This is a neuroscience and neuroethics course for non-experts. Unlike the scientific issues underlying more well-publicized political issues such as energy, the ethical issues in neuroscience cut deep into the heart of the issue of human identity, and affects decisions about whom we afford rights and how we preserve these rights in the face of new technologies. For example, with the advent of more refined brain imaging techniques we face the possibility of being able to read the thoughts of another person. How then should we protect those thoughts and the rights from the Fifth Amendment? As we get better able to predict future psychiatric disease or criminal behavior, how do we act on this knowledge to preserve individual rights? This class will explore the ethical arguments in these issues as well as the neuroscientific realities of these debates.

The class format will be short, scientific lectures followed by class discussion and debate on the issues. Students will have a final project intensively researching a neuroethical topic and making a policy recommendation. To emphasize real-life relevance, students should share at least one example of news or popular media’s depiction of a neuroethical topic.

Grading:
40% class participation, distributed as:
  25% participation in class discussions
  15% discussion/debate/reactions on Blackboard
40% final project
20% news and media suggestions

No extra credit work is permitted, and grades in this course are not "curved."

Reading:
Glannon, Ed. *Defining Right and Wrong in Brain Science*
A packet of other assigned readings will be made available on Blackboard.

It is critical to everyone’s class experience that readings are done before the start of class. Please only take this course if you are willing to do the reading in a consistent and thoughtful way and come to class prepared to talk about the ideas under consideration. A note on original scientific research: some of the readings are original science papers, and may be difficult to understand depending on your background. Learning the process of how to approach these papers is important, both for this class and for your education generally. Make a pass at the papers with the guidelines from this syllabus package. I will open each class by taking questions about the papers.

Proceedings:
As advertised in the grading section, conspicuous and consistent attendance and engagement with the issues are essential. Irregular attendance will not be helpful. However, if you cannot attend a class session I will assume it is for a legitimate reason, and will not require documentation to excuse the absence. Some out-of-lecture time will be spent engaging your colleagues in discussion/debate on Blackboard, as well as signing up for and presenting real-world examples of class topics.
Blackboard discussions:
Each student is expected to contribute to a discussion thread on Blackboard following each class session. I will post several possible response topics to give ideas, but feel free to start others. You may also write your own response, or reply to a previously posted response. To be counted as a contribution, your posts need to be thoughtful and grounded in the readings. Although I will not count words, a thoughtful and structured response will take 300-700 words. In other words, “I agree” or “LOL” does not count as posting for the week.

News and media suggestions:
Beginning with the second class session, part of the class session will be devoted to short presentations (<2 min) on a piece of news, art or popular culture that deals with issues raised in that week’s class. To ensure that each student has a unique contribution, sign-ups for each week will be available on Blackboard.

Final project:
The goal of the final project is to give you the opportunity to explore one of the course’s topics in depth, and to express this learning in a way that is congruent with your unique background and talent. The form of the final project is up to you, but must be approved by me, in writing, by the fifth class session. The final project could be in the form of a traditional research paper (4000-5000 words), or a more creative option if you are so inclined (write a screen play illustrating a neuroethics dilemma, make policy recommendation to your congressman based on proposed legislation, volunteer in a neuroscience lab and write about your experience, etc). Projects will be due on the last day of class when they will be presented.

Misc. policies:
Electronics – Please silence your cell phone upon entering class. Please do not use your laptop in class – it is impossible for you to completely engage in discussions when there are other pulls on your attention, and it is impossible for me to determine if you are understanding if your faces are hidden behind lids and eyes are looking down.
Food – Quiet, non-aromatic food and drink are fine provided you clean up after yourself after consuming.
Tardiness (you) – It is expected that you will arrive on time to class. If for whatever reason this is not possible for a class, please have respect for your colleagues and enter quietly with minimal distraction.
Tardiness (your work) – Late work will not be accepted, except in the case of documented emergencies.

Academic integrity
You can find Tufts University’s policy on academic integrity for graduate and undergraduate students at: http://studentservices.tufts.edu/dos/. Students’ work will be closely scrutinized for plagiarism and violations of the University policy will not be tolerated.

Class Plan:

Week 1:
Introduction and common misconceptions perpetuated about the brain
From common myths in advertising (“we only use 10% of our brains”) to more recent ideas without empirical support, such as the deluge of “brain training” software. The misuse of statistics in science reporting.
Readings:
Glannon, Ch. 3
“Open up your mind: the ethics of brain science” The Economist 2002
If you haven’t recently read it, you might want to review: Huxley’s *Brave New World*, http://www.huxley.net/bnw/index.html (Optional)

Week 2:
**Self sense and the brain**
Historical overview of neuroscience getting to the idea that the mind is what the brain does. Cartesian dualism. Patient populations exhibiting distorted self sense.

**Readings:**
Calvin & Ojemann, “In search of the narrator” from *Conversations with Neil’s Brain*
Hofstadter, “A conversation with Einstein’s brain”
Sacks, “The Man who fell out of bed” *Man Who Mistook his Wife for a Hat*
Crick, “Introduction” *The Astonishing Hypothesis*
Glannon, Ch. 14
Optional: Burwood, “Are we our brains?”, *Philosophical Interactions*
Optional : Kaposy, “Will Neuroscientific Discoveries about Free Will and Selfhood Change our Ethical Practices?” *Neuroethics*

Week 3:
**Brain imaging I: Scientific background**
The promise and potential. Overview of what techniques exist, what they measure, and their limitations. Important considerations for analysis and interpretation of imaging data.

**Readings:**
Savoy: “History and future directions of human brain mapping and functional neuroimaging” *Acta Psychologia*
Logothetis: “What we can do and what we cannot do with fMRI” *Nature*
Vul et al: “Voodoo correlations in social neuroscience” *Perspectives in Psychological Research*
Optional: Raichle, “Behind the scenes of functional brain imaging: A historical and physiological perspective”, *Proceedings of the National Academy of Sciences*

Week 4:
**Brain imaging II: Applications: lie detection, prediction and metal privacy**
The use of imaging data in the courts for lie detection. Can thoughts be read with brain imaging? Criminal responsibility and brain scanning evidence in the courts. Proposed uses for airport security, job interviews, etc. The misinterpretation of imaging data in the media.

**Readings:**
Glannon, chapters 9 & 13
Haynes & Rees, “Decoding mental states from brain activity in humans” *Nature Reviews Neuroscience*
Racine et al, “fMRI in the public eye” *Nature Reviews Neuroscience*
“Deceiving the Law” *Nature Neuroscience* editorial
Weisberg et al, “The seductive allure of neuroscience explanations” *Journal of Cognitive Neuroscience*
“Brain Scam” *Nature Neuroscience*
Week 5:

**Pharmacological cognitive enhancement I: Better brains through better memory and attention**

Drugs for enhancing attention, memory and wakefulness: how well do they work? Concerns: safety, equal access, “fairness”, the undermining of identity, character, social coercion. The difficulty determining the line between therapy and enhancement.

**Readings:**
Glannon, Ch. 22 & 25
Elliott et al, “Effects of methylphenidate on spatial working memory and planning in healthy young adults” *Psychopharmacology*
Farah et al, “When we enhance cognition with Adderall, do we sacrifice creativity? A preliminary study” *Psychopharmacology*
Volkow et al., “Effects of modafinil on dopamine and dopamine transporters in the male human brain: clinical implications” *JAMA*
Bendetti et al, “Neurobiological mechanisms of the placebo effect” *The Journal of Neuroscience*
Schiermer et al., “The Future of Psychopharmacological Enhancements: Expectations and Policies” *Neuroethics*
Greely et al, “Towards responsible use of cognitive enhancing drugs by the healthy” *Nature*
Sahakian & Morein-Zamir, “Professor’s little helper” *Nature*
Optional: Talbot, “Brain Gain” *The New Yorker*

Week 6:

**Pharmacological cognitive enhancement II: Improving your personality and love life**

Drugs for enhancing happiness, extroversion and social relationships: how well do they work? Concerns: safety, equal access, “fairness”, the undermining of identity, character, social coercion. The difficulty determining the line between therapy and enhancement.

**Readings:**
Glannon, Chapters 23-24
Elliott, *Better than Well* excerpts
Kramer *Listening to Prozac* excerpts
Kirsch et al., “Initial Severity and Antidepressant Benefits: A Meta-Analysis of Data Submitted to the Food and Drug Administration” *PLoS*
Savulescu & Sandberg, “Neuroenhancement of Love and Marriage: The Chemicals Between Us” *Neuroethics*
Knutson et al, “Selective alteration of personality and social behavior by serotonergic intervention” *American Journal of Psychiatry*
Optional - Charlton, “Diazapam with you dinner, sir?...” *Quarterly Journal of Medicine*

Week 7:

**Ethical considerations across human lifespan I: Children**

Children and ADD/ADHD, Autistic spectrum, bipolar diagnosis. The line between treatment and social control.

**Readings:**
Singh, “Beyond polemics: science and ethics of ADHD” *Nature Reviews Neuroscience*
Toga et al, “Mapping Brain Maturation”, Focus 
Rutter, “Incidence of autism spectrum disorders: changes over time and their meaning.”, Acta Paediatrica 
Munro, “Brain Politics”, PBS Frontline 

Week 8: 
**Ethical considerations across human lifespan II: The Elderly**

The dementia spectrum and issues of autonomy. The coming problem of the aging population.  
**Readings:**

Sowell et al., “Mapping cortical change across the human life span”, Nature Neuroscience  
Dekkers & Rikkert, “Memory enhancing drugs and Alzheimer's Disease: Enhancing the self or preventing the loss of it?”, Medicine, Health Care and Philosophy  
Dubois et al, “Research criteria for the diagnosis of Alzheimer's disease: revising the NINCDS-ADRDA criteria” The Lancet  
Lai & Karlawish, “Assessing the capacity to make everyday decision: a guide for clinicians and an agenda for future research”, American Journal of Geriatric Psychiatry 
Appelbaum et al., “The capacity to vote of people with Alzheimer's disease”, American Journal of Psychiatry 
Franzen, “My Father's Brain” The New Yorker

Week 9: 
**Human machine interfaces and invasive brain alterations**

Sensory devices (cochlear implants), deep brain stimulation, brain computer interfaces for the disabled, therapeutic TMS. The cyborg question.  
**Readings:**

Wolpaw & McFarland “Control of a two-dimensional movement signal by a noninvasive brain-computer interface in humans” Proceedings of the National Academy of Sciences of the USA  
Smith, “Brain implant allows mute man to speak”, Nature News  
Suaning, “The bionic eye (electronic visual prosthesis): A review” Clinical and Experimental Ophthalmology  
Mayberg, “Deep brain stimulation for treatment-resistant depression” Neuron  
Clausen, “Man, machine and in between” Nature  
Denning et al, “Neurosecurity: security and privacy for neural devices” Neurosurgical Focus

Week 10: 
**To whom do we afford consciousness and personhood?**

Borderline cases: PVS patients, the mentally ill, fetuses, non-human animals. Studies trying to assess consciousness in each. Historical overview of ethical considerations that set back science and medicine in the context of “respecting life”.  
**Readings:**
Glannon, Chs 26, 28, 29
Owen et al “Detecting Awareness in the Vegetative State” Science
Andrews et al, “Misdiagnosis of the vegetative state: retrospective study in a rehabilitation unit” BMJ
Rosenhan, “On being sane in insane places”, Science
Shriver, “Minding Mammals” Philosophical Psychology
Farah & Heberlein, “Personhood in neuroscience: naturalizing or nihilating?” American Journal of Bioethics

Week 11:
**Biological determinism, free will and personal responsibility**
Predictions and their problems. Specific cases of prediction of neurological and future criminal behavior. Neuroscience of pre-conscious decision making. Free will and the law. Free will and advertisements (from subliminal priming to targeted data mining)

**Readings:**
Glannon, chs. 17-18
Caspi et al., “Influence of Life Stress on Depression: Moderation by a Polymorphism in the 5-HTT Gene”, Science
Keri, “Genes for Psychosis and Creativity: A Promoter Polymorphism of the Neuregulin 1 Gene Is Related to Creativity in People With High Intellectual Achievement” Psychological Science
Soon et al, “Unconscious determinants of free decisions in the human brain” Nature Neuroscience
Murphy & Reiner “Neuroethics and Neuromarketing” Journal of Consumer Behavior
Vokey, “Subliminal messages”

Week 12:
**Altering memory: Selective memory erasure**
The new ability to selectively erase memories: a boon for PTSD patients? Concerns about military use. Psychological and neurological implications of use.

**Readings:**
Henig, “The Quest to Forget” The New York Time
Kindt et al, “Beyond extinction: erasing human fear responses and preventing the return of fear” Nature Neuroscience
Kolber, “Freedom of Memory Today” Neuroethics
Pitman et al, “Pilot study of secondary prevention of posttraumatic stress disorder with propranolol” Biological Psychiatry
Liao & Sandberg, “The Normativity of Memory Modification”, Neuroethics

Week 13:
**Military applications of neuroscience**
From the development of helmets to detect subtle neurological injuries to the concerns over drug use and social control.
Readings:
Moreno, “DARPA on your Mind”, Cerbrum
Moreno “Juicing the Brain”, Scientific American
Hoag, “Remote control” Nature
Wilson, “Mediums and Messages: An argument against biotechnical enhancements of soldiers in the armies of liberal democracies” Ethical Perspectives
Dando, “Biologists napping while work militarized” Nature
Winter, “The Making of Truth Serum”
Optional: “Project MKULTRA, the CIA’s Program of Research and Behavioral Modification--joint hearing before the U S Senate, 1977 transcript” Excerpts

Week 14:
Neuroprivacy
Keeping one’s thoughts, memories, and proclivities personal in an era of data mining.
Readings:
Gandy, “Data mining and surveillance in the post-9.11 environment” The new politics of surveillance and visibility
“Are Your Thoughts Your Own?:“Neuroprivacy” and the Legal Implications of Brain Imaging”
Lohr, “For today’s graduate, just one word: statistics” The New York Times

Week 15:
Concluding remarks and project presentations