Floor, Center

My Computing Devices showcases the complex story of Americans' ownership and use of computers, and challenges visitors to examine their own personal relationships with devices. A range of mechanical and electronic objects from the museum's collections will be on view; some were inventions of little practical use, others were the tools of scientists, business people, engineers and consumers; and others were toys, often designed by and for educators.

### **2. More Doctors Smoke Camels: A Close Reading of Historical Advertising** (April 5, 2019 – TBD)

1st Floor, West, Archives Gallery

Despite today's common knowledge that tobacco products cause cancer, advertisers from the 1920s to the 1960s used representations of medical professionals to make the case that smoking was healthy. The exhibit examines these period advertisements by tobacco companies seeking to exploit the influence of doctors, dentists, and nurses to ease consumers' anxiety over the health risks of smoking. Contemporary audiences will learn how advertisers worked to promote cigarettes in the face of the health problems they caused.

### **3. America's Listening** (October 19, 2018 – Indefinitely)

3rd Floor, West Gateway

America's Listening tells the story of recorded sound and innovations that contributed to how we consume music and movies today, with objects including Thomas Edison's phonograph, Alexander Graham Bell's graphophone, and Apple's iPod.

### **4. Places of Invention** (July 1, 2015 – Indefinitely)

1st Floor, West Wing, Lemelson Center Gallery

What kind of place stimulates creative minds and sparks a surge of invention and innovation? The answer may surprise you. Journey through time and place to discover the stories of people who lived, worked, played, collaborated, adapted, took risks, solved problems, and sometimes failed—all in the pursuit of something new. The exhibition examines what can happen when the right mix of inventive people, untapped resources, and inspiring surroundings come together.

Case studies include:

- medical innovations in Medical Alley, Minnesota, in the 1950s
- the rise of the personal computer in Silicon Valley, California, in the 1970s and 1980s
- clean-energy innovations in Fort Collins, Colorado, in the 2010s

### **5. Inventing in America** (July 1, 2015 – Indefinitely)

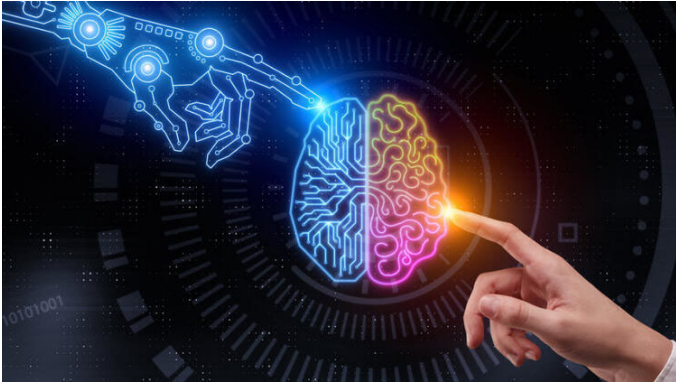
1st Floor, West

Inventing in America, a collaboration with the U.S. Patent and Trademark Office, focuses on inventions and innovators of the past and present, including Alexander Graham Bell and Thomas Edison. The displays feature early patent models, trademarks, and inventions.

Anchoring the floor is a new landmark object, Ralph Baer's Inventor's Workshop. Visitors are able to view the home workshop of Ralph Baer, known as the inventor of the home video game. A monitor adjacent to the workshop shows an excerpt from an original color videotape of the "Brown Box," the first video gaming system.

# Weekly Assignments

## Assignment 1. Artificial Intelligence



Create a company that produces a new AI technology. Describe your main product(s) and how they may address an existing need that can be served through AI technology. Consider your target market. Who would buy this product and for how much? How will your technology compete with other or similar products? How will you deal with issues that may come up on privacy and/or regulation? What does your company need (skills and resources) in order to succeed?

## Assignment 2. Alzheimer's Disease and Dementia



Develop a conference that uniquely brings together key figures that can advance knowledge and treatment for AD and dementia. List the kinds of scientists and policy makers that you may want to invite and other professionals pertinent to the cause. How will you promote interaction between diverse professionals on the issues? What would be your 3 primary goals for the conference? Where would the conference venue be and why?

## Assignment 3. Pharmaceuticals and Drug Development



Pick an emerging drug, class of drugs, or a neuro related therapy:

- 1) Create an advertisement for this technology for the public. This can be a visual or animated add. Make sure to highlight the benefit of this drug and inform them on how it works. Make sure to note how this new drug may outperform other existing therapies.
- 2) Create an announcement for a warning, class action lawsuit, or recall against this therapy also for the general public. Make sure to highlight the issues that have prompted this recall/warning.

## Assignment 4. Gene editing/Genomics



Draft an NIH style RFP for research into a specific form of gene technology. Expand on which areas or topics are important for funding covered by this RFP.

Emphasize which approaches and technologies are most valued in the submitted proposals. You can



also highlight which types of researchers and approaches are encouraged to apply. Include information on the funding range for each grant considering how much would be needed to enable the research. Which NIH institute could sponsor this and why? Look at RFPs on the NIH website for examples.

## Assignment 5. Stem Cells



You are a world-renowned stem cell scientist and have called to testify at an important congressional hearing on the “State of Stem Cell Research”. The aim of the hearing is to enable the congressional committee to decide whether the U.S. should or should not invest more in stem cell science including input on ways it can improve existing research. Draft a 2-3 page letter of the script of your speech. Consider carefully what you would tell the congressional committee and how to

effectively make your case in the short amount of time you are provided (~7 minutes). Note while the members of the committee are familiar with the science they are not scientists.

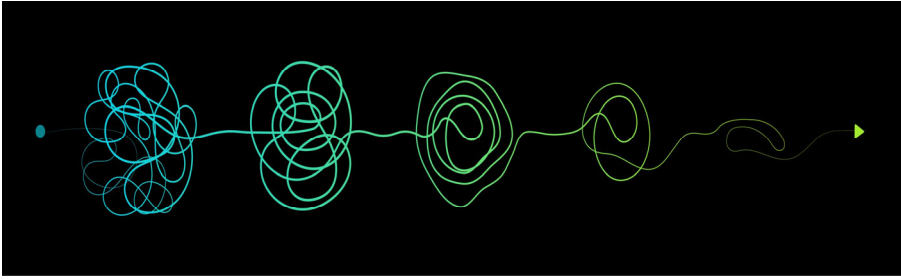
## Assignment 6. Addiction

<b>Main Point</b>	Five years ago, the Department of Energy (DOE) launched SunShot, an initiative to make solar cost-competitive with traditional energy sources. Since that announcement, the price of solar has nearly halved, solar industry employment has doubled, and solar electricity generation has grown twenty-fold. What we need now is to replicate this policy success with a SunShot for Carbon Capture Storage (CCS).
<b>Background</b>	<p>The International Energy Agency and the UN’s Intergovernmental Panel on Climate Change have made it very clear—we’re unlikely to win the climate fight without CCS. We know that CCS technology works. But getting it deployed as widely and as quickly as we need to will require additional policy incentives to make CCS more cost-effective, including an increase in federal RD&amp;D activity.</p> <p>As evidenced by SunShot and the more recent announcement of Mission Innovation, the Obama Administration clearly understands the importance and potential of aggressive, multi-year investment campaigns in energy R&amp;D. The President’s 2017 budget proposal streamlines DOE’s CCS innovation activities and includes programmatic updates that prioritize the most effective and successful activities. With a few additional tweaks by Congress, this spending plan could lay the groundwork for an equally promising innovation effort—a “SunShot for CCS”.</p> <p>To ensure this urgently needed technology is ready for an enhanced innovation effort in the coming years, Congress should:</p>
<b>Recommendation 1 and Evidence</b>	<p><b>Robustly Fund CCS and Advanced Power Systems</b></p> <ul style="list-style-type: none"> <li>While the Administration’s Fossil Energy request for 2017 was their largest to date, it is still slightly below 2016 enacted levels. Congress should meet or exceed previous funding levels for the recently-restructured “CCS and Advanced Power Systems” program within the Fossil Energy budget.</li> </ul>
<b>Recommendation 2 and Evidence</b>	<p><b>Fund Carbon Use and Reuse</b></p> <ul style="list-style-type: none"> <li>The 2017 budget proposal does not request any funding for the Carbon Use and Reuse activity. However, value-added products provide necessary cost reductions that allow for earlier and more effective CCS deployment and there is increasing private sector interest in carbon utilization, as demonstrated by the Carbon XPRIZE. As a first step, Congress should add to this momentum by providing \$10 million for the Carbon Use and Reuse activity within the Carbon Capture subprogram.</li> </ul>
<b>Recommendation 3 and Evidence</b>	<p><b>Protect Demonstration Funding through the Clean Coal Power Initiative</b></p> <ul style="list-style-type: none"> <li>The Clean Coal Power Initiative (CCPI) began in 2002 and is a cost-shared partnership with industry to develop and demonstrate cleaner coal power generation technologies at the commercial scale. The 2017 budget proposal requests that Congress include language to allow up to \$240 million in existing CCPI funds to be used towards the R&amp;D budget, which would pull funding from potentially promising large-scale projects. Congress should leave these funds where they are in order to enable additional CCS deployment.</li> </ul>
<b>Recommendation 4 and Evidence</b>	<p><b>Request a CCS Cost-Reduction Plan from DOE</b></p> <ul style="list-style-type: none"> <li>2017 is a first step, but accelerating clean energy technology can’t be done in a single year. Like SunShot, CCS needs a long-term commitment. Congress should request the DOE produce a detailed, multi-year plan with the goal of cost-competitive CCS deployment. This plan should include both the large-scale pilots in the 2017 budget and future demonstration projects.</li> </ul>
<b>Conclusions</b>	Climate change is a complicated problem, but this part of the solution is simple: We need CCS to meet emissions goals; we need to lower technology cost to deploy more CCS; and we have a proven model for cost reduction in SunShot. When you line up the facts, a “SunShot for CCS” becomes a rare no-brainer for climate policy. Congress has a chance this year to lay the groundwork for such an initiative. They shouldn’t pass it up.

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You are a Science Policy Fellow at the FDA. You have been tasked to draft a policy memo (see example below) on the addictive properties and regulatory guidelines for a drug/item of your choice. This memo is intended to help the Commissioner of Food and Drugs make an informed decision on action and regulation for this addiction.

## Assignment 7. Consciousness



Borrowing from readings and published texts, define “consciousness” in an animal or a system. Next design an experiment or a series of tests for examining consciousness in a model of your choosing. This experiment can be virtual or biophysical (e.g. in a

laboratory). State your specific hypothesis and method for data collection and analysis. List possible pitfalls and limitations in your work.

## Assignment 8. Synthetic Biology



Pick a scientist working in the field of synthetic biology and summarize his/her work citing major articles, contributions, and impact. Discuss his/her training and how they might have arrived at this work. For example, you may want to look back at their publication history via PubMed. Why did you pick this person?

## Assignment 9. Memory



How does neuroscience impact the legal landscape of testimony, eyewitness credibility, memory based facts, and claims of forgetting. In particular how can we incorporate neuroscience findings in areas such as neural plasticity and neuromodulation in the larger legal framework? For example, do we need neurotechnology in the courtroom? If so, which and why?