ETHICAL ISSUES IN NEUROSCIENCE
SYMPOSIUM REPORT

A ONE-DAY SYMPOSIUM
July 23, 2013

AAAS
1200 New York Ave
Washington, DC, 20005

Sponsored by:
AAAS & the Potomac Institute for Policy Studies

Hosted by The NeuroPolicy Affinity Group
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| 9:00 – 9:15 am | Welcome and Opening Remarks  
Alan Leshner, Chief Executive Officer of AAAS and  
Executive Publisher of the journal, “Science” |
| 9:15 am – 11:00 am | Panel on Neuroethics in Defense  
Moderator: Christian Macedonia  
Panelists: James Giordano, William Casebeer, Andrew Herr,  
and Jonathan Moreno |
| 11:00 am – 12:15 pm | Working lunch - Break-out I: Neuroethics in Defense |
| 12:15 pm – 1:00 pm | Report out on Break-out I |
| 1:00 pm – 2:45 pm | Panel on Promoting and Teaching Standards in Neuroethics  
Introduction: Michelle Groman  
Moderator: James Giordano  
Panelists: Rachel Wurzman, Debra Mathews, Carol Erting, and Joseph Procaccini |
| 2:45 pm – 3:45 pm | Break-out II: Promoting and Teaching Neuroethics |
| 3:45 pm – 4:30 pm | Report out on Break-out II |
| 4:30 pm – 5:30 pm | From Ethics to Policy and Law  
Introduction: James Giordano  
Keynote: Michael Swetnam, President and CEO of Potomac Institute |
| 5:30 pm – 5:45 pm | Closing Remarks  
Philip Rubin, Principal Assistant Director for Science in the  
Office of Science and Technology Policy |
EXECUTIVE SUMMARY

In the wake of “The Decade of the Brain” and with such recent strong and visible federal support for neuroscience research (e.g. The White House Neuroscience and BRAIN Initiatives), neuroscience is at the forefront of both research and policy agendas. Yet, advances in both military and civilian neurotechnologies and neurocapacities (e.g. brain machine interface, neuroenhancement, neurostimulation) have raised deep ethical concerns. Given these concerns, on July 23, 2013, the Potomac Institute for Policy Studies, in conjunction with the American Association for the Advancement of Science (AAAS) Science & Technology Policy Fellowships NeuroPolicy Affinity Group, convened a day long symposium to expose the neuroscience community to three types of ethical issues in neuroscience:

• Ethics in the use of neuroscience in defense
• Ethics of access to advances in neuroscience
• Ethical thought on the use or misuse of neuroscience

Over 100 members of the neuroscience community gathered for this one day symposium to discuss ethical issues in neuroscience. Attendees included those who are working in or interested in learning about the intersection of neuroscience with policy, law, ethics, media, and society. Speakers included personnel from government, NGOs, think tanks, and academia. The symposium addressed the topics of neuroethics in defense and promoting and teaching neuroethics, and ended by transitioning the focus from ethics to policy, education, and law.
Following opening remarks from Dr. Alan Leshner (Chief Executive Officer of AAAS and Executive Publisher of the Journal Science), the day was organized into two sections. The morning session addressed the topic of neuroethics and defense, starting with a panel and followed by a break-out session. The afternoon transitioned the focus from ethics to policy and education and consisted of a panel on promoting and teaching neuroethics followed by a breakout session designed to yield insight into how the neuroscience community might better prepare the next generation of neuroscientists to address novel ethical issues in neuroscience arising from future advances and technologies. The day culminated in a plenary by Michael Swetnam (President and CEO of the Potomac Institute for Policy Studies), who broadened the discussion from ethics to policy and law. Finally, Philip Rubin (Principal Assistant Director for Science in the White House Office of Science and Technology Policy) gave closing comments.

The report that follows has been prepared by the Potomac Institute for Policy Studies and the Neuropolicy Affinity Group and is intended to be a factual summary of the events and discussions that occurred at the symposium. The views contained in the report are those of the individual workshop participants and do not necessarily represent the views of all workshop participants, the Potomac Institute for Policy Studies, AAAS S&T Policy Fellows at large, or the AAAS.
WELCOME

ALAN LESHRNER

Opening Remarks

I want to acknowledge the AAAS NeuroPolicy Affinity Group and all of the other organizers for organizing this event and bringing us together. Today’s discussion should give rise to new ideas that should be pursued and bring about new kinds of questions that ought to be asked at this interface. Ethical issues are more important than ever for the scientific community. As someone who has worked at the intersection of science and society, I can tell you that the heavy influence of ideology, common sense, and intuition about the way people approach those issues makes it extremely important for science, and neuroscience in particular, to think about not only the pathophysiology of illnesses, but also the societal implications of everything we discover and the ethical issues that intersect with it.

It is also important to recognize that the current degree of tension between scientists, society, and policy makers is unprecedented. This tension makes policy makers and the public, the natural receptors for the products of science, less ready to accept what science is showing. The true benefit of science is for human kind, and when people are not interested in or ready for science, the consequences are tremendous.

The public is now for the first time interested in dictating not only what science is done, but also what science is not done. The origin of the tension falls into two categories, those internal and those external to science. There are many things going on within science that can have consequential impacts on the public image of science broadly, such as scientific misconduct, human subjects issues, animal welfare, and conflicts of interest.

External to science are issues in which societal beliefs conflict with scientific findings. What science is showing sometimes conflicts with certain public beliefs, human values, and cultural views. Widespread misunderstandings about autism or GMOs spread fear and lead to concerning results such as children not being vaccinated. Politically or economically inconvenient findings, such as those associated with climate change, are also an issue. Religious or cultural values can conflict with science, such as in embryonic stem cell research or the teaching of evolution.

There are several issues in neuroscience as well that can come into conflict with societal beliefs and values or pose legal and ethical questions. The prospect of future ability to predict behaviors or read minds is unsettling for society. The mind-brain dichotomy is a difficult issue to accept as well. Education is necessary but will not be enough. Public engagement with science, where people actually meet in small groups with people who have different views and try to find common ground, is important, as is policy. Today, we will talk about approaches for tackling and understanding these issues.
NEUROETHICS IN DEFENSE

Moderator: Christian Macedonia
Panellists: James Giordano, William Casebeer, Andrew Herr, and Jonathan Moreno

CHRISTIAN MACEDONIA

Moderator

Why would the Department of the Defense (DoD) have an interest in the brain outside of destroying our enemy? Just over the last decade we have spent over two billion dollars of Defense health money on brain issues. Most of these funds are going to major universities with only about 10% going to non-university agencies or defense contractors. The DoD is a significant funder of brain related research. This research goes to help deal with brain related injuries or illnesses. Additionally, the DoD has been charged with defeating the enemies of the United States and finding ways to do it in a constitutionally consistent manner.

One matter that is more discussed internally involves how we improve the brain functions of healthy people. Some people might call this an enhancement. There is a red line somewhere beyond where what we do is bad. Enhancement could create a society of haves and have-nots. A discussion on ethics should involve determining where that line lies.

Part of my four years working for the military was working to help our seriously wounded soldiers, including six trips to Afghanistan to work with our troops who had PTSD or severe brain trauma. The signature injuries of the war were related to the brain. Many of the technologies that were sent to Afghanistan, such as Magnetic Resonance Imaging (MRI) machines or the blast gauges produced by DARPA to mitigate blast-related injuries, could be used for applications that might make people feel uncomfortable or be what some might call nefarious.

Traditionally, the United States has always had to deal with matters of warfare and, more specifically, the warrior. Through the centuries, the government has consistently been driven to care for the warrior on the battlefield, from treatment of illness or injury to mitigating PTSD. Protecting the warrior sometimes means that the military must occasionally adopt offensive techniques like psychological warfare, decoy use, and submission techniques.

Another topic that might make people feel uncomfortable is the idea of fighting inside the enemy mind, even though this is an ancient tradition. That includes dropping leaflets or using decoys, or fighting when it is unexpected. Military use of neuropharmacologics also has a long history, as evidenced by the coffee included in the rations of US soldiers.
Neuroscience and neurotechnology (neuroS/T) offer a range of interesting opportunities and challenges for national defense. We have investigated assessment technologies, including neuroimaging, neurogenomics, neuroproteomics, and neurocyberinformatics. As well, we are able to weaponize neurotechnology to deal with others, including possibly changing the mindset of hostile individuals and groups. If we do not engage in R&D, current global trends reveal that other countries will, and we will be at a disadvantage. We need to take the moral high ground in any/all studies and applications of neuroS/T within the national defense agenda. How then, shall we approach such neuroS/T research and applications in ways that are ethically sound?

A 6-P process can provide guidance to achieve best practice.

1. Be prepared, not simply precautionary;
2. Include people that are poly-disciplinary, persistent and pragmatic;
3. Make predictions – think of possibilities, probabilities, problems, and solutions;
4. Be prudent in our decisions and actions;
5. Take a “parentalist” approach. Security issues may constrain full transparency, yet communication must be engaged (within the field, with policy-makers, and with the public) to foster discourse, avoid over- and/or under-examination of capabilities, benefit, risks, threats, and to facilitate ethically sound direction. To avoid potential conflicts of interest and to preserve missional integrity, we could possibly commission a national neuroscience lab for defense purposes;
6. Take a paradigmatic approach that begins with understanding history of science, technology, and the various agendas that shape – and are affected by – their use in context.

This paradigm proceeds to ombudsmanship: what are the real issues and problems? Finally, we must foster responsible yeomanry in addressing and dealing with identified questions and problems. Several groups of individuals must guide this practice. They must be multidisciplinary and multifocal. They will need to define issues, model trajectories, and understand exigencies and contingencies to meaningfully inform guidelines, policies, and laws.
We need to consider several groups of stakeholders that will be influenced by how we apply neuroscience in the national security domain. These stakeholders include: potential combatants, soldiers, and future generations.

We should consider the 3-Cs framework for the application of these technologies for these stakeholders: Character, Consequence, and Consent. There are seven general questions with which one must grapple before one can justify violence in war: Is it sanctioned by a legitimate authority? What are the consequential considerations? Will it produce a better world? What application of force will be used? Will there be proportionality in the application of technology? Will it produce benefit? Will we apply the technology against combatants discriminately?

This framework can be applied to neurotechnology:

- **Character**: what kind of positive traits should we develop to help us flourish? Is augmentation of human capabilities and capacity really conducive to and necessary for humanity to flourish?

- **Consequences**: what will happen if there is too much augmentation of human capability? Is the technology fundamentally changing our lives? Is our dignity as human beings being upheld? As it stands, most of our applications are used for military enhancement, but there are a few private benefits as well – cochlear implants, retinal applications, Modafinil. We need to work to keep it beneficial.

- **Consent**: It might be that some technology will blur the distinction between combatants and noncombatants. We must always take into account the humanity of others and have our eyes wide open when we think about those technologies. Neurotechnologies could help us to do things like deal with trauma in the aftermath of battle or mitigate the likelihood that noncombatants will be exposed to neutral trauma, but there are also potential horrific, although unlikely, consequences of neurotechnologies.

As long as we pay due care to the 3-Cs, we can proceed with research in this arena. In fact, we are morally required to do so, especially those in the military who have a fiduciary and moral duty to defend those whom they are charged to defend and to protect universal human rights. In an adversarial environment, restraint can be risky. These three stakeholders have a lot at stake, and it may be morally required of us to take their wellbeing into consideration when applying neurotechnology to the battlefield.
ANDREW HERR

Panelist

There are ethical issues that we see in defense today, but there are others coming as well. Neuroscience will progress with both opportunities and dangers.

Stress degrades the quality of our thoughts and memory as well as how we think and affects everyone differently. In fact, there are certain levels of stress-hormones that correlate with dissociation and thus an individual’s likelihood of being afflicted with PTSD. Pre-existing conditions may contribute more to PTSD than any combat-related condition. In the future, we could predict who can go into combat with a lower risk of PTSD or modify that risk. This leads to ethical issues involving whether injuries to the brain and personality are different than injuries to the body and fairness in how we decide whom to send into combat.

The second issue involves warfighter selection using neuroscience-based tests. Certain reactions to stress are correlated with physiological metrics, such as dissociation, which is negatively correlated with objective military performance. Thus, we could potentially use a physiological metric for selection, which conflicts with our ideal that all people are created equal. It means that we may exclude some people from an opportunity to try based on how their brains operate.

There are also many issues associated with enhancement. We already enhance brains through training and certain drugs, but new technologies are coming. We need to care about cognitive effects, as military might is moving from physical to cognitive. Training has been shown to give several-fold improvement in combat performance, and with continued advances in technology, the cognitive aspect will become increasingly important. We have to consider whether the military will enhance its soldiers or whether society will develop enhancements and the military recruit from a pool of people who choose to enhance themselves, which may be the more important factor as private sector interest is high. We also need to consider then whether we have a responsibility to make sure that the enhancements that people are trying are safe. For enhancements in the military, with its hierarchical structure, consent will be a critical issue.

The last issue here is translation in enhancement research from lab to life. We can produce enhancements in a lab, but we do not always understand why they work. Transcranial stimulation affects vigilance, though in different ways than expected. Animals are not the same as humans, and humans in the labs are not the same as humans on the battlefield. Sometimes lab research has uncertain applicability to military operations, but our priority is to develop research to help make sure we protect our personnel.

The final thought here is about an effective commercial brain machine interface that could read our brain. It would be of tremendous economic importance and one day possibly a requirement in order to operate in many high-end careers, which presents many issues. People with access to classified information would not be allowed to connect to a computer. This could lead to a huge recruiting challenge, as government work may then disqualify otherwise highly qualified people from later jobs. This is an ethical issue for those already in government who signed up not knowing that it could later keep them from jobs. Thus, BMIs could interfere with individual liberties, freedoms, and opportunities, core values in the United States.
I want to tie the current conversation on ethics to implications for privacy, an important issue with recent NSA disclosures and the resulting debate. Greeks and Romans did not share our current concerns about privacy. Up until the Enlightenment, this was not an issue, as evidenced in the lack of privacy in architecture of the time. However, from that movement emerged the idea that every human is a unique individual with dignity and, therefore, a right to privacy.

Many of us now feel we have nothing to hide, but privacy is still important. In our digital age and interconnected world, we should be especially worried about privacy. Our neurotechnologies are now at the point at which we can reconstruct words or images from signals in the brain, but on a practical level, neuroS/T does not present a near or mid-term threat to privacy. These technologies cannot be used without an individual’s consent and are not portable. There are other privacy issues, however, and these may in the future merge with neuroscience.

Now, a segue to networks. The concept of “networks” has been under-recognized, although it is a significant progression. Networks are all around us and even in us. Our brains’ neural networks, shown graphically, are strikingly similar to social networks. This is not just an accident of representation. Our neural system shows plasticity and grows in the direction it is stretched and exercised, some of that affected by our social networks. This is not a new concept (as seen in the past in sociometrics, sociograms, sociology, social psychology), but with the rise of interconnectivity and the internet in the 90’s, one can physically see the connections between people. Social media continues this trend, and laws and regulations have not kept up.

Social neuroscience as an emerging field is teaching us about how our brains respond in social situations and the role of neuromodulators such as oxytocin. Social networks can reveal more about a person than a brain scan. Behavior is a function of the person and that person’s environment. We can take the concept a step further to social neuroscience, or how biological systems implement social processes and behaviors. The combination of neuroscience and social networks can be powerful and are only now beginning to merge.

New technologies, like Google Glass, will affect our social networks. New technologies might also include artificial intelligences, and we still do not know the full consequences of such.
1. How do we protect our liberty using neurotechnology?

We have accountability and transparency problems in government. We need to better implement our current system for privacy. We have a strong tradition for privacy and liberty but also the need for security. We underestimate the low-tech elements of our world and place too much faith in high-tech gadgets. We have conflicting goals that are playing out now with tensions about the NSA.

2. What are practical ways to balance security and personal liberties?

After attacks perpetrated by people with mental problems, neuroscientists are often asked to do something to prevent future attacks. We cannot yet read minds, though there may be ways in which neuroscience can be used to improve security. Whatever balance between security and liberty that we as a polity decide on must be achieved in a transparent and democratic fashion. Education of the public is key. We need to parse out what we can do and what we should do and use neuroscience in a way that is appropriate and just. There is much hype and misunderstanding about what we can do.

3. What are the ethical issues surrounding the tech hype?

We cannot yet do as much with neuroscience as some imagine. Technology can be overstated by policy makers in order to show that there is progress, leading to “neurohype”. We need an honest and pragmatic appraisal of the realistic capabilities and limitations of the science and technologies available. We must also make sure that we use technology only for its intended purpose. That can be difficult, since open access means that those in other countries also have access to advances that can be used in ways in which we may not want to see them used.

There are real limitations to using neuroscience in security, especially since we ethically cannot tolerate any significant false positive rate. Historically, when there are any issues with a new science, such as the use of social psychology tests in the military, there has been a retreat from use even though there was a potential for good, e.g. a decrease in interpersonal problems when using those tests. We may see the same in neuroscience.

4. Does fear drive belief in science?

There are misunderstandings about what science is and does and the certainties of science, and education is important. We need to be exposed to what science can and cannot do. There are issues with taking science too seriously or taking science to the ethical brink, fear of which can be seen in popular fiction. Fear, coupled with opportunity, plays a role in driving
scientific beliefs. With neuroscience, opportunity and competitive advantage drive innovation, and money drives enthusiasm in the technology. We need to educate our leaders, as the application of any tool will be much greater if the leadership buys in, and the application will be much more restrained if the leadership understands the need for restraint.

5. **What ethical framework do we reference when we consider a possible alteration of central behavioral, e.g. emotional circuits, in infantrymen, and how do we keep in mind the personal identity of the affected individual?**

We must inform people of the requirements of consent in military infantry work. The same standards that are applied to respect of a person’s body, personal dignity, and agency must also be applied to neuroscience to ensure that there is no abuse of power. It is a testament to moral progress that we are thinking about this, as training used to be understood as changing personality. Forcing certain things on people is contrary to our values. There are dangers to even offering the choice of neurotechnology use to soldiers due to the inherent coerciveness of the military structure and advancement opportunities. There are many interlinked ethical and practical effects of neurotechnologies, and the practical effects must be taken into account.

6. **How do we prevent medical neurotechnologies from getting into the wrong hands?**

Withholding tech from some gives an advantage to those who have it. Dual-use neuroscience and neurotechnology exist in the public domain and the issue is preventing those who would use these for harm from having enough information and resources to act. This is more difficult with neuroscience than nuclear technology, for example, because the resources are easier to access. We need to better explain the rules for ethical use of these technologies, how we are following those rules, and what counter measures other than retaliation exist. All science is dual-use. We need to think about how science can be used unethically even if we do not intend to, so that we can develop ethical counter-measures if others do.
REPORT ON BREAK-OUT I: NEUROETHICS IN DEFENSE

The symposium attendees were divided into four groups to address the following questions.

1. New neurotechnologies have the potential to treat, if not prevent, certain neuropsychiatric disorders and injuries and can be used to enhance our senses, our ability to learn or perform new tasks, our interactions with others, and much more.
   a. What grounds and/or circumstances could be seen as providing these interventions to augment (certain) individuals’ performance?
   b. How might such decisions regarding who will be enabled or enhanced and the extent of such interventions be made? Who should render these decisions?
   c. What are the ethical implications of limited access to such advances? What could the effects on soldiers or civilians be if the enhancement is temporary versus permanent?
   d. How will “post-enhancement” condition(s) be viewed, addressed, and dealt with? Would this constitute “treatment” of a potentially newly created and defined “disorder” (e.g. “post-enablement distress syndrome”)?
   e. Who (i.e. which individuals and groups within the social and political infrastructure) will bear responsibility for the care and treatment of those who have been enhanced or are post-enhancement (e.g. the VA, Medicare)?
   f. Could scientific “enhancements” create a world of haves and have-nots? What are the limits of neuro-augmentation?

2. We recognize that the use of science and technology (S/T), and in this case neuroS/T, in defense and national security operations may necessitate some margin of classification and secrecy in accordance with national security and defense policy. How can the community of neuroscience, neuroethics, and military stake- and share-holders provide some level of protection against misuse of this science and technology, maintain public information, and also provide a modicum of public privacy?

3. Is neuroscientific and neurotechnological engagement of cognition, emotions, and behavior “different” than prior attempts at affecting and controlling the same variables through other means, such as PSYOPS and/or propaganda? If so, how?

4. At what point does neuroimaging and brain mapping become mind-reading? If such an advanced technology were possible, how could (or should) a free society ensure that it is appropriately used?
5. We know that even if we are not pursuing an avenue of research for ethical reasons, other groups and governments might very well be. How can – and should – we balance the need to remain prepared for the contingencies and exigencies of others engaging this research and the ethical issues that may be generated by rapid progress and such use of neuroS/T?

6. Sharing civilian neurotechnology with the national security and defense resources could potentially augment national security (and political economic advantage). How might such “dual-use” potential be addressed, guided, and perhaps directed? What types of methodologies might need to be in place to direct and govern such exchange? Is there an ethical imperative to share and/or use the research?

The results of the group discussions were presented to the attendees during the symposium. Here are some of the highlights of the discussions:

- We can draw conclusions from current discussions on athletic enhancements as well as military enhancements to discuss the legal and ethical issues of intellectual enhancements. With respect to unacceptable enhancements, the non-transparent and illicit types, issues arise that include potential health effects and unfairness. What are the consequences of unregulated non-transparent augmentation? There are already ethical questions regarding future responsibility when enhancement leads to later health issues. The issue of fairness comes up when one person or team has access to legal enhancements that are unaffordable to others. Are these issues alleviated when we provide enhancements only to those not already naturally gifted?

- Enhancement above a baseline is different than restoration of normal. The goal of enhancement should be to set a level playing field. Highly educated individuals are already using “enhancements” to improve mental abilities and attention spans. What is normal is always being redefined, as can be seen in the changing DSM. The group discussed limitations on the role of scientists and the need for ethical training and when policy-makers might need to intervene. They also had a theoretical discussion of “mind-reading” and its feasibility and implications, despite the fact that it is still a future technology. What would we do with information about what a person might do?

- Neuroscience can be used to enhance certain functions, but also to degrade them, as in erasing selective memories or diminishing inhibitions. There was no consensus on who should be making these decisions.

- When is regulation needed? Dual-use is different in neuroscience than in other technologies because of the involvement of consciousness and the humanity of a person.
• When is the use of enhancement allowed and how will that use be informed by philosophies different from our own? We need to define enablement before we can make an ethical judgment. Different ethical frameworks will apply in different situations, as the interventions used to dissuade someone from joining a radical group and doing harm to others would not be considered appropriate when used to convince someone to vote in a certain way in this country.

• Although there are certain protocols in place, their efficacy is unclear, partly due to lack of transparency or engagement by all interested parties. While we worry about whether or not other countries will use technology in instances in which we would not, the fact that we are moving toward those points can be the impetus for other nations to go there, and we might want to consider a regime that negates the reason for going in a particular direction. Perhaps there could be a more cooperative regime.

• Neuroscience is more than an extension of PSYOPS or propaganda because of the increased invasiveness and potential ability to be covert.

• Context affects our discussions on neuroethics, as the solutions offered in a non-competitive, non-urgent context such as this symposium could be very different than those offered in opposite situations. We must have informed leaders and decision-makers ready for difficult situations.

• Mind reading is not new; we actually practice a theory of mind every day as social creatures to infer mental states, beliefs, desires, and attitudes via body language and social cues. An inability to do that is considered a clinical disability. Persuasion also has been recognized as a tool for millennia. We have had hypnosis and meditation to lead to altered mental states, though new drugs and technologies offer new opportunities. We still do not have a framework for regulating in these domains or dealing with new technologies. Two things that differentiate these new technologies include the potential covertness and the lack of defenses. The rate at which technology is changing is accelerating, and our policies must deal with that increasing pace.
Just a few weeks ago, the Presidential Commission for the Study of Bioethical Issues received a charge from President Obama, as part of his BRAIN Initiative, to look at the ethics of neuroscience research as well as the ethics of applications of the results of that research.

The Commission has provided recommendations on the importance of bioethics education and expanding bioethics education at all levels and across all disciplines. The Commission made explicit recommendations on bioethics education in both its synthetic biology report and its report on current protections for human subjects in research. The Commission has also been working to implement these recommendations in part by producing educational materials. They released a study guide on the Commission’s Report Ethically Impossible, which is about the United States public health service funded research in Guatemala in the 1940s, available on the website. The Commission also has publications directed at traditional and nontraditional audiences, with materials for all levels.
A challenge has been posed by the Presidents’ Commission for the Study of Bioethical Issues, UNESCO, and the World Health Organization to fortify neuroethics education across disciplines and across levels of education in order to create a citizenry that is neurotechnologically capable and ready. Is neuroscience is going to be something new or exist as a part of the larger palette of what bioscience and biotechnology offer? To address such possibilities, and their stewardship in society, neuroethics education will be very important.

Dr. Casebeer asked earlier, “Do we think that there is anything new, or in fact, do neuroscience and neuroethics just repeat what we have seen before?” The answer to the question is yes, to both. In many ways, neuroscience reflects Gigerenzer heuristics:

Neuroscientific theories and technical capabilities are developed from the existing knowledge and technologies. Those theories are tentative, but they prompt development of newer tools to expand existing – and create newer – theories. Neuroscience is a field that is rapidly transitioning and being integrated into every area of science. However, this field is unique in that it has the ability to change how we think and what we think of ourselves as human.

What does this mean? What are the capabilities and limitations of human society in dealing with such novelty? We need to keep neuroethics in step with science, technology, and societal change, and the need for neuroethics education is going to be great.

Neuroscience is an ever-increasing part of contemporary society and culture. As such, neuroethics can play a vital role in understanding neuroscience, it will pose the questions, “How should neuroS/T be used?” and, “How should it not be used?” Indeed, with great knowledge and great capability comes great power. The future is in our hands. How will we as scientists, philosophers, ethicists, politicians, policymakers, and academicians educate and prepare the future citizenry of the increasingly neuroscientifically and neurotechnologically defined world that is our future? These questions will be addressed by the panelists.
Bioethics and neuroscience both coalesced in the ‘60s and ‘70s; in fact, the terms “bioethics” and “neuroscience” were both coined at around the same time. Both fields are inherently interdisciplinary and have a focus on education for health professionals. Not only are both of these fields rather young, but they have grown up in a similar way. Very different people with very different backgrounds have addressed similar problems with different perspectives. Much more recently, the field of neuroethics came into formal being. Neuroethics is bioethics as applied to neuroscience, although neuroscience does have the mind-brain issue, which differs from the standard bioethics issues related towards consent and coercion. Neuroethics has, at least in some ways, learned from the ethical, legal, and social implications (ELSI) program of the Human Genome Project, and there are many analogies between neuroscience/neuroethics and ELSI/ethics around genetics’ issues – especially as it relates to the way that we are thinking about the brain as key to who we are as people. We feel similarly about our genomes.

Currently, when we think about what motivates a lot of neuroethics training within the academy, our motivation is provided by our funding agencies. For a long time there were requirements for Responsible Conduct of Research (RCR) training, but in early 2010, the NIH added in the ELSI component, the societal component: the scientist as a responsible member of society, who considers the environmental and societal impacts of his or her research. Scientists need to think more broadly about what they are doing, and the ethicists need to receive education about the science to facilitate communication. It requires both sides.

A discussion of bioethics as it applies to neuroscience to address issues of consent and coercion is needed. Trying to move the discussion forward can be tricky, but we can start with the ELSI model and bring together an interdisciplinary group from very different fields.

Neuroethics should answer the moral and ethical issues brought about through science. For example, we can look at the stem cell debate: the scientist can tell you it is human in its DNA and how it will grow and develop but cannot tell you what duties you owe to that embryo. It takes both of those sets of knowledge to move that conversation forward. Scientists can explain the underpinnings of decision-making in the brain but cannot determine what decision should be made. These are ethical questions. It takes both scientists and ethicists to answer the tough questions. They need to talk early and often and before articles are written and published.

Additionally, it is important for the ethicists to have an accurate depiction of the science so that they can accurately forecast potential ethical concerns. Some of the technology will not be available for ten, twenty, or even thirty years. By partnering early, they can develop a shared vocabulary, have a frame of reference for other perspectives, and create dual mentorships and joint training. We must think creatively for how we can start a shared conversation.
CAROL ERTING  

*Panelist*

The deaf community is directly impacted by neurotechnology, i.e. cochlear implants. However, there is an existing community that supports them and their daily living. We have to be aware of the societal and social impacts neurotechnology has and can have on these individuals. Education of the citizenry is essential. We can move forward by educating to produce well-informed, engaged people.

Providing accurate and adequate information to the parents of deaf children and to deaf adults is paramount. The majority of the deaf population does not know that a cochlear implant can be used as an aid to understanding language and sign language. This is an example of misinformation associated with neurotechnologies. Research shows that bilingualism has positive effects on the brain. Parents and adults do not have an all or nothing decision. Again, this is important because it impacts the deaf community in a variety of ways. The current community exists to support one another and has intrinsic benefits. We need to use technology to improve communication within that community and not to disrupt the community itself.

As we go forward, it is important to think in the following terms: what effects does the technology have on the community, and what are the effects of misinformation and marketing on individuals? It is important to understand the inner workings of the system that is influencing their lives. This will take several years and collaboration.

JOSEPH PROCACCINI  

*Panelist*

Bioethics should be added to the high school curriculum. The Aristotelian tradition of teaching posits values as habits ingrained as a result of the maturation process. The earlier we learn, the better we learn, since we develop habits. It aims to develop individual courage, magnanimity, justice, and prudence, leading to better decision-making and broader understanding, as well as moderation and balance. Virtues should have practical applications. Learning to talk, know, and apply knowledge will result in the resolution of personal, family, and societal issues.

What are the practical reasons for teaching bio/neuroethics? It is not sufficient to know the material and talk about it. It is also important to think about what it means for our behavior. More directly, teaching students will help enable them to make ethical decisions about themselves and their families. It will help them assess risk and consequences. As citizens, they will eventually have a responsibility to participate in forming public policy that is cognizant of scientific research and consistent with the moral standards in the society in which they live. They also must be equipped with the knowledge to make legal, ethical, and personal preference distinctions.
Neuroethics education is needed to prepare neuroscience graduates for their interdisciplinary professional roles. Neuroscience careers are characterized by transition, as only 65% of recent doctoral graduates will do post-doctoral research, and then a minority will continue into academia. Alternative careers include industry, policy, and research administration. Neuroscience graduates might advance in one or several of these careers. These various career options require additional graduate study training to supplement the standard research preparedness, including responsible conduct of research and general best practices of science. There is currently a void of targeted ethical education.

A framework is lacking for students to consider ethical issues in a larger way. The consequence can be described by looking at a larger trend in innovation in society. Industry, academia, and government work together to fund research and development in a bi-modal system, but these could be far more integrated. Industry funds academia when there are technological solutions. Government funds academia when there are public goods to be delivered. Industry can affect policy, while government makes the policy decisions. We are moving, as a society, from differentiation of the roles of these three to integration and hybridization, called the Triple-Helix model. This is a meta-innovative system with bottom-up, top-down, and lateral initiatives in which science, technology, and innovation policy are the outcome of the interaction among the university, industry, and government. A quintessential example of the triple helix dynamic in action is the BRAIN Initiative, a government proposed initiative funded by both private and public entities.

There is an inherent tendency to overhype neuroscience and mislead the public, but whose responsibility is it to control and dispel these misunderstandings? The Nuffield Council of Bioethics published a report that included this idea of Virtue Actors – those who research, develop, administer, use, fund, market, govern, and communicate the capacities of novel neurotechnologies. We all have a shared responsibility to highlight the truths in neuroscience and technology. The roles of researchers, government officials, and industry must be combined in a triple helix approach to facilitate different types of responsibilities and mandates. Collaborative education will prepare them for the individual ethical responsibilities of their profession.

Neuroscience PhDs need ethical education that will prepare them for the responsibility in their professional roles. Due to the interdisciplinary nature of their careers, they need more integrated and hybridized ethics suitable to Triple-Helix dynamics.
PROMOTING AND TEACHING STANDARDS IN NEUROETHICS

PANEL QUESTIONS

1. What is the ideal educational situation?
   The ideal educational situation is a prescriptive process emphasizing critical thinking and decision-making. STEM education should not be segregated from ethics. Both scientific and literary perspectives should be integrated to encourage simultaneous critical thinking.

2. Why aren’t scientists better at communicating with society?
   They are trained at a high level and in a specific community and do not always know how to get to the bottom line upfront. Complex issues cannot be boiled down – we cannot simplify because we then become inaccurate. You cannot affect policy without good communication. It is important to responsibly educate our younger generation and instill the value of ethics as well as the ability to communicate. We should allow those in the humanities to engage in the scientific community and encourage a truly integrated humanistic construct early on.

3. Is the neuroscience underpinning learning a language fairly similar to that for sign language?
   It is exactly the same.

4. In this new area, did you feel the Nuffield Council was able to identify and marshal the scientific talent to create a groundbreaking report? Did they possess neuroscience expertise?
   Yes, and they appropriately reached into the neuroscience community, discussing viable conceptual possibilities. As a caveat, they did not get an accurate representation of the global impact of neuroscience, specifically security and defense.

5. When you are dealing with questions with no right/wrong answer (as in religion or morality), how does one fully address related issues when your hands are tied by policy and other limitations?
   A very important factor is the involvement of the parents in emphasizing good ethics and decision making.

6. We spent a lot of time on teaching ethics. But what about actually applying neuroethics to teaching and education? What do you do with neuroscience as an educational tool? Can we use it to enhance the mind? Who gets access?
   There is a big difference between technology and technique. When does education become enhancement, and what are the goals?
7. If you could evoke change to make meaningful education, how would you do it?
Within neuroscience programs, there should be funding to integrate bioethics. We should also establish more educational neuroscience programs. It could be useful to make school administrators sit in on discussions such as this. We need to convince decision-makers to value bioethics. We can use the issues that neuroscience brings up (autonomy, agency, motor control) and the connections within those themes to advance education.

REPORT ON BREAK-OUT II: PROMOTING AND TEACHING NEUROETHICS

The attendees were divided into four groups to address the following questions regarding promoting and teaching neuroethics.

1. Should there be general standards in neuroethics? If so, how might these be developed, taught, and implemented? Who should be responsible for developing these standards? How might they need to change over time?

2. What should be included in neuroethics education and training? What form can or should training programs in neuroethics take at various levels of education?

3. Can – and should – neuroethics education represent a field in and of itself in addition to being an integral part of the education and training of neuroscientists? What is necessary and what is sufficient to promote awareness of the field, discipline, and issues for today's students and tomorrow's citizens?

4. Funding agencies often require graduate students and postdoctoral fellows to take training courses in ethical research practice. Should neuroscience funding be tied to requirements for neuroethics training and discussions of the neuroethical implications of brain research? How might this affect how government agencies and private foundations allocate BRAIN Initiative funding? Should faculty also be required to take training courses? How might such ethics training be made engaging?

5. Neuroscience discoveries and technologies are increasingly being used in everyday life. How might neuroethics education and training be important to guide and govern the reality that these discoveries and technologies, while offering obvious benefits, may also incur burdens, risks, and harms? Are there any technologies that you are concerned about becoming easily/cheaply available on the mass market?

6. How might current ethical approaches and systems be informed by – and inform – a contemporary, and more globally cosmopolitan neuroethics?

Answers to these questions from the four breakout groups were presented to the attendees as a whole. The highlights of the discussions are provided.
• With any new technology, responsibility lies in ethical dissemination. We need to answer the question, “What does the technology do and what does it offer?” Leaders and scientists should have a sophisticated understanding of the mechanisms of new technology and be able to communicate the impact and limitations properly to the public. This way, the public can make the determination for themselves.

• Neuroethics standards should be flexible; they should start out broad and narrow down over time as we decide what is important – like a Google doc with edits welcome. Neuroethics training should take a multi-pronged approach. As an earlier panelist mentioned, we could use fields such as theater arts to help scientists better communicate.

• In creating standards, we need to consider the setting in which they will be applied. There was much discussion about who would create the standards. The “who” should include government, health professionals, pharmacologists, biologists, neuroscientists, educators both at the collegiate level and pre-collegiate, advocacy groups for patients, and also consumer advocacy groups as these technologies become commercialized.

• Topics that could be covered in neuroethics training include: diversity, research ethics, consciousness, whether biology equals destiny, the human algorithm, treatment vs. enablement vs. enhancement, and animals in research.

• Neuroethics could be considered its own field. A diverse group of scientists and ethicists should come together to form a set of general guidelines that could be used by any program looking to incorporate neuroethics into their curriculum. As Rachel Wurzman suggested, we should consider the triple helix approach when looking at neuroethics as a field. Neuroethics should not be seen as a siloed discipline though. While there is value in studying neuroethics alone on its own merits, curricular integration of neuroethics concepts has value. Educators in the group did point out that integration would require substantial reworking and review of curriculum.

Ethics and neuroethics should be dispersed throughout curriculum in multiple disciplines and taught from middle school on. A conversational approach facilitates new understanding that is unique for each individual and leaves questions of morality up to the individual’s perspective. Education in neuroethics is viable for many disciplines, not just medicine or neuroscience education, but across the spectrum of graduate and professional training, and from high school to graduate and medical education.

• Neuroethics training should be different for different groups. For graduate students, there exists a need for them to work in realistic, nuanced scenarios that lead to discussion and prepare them for the real world. For faculty, grant funding and the policy that drives grant funding could be tools that drive faculty to consider ethics – not just conflict
of interest but broader ethical implications of their research. Does the public need neuroethics training? If so, to what level? Who should provide the training?

- There are several opportunities to initiate ethical dialogue, considering the parts played by the entertainment industry, media, and education. Media engages the masses and often shapes the public's attitude on neuroscience (e.g., the television show House). But do we expect entertainment to be bioethically driven? Often, they engage activists and experts to give proper context, and it is up to those experts to inform entertainment groups and the media to the best of their ability.

- Education should integrate neuroethics with critical reasoning, emphasizing the thought process and analytical process. How do we educate everyone in neuroethics? Do we introduce ethics into primary education? Should we make it a requirement in the basic college curriculum? On a global scale, the ethical frameworks we have should be firmly encouraged. How do we blend them to produce a global common understanding of neuroethics?

FROM ETHICS TO POLICY AND LAW

JAMES GIORDANO

Introduction

The challenge of neuroethics may be to define or redefine certain ethical concepts and principles. In our group, we discussed cosmopolitanism, not as the sine qua non of ethical address, but one that recognizes that there are different views, values, norms and standards. These views may change based upon scientific and technological enablement and empowerment. The question then becomes, what does an informed public mean? What is necessary, and what is sufficient? What are the rules, regulations, guidance, and governances that we would need for any form of science or technology that we let loose as a viable public good? What do those goods mean when they are embraced in a social or commoditized sense? I don’t know the answers, but these represent the important questions that we must ask as we move forward. As Mr. Swetnam will explain, this speaks to the momentum of the field. In some ways it has carried the impetus of the Human Genome’s ELSI Project and of bioethics forward, but in other ways neuroethics is new. It has created its own momentum, and has done so in a way that has illustrated discontinuities and misalignments between the pace of scientific discovery and the agility of governance, guidance, policies, and laws.

Our next speaker this afternoon is Mr. Michael Swetnam. The Potomac Institute for Policy Studies was wise enough to recognize that neuroscience is going to be a social, economic and political game-changer. Mike Swetnam will address how neuroscience and neurotechnology represent a wave of the future and how preparation for this wave must translate into viable policy and law.
The Potomac Institute for Policy Studies is a unique entity in the DC area. We are an independent, non-for-profit organization that focuses on science and technology policy. More importantly, we work on issues surrounding how science should inform policy and how policy should drive good science. Our policymakers need to understand which sciences and technologies to invest in and which ones are overstated. Especially important in DC, policymakers need to base law on a rational understanding of nature, humanity, and the universe as opposed to enacting legislation based on societal norms or morality. Simply put, policy should be founded on what science tells us is good for mankind.

Policymakers often have trouble grappling with scientific advancements and disruptive technologies. These new and near-future areas of science are unpredictable and complex. We need to provide expert guidance to ensure that the legislative process successfully handles revolutions in digital technology, biological technology, nanotechnology, and neuroscience. To ensure the success of the legislative process, the Potomac Institute follows trends in where science is going, who is doing what, what fields are flourishing, and what fields are stagnant. Understanding and assessing new trends in science is the first step in helping policymakers react to scientific progress.

Throughout history, social transformations occurred as a result of technological advancements. Over the last several centuries science and technology has been the single largest driver in the evolution and change of human affairs. The printing press made it easier to propagate books across a continent; spreading education, provoking thought, inspiring a revolution and a renaissance in Europe, and even resulting in the overthrow of governments. This single technical leap had a more profound impact on our society than any prior innovation. The Industrial Revolution uprooted the agrarian society and enabled mass migrations to cities. Technological innovations contributed to world-altering events like the Great Depression and the World Wars. This trend of social upheaval via technological advancement will continue and its cumulative impact will be more and more difficult to mitigate without focused policy direction.

Currently we are undergoing massive societal impacts due to four major technologies. First, digital technology has drastically changed the way we communicate. Biotechnology is extending human lifetimes, potentially up to 40 percent. Nanotechnology has changed the way we build things. Finally, neuroscience and neurotechnology changes our understanding of the human mind. The neurotechnology revolution encompasses the previous revolutions and will make a larger impact than any of them individually. As a result of these transformations, governments will have more complicated and difficult issues to face than ever before.
One of the challenges arising from the neurotechnology revolution is that it fundamentally changes how we use tools, how we interact with other technologies, and even how we think. Neurotechnology will undoubtedly improve our standards of living, grow our economy, and change our society. While these positive opportunities are appealing, there is also the potential for negative outcomes and abuse of neurotechnology for private gain at the expense of the public good. Neuroweapons are a very risky technology that cannot be ignored from a policy perspective. Nuclear war was largely prevented because policies prevented proliferation of nuclear weapons. The same care must be taken with new technologies that have similar power to cause widespread damage. We must consider the output and future impact of neurotechnology through the lens of ethical understanding. This is the only way to ensure that the legislative process can govern, control, and manage properly.

We need to evaluate our government’s ability to deal with policy decisions involving advancements in science and technology. There is a long-running trend that can shed some light on the issue. Over the past 50 years, the number of laws ratified by Congress has decreased precipitously while patent filing for new technologies has grown immensely. There is an ever-growing need for regulation, legislation, and policy that balances control over potentially harmful technologies with advocacy for society-enhancing science. Here is an example. In the past, growing from a local business to a national one required an immense investment in infrastructure and logistics. Today, an international corporation can essentially be formed with a FedEx account and an Internet connection. Our current laws and policies are struggling to address these changes brought about by the digital technology revolution; advances in neuroscience and neurotechnology will only be more difficult to handle.

The United States political process was designed to be deliberative and methodical so that all issues could be sufficiently explored and all actions could be purposefully taken. Policymakers are constantly faced with problems from both the political process and the science they are trying to understand. We need organizations like AAAS and the Potomac Institute to support science and technology decision bodies (e.g. the Office of Science and Technology Policy). This will provide the capacity to explain the implications of neurotechnology policies, legislation, and investments to our policymakers. Forty three pieces of legislation on cybersecurity and information technology were proposed last year and none were passed. Cybertechnology has been transforming our society for two decades but the policy still lags behind it. Few of our leaders are technologists and we absolutely need a way to connect them with the current state of our science and technology.

Many people complain about the broken political system. Analyzing the situation provides us with the insight that there are many opportunities to communicate with Congressional members and their staff. If policymakers capitalize on this insight, legislation can be passed quickly and
with a large number of votes. For example, the Patriot Act was passed three times in the face of controversy because it was fueled by well-orchestrated communications campaigns. Many outside individuals spent a long time on Capitol Hill interacting with policymakers about the facts of the issue. The same process can be attempted for science and technology legislation, but a doctrine to guide underlying policies must be created first.

There are three general doctrinal categories for neuroscience and technology. First, we can take a laissez-faire approach and do nothing to affect the natural progression of science and technology. This is a typical approach in science policy; we wait for a reason to create policy and then react accordingly. The second approach is a precautionary one, where a potentially harmful action or technology cannot be undertaken until there is a sufficient risk management system. The government restricts science and technology from progressing until any potential for harm is addressed. The third approach incorporates moral and ethical standards held by society to restrict science and technology. Cybertechnology policy, nuclear technology regulations, and stem cell research are examples of these three doctrines, respectively. Cybertechnology laws were not created until after problems arose within society. Nuclear regulations were created as a precaution before the threat of nuclear war became too uncontrolled, but research in the technology was not inhibited. Stem cell research was banned because of the values held by society and implications arising from the science. The reason for choosing a specific doctrinal approach should be informed by the science and technology as well as using the doctrine to manage the development of the science and technology.

Neurotechnology policy should be tackled with a combination of these doctrines. Neural enhancements could probably be dealt with in a reactionary manner while neuroweapons might require a prophylactic set of regulations. Policy has a dual role: it can be driven and informed by neuroscience and it can manage the development of neuroscience itself. Scientists have an obligation to help our leaders understand science and technology issues. Scientists can drive policy changes by informing Congress about the implications of research findings and providing honest assessments of the promise that neuroscience holds. Scientists should not overpromise medical benefits and fully consider the potential and limits of neurotechnology. We also need to encourage and incentive neuroscience technologies that will benefit society. We need to focus on areas of clear benefit: learning enhancement, brain repair, artificial and limb control. We need to create the research and investment environment necessary for development of effective products. Oversight and enforcement are critical components of legislation for neuroscience policy. Policing mechanisms involving self-regulation are not guaranteed to work. Therefore, it is important to provide neuroscience policy with effective mechanisms of influencing and regulating its systems. An overall doctrinal framework that incorporates all of these different policy types will be required.
The most effective way to create policy is through communication with policymakers. The public debate can be framed through opinion pieces and books. Briefings and seminars discussing emerging science and technology should engage legislators and ensure that these topics are included in future bills. Scientists and technologists can focus on good scientific practices and hard facts and sidestep a lot of partisan pitfalls. Most legislation is written by advocacy groups, think tanks, friends of the court, and other concerned individuals. A scientist can use his or her expertise to draft white papers, books, articles, and even legislation for Congress members and provide insight into the facts behind an issue. There is a great need for increased effort in the realm of science and technology policy and many of us have the potential to provide this service.
PHILIP RUBIN

Closing Remarks

Thanks to the Potomac Institute for Policy Studies, AAAS S&T Policy Fellowship Program, Alan Leshner, Pellegrino Center for Clinical Bioethics at Georgetown University, speakers, panelists, audience(s), and the NeuroPolicy Affinity Group.

The future is not here. We live in primitive times, but things are changing very rapidly. We have to plan now for what the future can be. We have to understand that there is still so much we cannot do and cannot imagine. Emerging tools and technologies call to mind the early days of the telescope and microscope. We can see our universe and micro-universe, but there is much we still do not understand. We must balance valuable reductionist approaches with the need to understand context and complexity. We cannot study the brain without considering the mind and the environment. Community and culture are also part of neuroscience. This is an extremely exciting time in neuroscience, and there is enormous opportunity that we need to take advantage of.

Let me give you a brief perspective on some of the things that have been going on at the White House on neuroscience. The Obama administration has taken a more entrepreneurial approach, and more partnerships have been formed outside the government than in past administrations. Most of you have heard of the BRAIN Initiative because of media coverage, but that is actually only a small part of the broad range of activities associated with the White House Neuroscience Initiative. Over twenty agencies are involved in the Interagency Working Group on Neuroscience, which is wrapping up an internal report to be publically released this fall. The BRAIN Initiative is a more focused, grand challenge type of activity. From day one, there has been neuroethics, and bioethics and ethics more broadly, in this activity.

We care a lot about emerging technologies, and over the years there have been ELSI (ethical, legal, societal implications) and considerations. There are enormous challenges with which we have to contend in the future. The main way to get involved in policy is to be interested and to educate yourself and realize that part of what you do in policy is not about you; it is about educating the public. If we have a literate, knowledgeable public, we will be able to make more progress. Things will excite people if they are exciting. Neuroscience is one of those areas right now that is grabbing the imagination.

I would encourage you to think about neuroscience broadly. It is about real people living in real worlds, each of them unique and each of them a part of a complex system. Our approaches need to be as rich as the real world we live in.
Welcome and Opening Remarks

Dr. Alan I. Leshner is has been Chief Executive Officer of the American Association for the Advancement of Science and Executive Publisher of the journal Science since December 2001. AAAS (triple A-S) was founded in 1848 and is the world’s largest, multi-disciplinary scientific and engineering society.

Before coming to AAAS, Dr. Leshner was Director of the National Institute on Drug Abuse (NIDA) from 1994-2001. One of the scientific institutes of the US National Institutes of Health, NIDA supports over 85% of the world’s research on the health aspects of drug abuse and addiction.

Before becoming Director of NIDA, Dr. Leshner had been the Deputy Director and Acting Director of the National Institute of Mental Health. He went to NIMH from the National Science Foundation (NSF), where he held a variety of senior positions, focusing on basic research in the biological, behavioral and social sciences, science policy and science education.

Dr. Leshner went to NSF after 10 years at Bucknell University, where he was Professor of Psychology. Dr. Leshner received an undergraduate degree in psychology from Franklin and Marshall College, and MS and PhD degrees in physiological psychology from Rutgers University. He also has been awarded six honorary Doctor of Science degrees. Dr. Leshner is an elected fellow of AAAS, the National Academy of Public Administration, the American Academy of Arts and Sciences, and many other professional societies. He is a member of the Institute of Medicine of the National Academies of Science and served on its governing Council. He was appointed to the National Science Board by President Bush in 2004 and reappointed by President Obama in 2011.
JAMES GIORDANO

Panel on Neuroethics in Defense, Breakout Group Leader
Panel on Promoting and Teaching Standards in Neuroethics, Moderator

Dr. James Giordano is Chief of the Neuroethics Studies Program in the Edmund D. Pellegrino Center for Clinical Bioethics, and is on the faculties of the Division of Integrative Physiology, Department of Biochemistry; Interdisciplinary Program in Neurosciences, and Graduate Liberal Studies Program at Georgetown University Washington, DC, USA. He is a Senior Fellow and Member of the Board of Regents of the Potomac Institute for Policy Studies, Arlington, VA. He was 2011-2012 JW Fulbright Foundation Visiting Professor of Neuroscience, Neurotechnology, and Ethics, and currently is Clark Fellow and Director of the Neurotechnology and Neuroethics Across Generations Program at the Human Science Center of Ludwig-Maximilians Universität, Munich, Germany. Additionally, he is William H. and Ruth Crane Schaefer Distinguished Visiting Professor of Neuroethics at Gallaudet University, Washington, DC.

The author of over 200 peer-reviewed publications, his recent books include: Neurotechnology: Premises, Potential and Problems (CRC Press); Scientific and Philosophical Perspectives in Neuroethics (with Bert Gordijn; Cambridge University Press); Maldynia: Multidisciplinary Perspectives on the Illness of Chronic Pain (Taylor-Francis/Routledge), and Pain Medicine: Philosophy, Ethics and Policy (with Mark Boswell, Linton-Atlantic Books). Prof. Giordano is Editor-in-Chief of the journals Philosophy, Ethics, Humanities in Medicine, and Synesis: A Journal of Science, Technology, Ethics and Policy; Executive Editor-in-Chief of the BioMed Central multi-journal thematic volumes: Toward A New Psychiatry (2011-2013), and Global Neuroethics: From Bench to Bedside and Beyond Borders (co-edited with Dan Stein; 2013-2015), and is Associate Editor of the journals Neuroethics and Ethics in Biology, Engineering and Medicine.

In recognition of his work, he was awarded Germany’s Klaus Reichert Prize in Medicine and Philosophy (with longtime collaborator, Prof. Roland Benedikter of Standford University, CA), was named Sigma Xi Distinguished National Lecturer for 2012-2014, and was elected to the European Academy of Science and Arts.
WILLIAM CASEBEER

Panel on Neuroethics in Defense

Dr. William D. Casebeer is a Program Manager in the Defense Sciences Office at the Defense Advanced Research Projects Agency (DARPA), where he develops science and technology dealing with the neurobiology and psychology of training, education and influence. His twenty-four year career in the Air Force as an intelligence officer and Associate Professor at the US Air Force Academy included multiple overseas tours and deployments to Southwest Asia, where he was awarded decorations such as the Defense Meritorious Service Medal. A former Harvard fellow at the Kennedy School of Government’s Carr Center for Human Rights Policy and advisor in the Chairman of the Joint Chief of Staff’s Action Group, Bill’s academic background included study at the US Air Force Academy (BS, Political Science), the University of Arizona (MA, Philosophy), the Naval Postgraduate School (MA, National Security Affairs), and the University of California at San Diego (PhD, Cognitive Science and Philosophy, and where his dissertation on the neural mechanisms of moral cognition won the 2001 campus-wide award for best doctoral thesis).

Bill’s research interests include neuroethics, the evolution of morality, the intersections of cognitive science and national security policy, philosophy of mind and military ethics (such as the ethics of torture interrogation). He is author of Natural Ethical Facts: Evolution, Connectionism, and Moral Cognition (MIT Press), co-author of Warlords Rising: Confronting Violent Non-State Actors (Lexington Books), and has published on topics ranging from the morality of torture interrogation to the rhetoric of evil in international relations, in venues such as Nature Reviews Neuroscience, Biology and Philosophy, and International Studies. He is a reviewer for multiple academic presses and journals and has conducted numerous refereed conference presentations. Before joining DARPA, Dr. Casebeer was the Deputy Head of the Joint Warfare Analysis Center’s Technology Advancement Department. His most recent intelligence assignment was as the Chief of Eurasian Intelligence Analysis, NATO Military Headquarters.
ANDREW HERR

Panel on Neuroethics in Defense

Andrew Herr is the President of Helicase LLC, a technology and strategy consulting firm which conducts assessments and develops programs for corporate and government clients focused in three areas: emerging and potentially disruptive technologies; corporate strategy and structure; and optimizing human performance at the individual and team level. As part of the human performance work, he developed and regularly teaches courses on optimizing performance under strenuous conditions to civilians preparing for deployment.

Prior to his current position, he was the Principal Investigator for Defense & Human Performance at Scitor Corporation, was a Next Generation Fellow at the Center for a New American Security, and worked with US government agencies in a variety of capacities, ranging from policy development to prototype design and testing. He has experience in both biology and physics laboratories, where he worked on hepatitis B drug development, nuclear weapons detection, and radiation dosimetry. Andrew received Master’s Degrees in Microbiology & Immunology, Health Physics, and Security Studies and a Certificate in Eurasian, Russian, and East European Studies from Georgetown University, where he had previously completed his undergraduate work in the School of Foreign Service. In addition to his academic work in the area, he has also lived and traveled extensively in Russia and Central Asia and speaks Russian.
Panel on Neuroethics in Defense

As the David and Lyn Silfen University Professor, Dr. Jonathan D. Moreno is one of fourteen Penn Integrates Knowledge professors at Penn, where he is also Professor of Medical Ethics and Health Policy, of History and Sociology of Science, and of Philosophy. His book, *The Body Politic: The Battle Over Science in America*, was named a Best Book of 2011 by Kirkus Reviews. Among his other books are *Mind Wars: Brain Science and the Military in the 21st Century*, and *Undue Risk: Secret State Experiments on Humans*. He was an Andrew W. Mellon post-doctoral fellow, holds an honorary doctorate from Hofstra University, and is a recipient of the Benjamin Rush Medal from the College of William and Mary Law School and the Dr. Jean Mayer Award for Global Citizenship from Tufts University.

Moreno is an elected member of the Institute of Medicine of the National Academy of Sciences and is a National Associate of the National Research Council. He is a member of the UNESCO International Bioethics Committee and has served as a senior staff member for three presidential advisory commissions. In 2008-09 he served as a member of President Barack Obama’s transition team.

He is a Senior Fellow at the Center for American Progress in Washington, DC, where he edits the magazine *Science Progress* (www.scienceprogress.org). He has served as an adviser to many governmental and non-governmental organizations, including the Department of Defense, the Department of Homeland Security, the Department of Health and Human Services, the Howard Hughes Medical Institute, and the Bill and Melinda Gates Foundation.

Moreno has published 15 books and more than 500 papers, book chapters, reviews and op eds. He is a frequent contributor to the *New York Times*, the *Wall Street Journal*, the *Huffington Post*, *Psychology Today*, and other major media. The *American Journal of Bioethics* has called him “the most interesting bioethicist of our time.”
Dr. Christian Macedonia, MD is a Program Manager at the Defense Advanced Research Projects Agency (DARPA) in the Defense Sciences Office. Dr. Macedonia’s scientific efforts are aimed at understanding how humans are created, sustained, and encouraged to thrive under adversity. He is a GYN surgeon and completed a fellowship in maternal fetal medicine and bioinformatics in a joint program at Georgetown University and the National Institutes of Health, Computational Bioscience and Engineering Laboratory. Dr. Macedonia’s early work with DARPA included contributions to the development of 3-D sonography and telemedicine under the Revolutionizing Ultrasound Program in the mid-1990s. He is an avid explorer having conducted three flagged expeditions of the Explorer’s Club including two scientific expeditions to Mt. Everest, and diving to the wreck of the RMS Titanic, submerging to a depth of 3800 meters. Dr. Macedonia served in a variety of leadership roles in his 27 years of service as a US Army Medical Corps officer, including chief of the medical staff of the 115th Combat Support Hospital in Iraq and most recently as the Medical Sciences Advisor to the Chairman of the Joint Chiefs of Staff. He has published over thirty peer-reviewed publications and book chapters. His military awards include the Bronze Star, the Combat Action Badge, the Defense Superior Service Medal, and Parachutist Wings. In addition to his role at DARPA, Dr. Macedonia is on the faculty of the Johns Hopkins University School of Medicine and serves on a volunteer basis at the Walter Reed Military Medical Center in Bethesda, Maryland.
Michelle Groman, JD, is Associate Director at the Presidential Commission for the Study of Bioethical Issues and served as staff lead for the Commission’s report, Moral Science: Protecting Participants in Human Subjects Research. Prior to joining the Commission staff in 2011, Michelle practiced law at Jenner & Block LLP as a litigation associate in the firm’s Creative Content group. She has published articles on various legal issues and topics in bioethics that include end-of-life decision-making, research ethics, and emerging genetic technologies.

Michelle graduated from Harvard College in 2001 with an AB, cum laude, in biology and received her JD, magna cum laude, from Harvard Law School in 2005, where she served as a notes editor on the Harvard Law Review. She clerked for the Honorable Bruce M. Selya on the US Court of Appeals for the First Circuit from 2005 to 2006 and, prior to law school, worked as a Research Assistant for the Program in Medical Ethics at the University of California San Francisco, and as a Program Coordinator for the Greenwall Faculty Scholars Program in Bioethics.
Rachel Wurzman is a doctoral candidate in the Interdisciplinary Program in Neuroscience at Georgetown University. Her doctoral research, supported by an NIH Ruth L. Kirschstein National Research Service Award Fellowship, investigates molecular mechanisms influencing neural circuitry development and their role in the etiology of neuropsychiatric spectrum disorders. Additionally, she performs research with the Neuroethics Studies Program in the Pellegrino Center for Clinical Bioethics (PCCB) at Georgetown, where her ongoing collaboration with Dr. James Giordano has yielded several articles and book chapters on diverse topics, including ethical issues in neurogenetics, furthering interdisciplinary STEM education, the utility and neuroethical implications of spectrum disorder diagnostic taxonomies, and the application of neurotechnologies as weapons in national intelligence and defense.

Ms. Wurzman was previously an Intern with the Science division of the Office of Science and Technology Policy in the Executive Office of the President of the United States. She earned her BA in Neuroscience from Smith College and her MS in Physiology and Biophysics from Georgetown University.
DEBRA MATHEWS

Panel on Promoting and Teaching Standards in Neuroethics

Dr. Debra JH Mathews, MA, is the Assistant Director for Science Programs for the Johns Hopkins Berman Institute of Bioethics. She is also an Assistant Professor in the Department of Pediatrics, Johns Hopkins School of Medicine, with a secondary appointment in the Institute of Genetic Medicine. Dr. Mathews earned her BS in Biology from the Pennsylvania State University and a PhD in genetics from Case Western Reserve University. Concurrent with her PhD, she earned a Master’s degree in bioethics, also from Case. She completed a Post-Doctoral Fellowship in genetics at Johns Hopkins, where she continued her work on human genetic variation and human population history. She also completed the Greenwall Fellowship in Bioethics and Health Policy, which is jointly administered by Johns Hopkins and Georgetown Universities. As a Greenwall Fellow, she worked at the Genetics and Public Policy Center, in Washington, DC, and the US Department of Health and Human Services. As the Assistant Director for Science Programs, Dr. Mathews is responsible for overseeing the Stem Cell Policy and Ethics program and the Program in Ethics and Brain Sciences, as well as other Institute initiatives in policy and ethics related to biomedical research. Her research interests focus on the intersection of science, public policy and society.
Dr. Carol J. Erting is Associate Provost for Research, Dean of the Graduate School and Professor of Education at Gallaudet University. She has been chair of the Education Department, a faculty member in the Department of ASL, Linguistics, and Interpretation, Director of the Culture and Communications Study Program of the Gallaudet Research Institute, and program chair of The Deaf Way, an international conference on the history, language and culture of deaf communities. Her ethnographic research in Deaf homes, schools, and classrooms has focused on language, culture, and literacy with interest in collaborative partnerships between researchers, teachers and caregivers. She has contributed numerous scholarly articles, chapters, and books to the literature on socialization and education in the deaf community from a cultural and linguistic perspective. Dr. Erting is currently Co-PI of the Gallaudet Scholarship of Teaching and Learning Initiative investigating issues of linguistic diversity and visual teaching and learning in Gallaudet classrooms. She has a PhD in Cultural Anthropology from American University, a QE in Social Anthropology from the School of Oriental and African Studies, University of London, and BS and MA degrees from Northwestern University in Communicative Disorders/Deaf Education.
Since 1973, Dr. Joseph Procaccini has been on the graduate Education faculty at Loyola, where he has also served as Department Chair, Director of Educational Leadership Programs, and Graduate Dean. He has also taught in the Sellinger School of Business and Management and was Director, Center for Work, Family and Schools. He is the author of three books and several articles on school administration and family-school relations. He completed bioethics training at the Kennedy Institute of Ethics at Georgetown, the Berman Institute of Bioethics at Johns Hopkins, and the Harvard Divinity School. He has recently served as a visiting research scholar in bioethics at Weston Jesuit School of Theology, Episcopal Divinity School, and Georgetown University. He has spoken to professional and parents groups in 45 states and across Canada and has appears on over 100 television and radio shows at the local and national levels. In addition, he has served as a management consultant to schools, churches, hospitals, banks, nonprofit organizations, and government agencies. He has served on the boards of five private schools and numerous local and state government boards, including the Anne Arundel County Planning Board and the Baltimore Regional council of Governments. He has visited 20 foreign countries in Europe, Asia, and Latin America.
MICHAEL SWETNAM

From Ethics to Policy and Law

Michael Swetnam assisted in founding the Potomac Institute for Policy Studies in 1994. The Potomac Institute for Policy Studies focuses on Science and Technology Policy. Since its inception, he has served as Chairman of the Board and currently serves as the Institute's Chief Executive Officer. He has authored and edited several books and articles including: #CyberDoc, No Borders, No Boundries; Al-Qa’ida: Ten Years After 9/11 and Beyond; Cyber Terrorism and Information Warfare, a four volume set he co-edited; Usama bin Laden’s al-Qaida: Profile of a Terrorist Network; ETA: Profile of a Terrorist Group; and Best Available Science: Its Evolution, Taxonomy, and Application. Mr. Swetnam is currently a member of the Technical Advisory Group to the United States Senate Select Committee on Intelligence. In this capacity, he provides expert advice to the US Senate on the R&D investment strategy of the US Intelligence Community. He also served on the Defense Science Board (DSB) Task Force on Counterterrorism and the Task Force on Intelligence Support to the War on Terrorism. From 1990 to 1992, Mr. Swetnam served as a Special Consultant to President Bush's Foreign Intelligence Advisory Board (PFIAB) where he provided expert advice on Intelligence Community issues including budget, community architecture, and major programs. He also assisted in authoring the Board's assessment of Intelligence Community support to Desert Storm/Shield. He has served in several public and community positions including Northern United Kingdom Scout Master (1984-85); Chairman, Term limits Referendum Committee (1992-93); President (1993) of the Montgomery County Corporate Volunteer Council, Montgomery County Corporate Partnership for Managerial Excellence (1993); and the Maryland Business Roundtable (1993).
PHILIP RUBIN

Closing Comments

Dr. Philip Rubin is the Principal Assistant Director for Science at the Office of Science and Technology Policy (OSTP) in the Executive Office of the President of the United States, where he also leads the White House Neuroscience Initiative. His responsibilities also include serving as the Assistant Director for Social, Behavioral, and Economic Sciences and serving as the co-chair of the National Science and Technology Council (NSTC) Committee on Science with Dr. Francis Collins of NIH and Dr. Cora Marrett of NSF. He is on leave as the CEO of Haskins Laboratories in New Haven, Connecticut, where he remains as a Senior Scientist, and is also a Professor Adjunct in the Department of Surgery at Yale School of Medicine and a Fellow of Yale’s Trumbull College. Rubin is a cognitive scientist, technologist, and science administrator who for many years has been involved with issues of science advocacy, education, funding, and policy. His research spans a number of disciplines, combining computational, engineering, linguistic, physiological, and psychological approaches to study embodied cognition, most particularly the biological bases of speech and language. He is best known for his work on articulatory synthesis (computational modeling of the physiology and acoustics of speech production), speech perception, sinewave synthesis, signal processing, perceptual organization, and theoretical approaches and modeling of complex temporal events. From 2000-2003 Rubin was the Director of the Division of Behavioral and Cognitive Sciences at the National Science Foundation (NSF), where he helped launch the Cognitive Neuroscience, Human Origins (HOMINID), and other programs and was the first chair of the Human and Social Dynamics priority area. He was the NSF ex officio member of the National Research Protections Advisory Committee (NHRPAC) and the Secretary’s Advisory Committee on Human Subjects Protections, both advisory to the Secretary of the Department of Health and Human Services, and was the Chair of the inter-agency NSTC Committee on Human Subjects Research Subcommittee (HSRS). From 2006-2011 he was the chair of the National Academies Board on Behavioral, Cognitive, and Sensory Sciences. He is also the former Chairman of the Board of the Discovery Museum and Planetarium in Bridgeport, Connecticut. Rubin is a Fellow of the American Association for the Advancement of Science, the Acoustical Society of America, the American Psychological Association (APA), the Association for Psychological Science, a Senior Member of the IEEE, and an elected member of the Psychonomic Society and Sigma Xi. In 2010 he received the APA’s Meritorious Research Service Commendation “...for his outstanding contributions to psychological science through his service as a leader in research management and policy development at the national level.”
HERBERT LIN

Breakout Discussion Leader

Dr. Herbert Lin is chief scientist at the Computer Science and Telecommunications Board, National Research Council of the National Academies, where he has been study director of major projects on public policy and information technology. Of particular note is his role as editor on a 2009 NRC study on cyberattack as an instrument of national policy and a 2010 study on cyber deterrence. Prior to his NRC service, he was a professional staff member and staff scientist for the House Armed Services Committee (1986-1990), where his portfolio included defense policy and arms control issues. He received his doctorate in physics from MIT.
Dr. Diane DiEuliis is the Deputy Director for Policy in the Office of the Assistant Secretary for Preparedness and Response (ASPR), US Department of Health and Human Services, a position she has held since August, 2011. In this position, she is responsible for assisting in the coordination of policy and strategic planning for components of the Office of the ASPR and directly supporting the Deputy Assistant Secretary for Policy.

Prior to joining the US Department of Health and Human Services, Dr. DiEuliis was the Assistant Director for Life Sciences and Behavioral and Social Sciences in the Office of Science and Technology Policy (OSTP) in the Executive Office of the President. During her 4 year tenure at the White House, she was responsible for coordinating health issues among Federal departments and agencies, and was involved in developing policy in areas such as biosecurity, biosafety, human subjects, synthetic biology, Federal scientific collections, public access, and biotechnology. She also managed portfolios in the Science of Science Policy (devoted to measuring the outcomes of Federal investments in S&T), and Research Business Models (devoted to streamlining administrative requirements in the grants and contracts process). Dr. DiEuliis also worked to help coordinate agency response to public health issues such as the H1N1 flu. Prior to working at OSTP, Dr. DiEuliis was a program director at the National Institutes of Health (NIH), where she managed a diverse portfolio of neuroscience research in neurodegenerative diseases such as Alzheimer's and Parkinson's. She completed a fellowship at the University of Pennsylvania in the Center for Neurodegenerative Disease Research. She obtained her PhD degree from the University of Delaware, and completed her postdoctoral research in the NIH Intramural research program, where she focused on cellular and molecular neuroscience.
Dr. Dorothy Jones-Davis is currently an AAAS Science and Technology Policy Fellow in the Division of Engineering Education and Centers (EEC) within the National Science Foundation’s Directorate for Engineering. Dr. Jones-Davis is a graduate of Wellesley College, where she majored in Psychobiology, and she received her PhD at the University of Michigan in Neuroscience. While at the University of Michigan, she studied the mechanism of benzodiazepine pharmacoresistance in status epilepticus. After receiving her PhD, she completed a postdoctoral fellowship in the Department of Neurological Surgery at UCSF, where she studied the physiological and behavioral effects of using interneuron precursor cells as a potential therapeutic in a model of epilepsy. She then became an IRACDA Scholars in Science (ISIS) Postdoctoral Teaching and Research Fellow at UCSF, where she studied the genetic basis of epilepsy and autism in the Department of Neurology while serving as a lecturer in the Department of Biology at San Francisco State University.

During her fellowship tenure, Dr. Jones-Davis has been engaged in a number of projects surrounding broadening participation in the STEM workforce, particularly in the engineering and technology fields. In particular, she has focused on trying to leverage potential disruption (e.g. MOOCs, inverted classrooms, educational technologies, digital games, “maker” culture) in engineering education systems to improve access to and participation in engineering education for traditionally underrepresented populations. Additionally, she has become interested in the role of ethics training in the context of engineering education and practice, particularly as it relates to the intersection of neuroscience and engineering.
Dr. Laurie Stepanek is an AAAS Science & Technology Policy Fellow at the National Science Foundation, in the Division of Engineering Education and Centers. She obtained her PhD in neuroscience from the University of Miami, where she studied proteins that regulate axon growth and guidance. She went on to do a postdoctoral fellowship at the University of California, San Francisco where she studied the neural basis of vocal learning and plasticity in songbirds. At UCSF Dr. Stepanek was on the executive council of the Postdoctoral Scholars Association. She taught lab and lecture courses at UCSF and the University of San Francisco, in addition to partnering with elementary school teachers to teach science lessons in K-12 classrooms.

Dr. Stepanek is interested in policy and research that can improve education with the goal of teaching the next generation of scientists and engineers to become innovators and develop the skills they need to have flexible career pathways. Her current projects at NSF include developing quantitative and qualitative metrics to evaluate educational investments. Dr. Stepanek became involved in the AAAS Neuropolicy Affinity Group because she is interested in training scientists and engineers to consider the societal impact of their work.
HEATHER DEAN

Symposium Organizer

Dr. Heather Dean is currently a AAAS Science and Technology Policy Fellow in the Directorate for Social, Behavioral, and Economic Sciences at the National Science Foundation. At NSF, she is working on big picture issues such as replicability of published scientific findings and broadening participation in science and technology fields. She founded a NeuroPolicy group and speaker series in Washington, DC that is building a neuroscience policy community. Dr. Dean is interested in issues related to cutting-edge interdisciplinary neuroscience, data sharing, science communication, new technologies in science education, and broadening participation.

Dr. Dean started out as an electrical engineering major at Caltech interested in neural networks and was soon exploring the biological side of such networks by studying locust olfaction with Dr. Gilles Laurent. She earned her Master’s degree in Computation and Neural Systems along with her Bachelor’s degree in Electrical Engineering. This research experience also set her on the path of neuroscience research, and she went on to earn her PhD in Neurobiology at Duke University, where she went into monkey electrophysiology with Dr. Michael Platt. After graduate school, she spent six years at New York University helping to found the lab of Dr. Bijan Pesaran and studying the neural circuitry underlying hand-eye coordination in monkeys.

Dr. Dean currently serves as President of the Caltech Alumni Association and has previously served on the Duke Alumni Association Board and the Duke Board of Trustees.
The Potomac Institute for Policy Studies is an independent, 501(c)(3), not-for-profit public policy research institute. The Institute identifies and aggressively shepherds discussion on key science, technology, and national security issues facing our society.

The Institute hosts academic centers to study related policy issues through research, discussions, and forums. From these discussions and forums, we develop meaningful policy options and ensure their implementation at the intersection of business and government.

The Institute remains fiercely objective, owning no special allegiance to any single political party or private concern. With over nearly two decades of work on science and technology policy issues, the Potomac Institute has remained a leader in providing meaningful policy options for science and technology, national security, defense initiatives, and S&T forecasting.

The NeuroPolicy Affinity Group was established to connect and inform AAAS Science and Technology Policy Fellows who are working in or interested in learning about the intersection of neuroscience with policy, law, ethics, media, and society. The group has since expanded to include others from throughout government, industry, think tanks, and more. It is led by AAAS Policy Fellows Heather Dean, Dorothy Jones-Davis, and Laurie Stepanek.