

THE INTERNATIONAL FUTURE OF NEUROETHICS

1st International Workshop of Neuroethics in JAPAN
Dialog on Brain, Society, and Ethics

July 2006

Judy Illes, Ph.D.

Director, Program in Neuroethics
Stanford Center for Biomedical Ethics
Department of Radiology

Abstract

With an ever-increasing understanding of the brain mechanisms associated with core human attributes and values, there is increasing interest in the results that neuroscience is producing and the way that new knowledge will be used. Here I present a brief historical overview of modern neuroethics, perspectives on current priorities for engaging the international community in scientific endeavors, and prospects for the new field of neuroethics as both a focus and a driver of this international effort.

A Vision for a New Discipline: Neuroethics

While questions about the nature and origins of human identity and behavior have been the focus of philosophical discussions dating back to antiquity, it is only in the last few centuries that scientists have sought to understand the intricacies of the structure and function of the nervous system and, more recently, the nature of mind and brain ¹. Although there is a widespread notion that scientific research and especially new technologies bring new ethical problems, ethical concerns reflect the values of the society. New technologies and scientific findings create the circumstances in which ethical issues pose new challenges.

In response, the growth of modern neuroethics has been steady and steep, if not surprising. In the 1990's the Churchlands first used the term "neuroethics" in the context of neurogenetics to describe how genes give us a head start with some *in situ* but modifiable neural organization². Around the same time, clinicians (e.g.³) and major health organizations (e.g., World Health Organization 1997) used the term neuroethics to describe the challenges faced in end-of-life care for neurologic patients. The Dana Foundation's William Safire set the stage for modern neuroethics when, at meeting it sponsored in 2002 called Neuroethics: Mapping the Field, he said: "... *neuroethics – the examination of what is right and wrong and good and bad about the treatment of, perfection of, or unwelcome invasion of and worrisome manipulation of the human brain [...]* "It deals with our consciousness – our sense of self – and as such is central to our being"⁴. His charge to the multidisciplinary group of scientists and scholars to "*carve out new territory for an old philosophical discipline (bioethics)*" was no less telling, but the extent to which theoretical and empirical neuroethics-related work would flourish was unexpected. Through the efforts and interests of increasing numbers of investigators and scholars, publications, conferences and press coverage, the scientific world and the public gained a new awareness of the ethical, legal and social challenges accompanying advances in neurosciences e.g.,^{5, 6}.

The Dana mapping meeting identified four major themes for neuroethics that have been useful for classifying major areas of neuroethics activity. They are:

- Neuroscience and the self – drive, motivation, belief
- Neuroscience and social policy – the implementation of results for making new resources available to society, in education and government
- Neuroscience and therapeutic intervention – advances in clinical practice
- Neuroscience, communication, public discourse and training

Although neuroscience and the self is the strongest unifying feature of all four pillars, the fourth pillar – that is, engaging the public on topics brain and brain disorders and, now, neuroethics, has been the first focus area for the field on an international scale. I will discuss this next.

International Approaches to Neuroethics and Public Engagement (adapted from ⁷)

The United States has been a hub of 21st century neuroethics activity, and has hosted a number of key events that have come to define the field. In 2002, for example, the Dana Foundation sponsored the conference *Neuroethics: Mapping the Field* ⁸. In 2004, the American Association for the Advancement of Science in (AAAS) sponsored a meeting on neuroscience and law ⁹ and, in 2005, another on neuroethics and religion. The Library of Congress sponsored a neuroethics meeting called “Hard Science – Hard Choices”, also in 2005. With funding from The Greenwall Foundation, a special issue of the journal *Brain and Cognition* was published devoted to ethical issues in advanced neuroimaging¹⁰, The Dana Foundation’s journal *Cerebrum* published a special issue on neuroethics in the Fall of 2004¹¹ and the US-based *American Journal of Bioethics* published its own special issue on neuroethics in 2005¹². The fierce interest of

Americans in their brains and growing literacy about brain diseases that affect millions of people has been due in part to concerted efforts to share the excitement of neuroscience discoveries as well as their ethical, social and legal implications.

Public engagement efforts in the United States have generally involved two approaches to science literacy and action – education and dialogue – consistent with those described by the World Health Organization¹³ for: (1) informed decisions about health care; (2) participation in government decisions in research and treatment of new neurological disease and mental illnesses; (3) critical judgment of neuroscience-related material in popular media; and (4) promotion of optimal brain development. The straightforwardly educational approach encompassing these approaches seeks to increase public understanding and appreciation of neuroscience research. The second attempts to engage the public in dialogue about the meaning of neuroscience discovery for society.

Specific efforts at public education have come from funding agencies, including many at the National Institutes of Health (NIH), from professional societies like the Society for Neuroscience (SfN) and more specialized groups in both neurology and psychiatry, and from patient advocacy groups like the National Alliance for the Mentally Ill (NAMI). A dramatic effort was the initiative that culminated in the declaration of the Decade of the Brain in 1990. The efficacy of the effort was evident, in part, by the ever-growing public acceptance – gained after decades of intensive work by scientists, clinicians, and patients and their families – of the fact that severe mental illnesses like schizophrenia and bipolar disorder are brain diseases, not simply symptoms of weak wills or poor parenting. The US President's Council on Bioethics created by an executive order in 1995 has had a specific public education mission. It has concentrated on issues that include neuroscience, such as enhancement, but has been decidedly controversial among scientists.

In *The Ethical Brain*¹⁴ Gazzaniga introduces ethical issues that concern the development and expression of human consciousness – issues central to understanding the nature of humanity and our very existence. For example, understanding when consciousness first emerges developmentally has implications for embryological research and its applications. A study by Kosfeld and his colleagues on neuroendocrine influences of human trust provides another example of ways in which neuroscience research may get closer than ever before to elucidating core human traits and values¹⁵. These extend naturally to other neuroethics issues, including issues of personal responsibility in brain diseases that affect behavior¹⁶, vulnerability of individuals with addiction disorders or dementia¹⁷, and privacy¹⁸.

Canada follows closely on the heels of US leadership in promoting opportunities for engaging the public in neuroscience, and support for specific research initiatives in neuroethics. Led by the Institute of Neuroscience, Mental Health and Addiction (INMHA), one of the Canadian Institutes of Health Research, partnership has been formed including the Dana Foundation, the Canadian Chapters of the Society for Neuroscience and non-government voluntary sector organizations to engage in neuroethics activities, especially in the context of the annual Brain Awareness Week which is now a global event. Similar initiatives, albeit on a smaller scale, are found in Switzerland, Italy and Sweden. With a proactive focus on the overall understanding and dissemination of information about brain function and diseases, a Brain Awareness Week has been held in Switzerland every year since 1998 with considerable success. It led to the creation of other structures designed to bridge the gap between science and the public. Among the most innovative are “cafés scientifiques”, a movement originating in the United Kingdom that provides an informal setting for a dialogue between scientists and the public. In Italy, government was the first in the world to endorse the US-led initiative for the Decade of the Brain in the 1990s, and publications such as *Travel in the Brain*, and a newly founded National Institute of Neuroscience,

place neuroscience literacy among their core objectives. In Sweden there is a long tradition upheld by universities, hospitals and research foundations in advancing public awareness about the progress and benefits of brain research. The activities of the “Decade of the Brain” in the 1990s reached all sectors of society, and the Swedish Brain Foundation has collaborated with local hospitals and schools for several years during their Brain Awareness Week. In 2005, eight sponsors of research from both the public and private sector undertook an ambitious initiative to specifically promote public engagement in matters related to brain research and neuroscience in Sweden. The effort includes collaborations with local science museums and schools. A public website (www.forskning.se/sehjarnan) is a core resource for stimulating debate and discussion. This project differs from previous ones in Sweden in its comprehensive section on neuroethics. Issues related to personal responsibility and identity, discussions about what is normal and the potential benefits of enhancing brain function are raised, as are the consequences of manipulating complex human behavior.

There is a particularly strong commitment to science communication in the United Kingdom (UK), launched with the Bodmer Report from the Royal Society, the British Association for the Advancement of Science and the Royal Institution in 1985. A shift of emphasis from didactic communication to active dialogue came in 2000 with a report entitled “Science and Society” from the House of Lords Select Committee on Science and Technology, and there now is robust debate about whether and how the public should be involved in setting the strategic agenda of academic science, as well as their well-established participation in ethical debate.

In Japan, strong government efforts promote brain research at both ends of the life spectrum. In 1995, pathologies of sleep were recognized as both a health and a social problem¹⁹. Studies were designed to focus not only on medical features but also on characteristics and role of sleep and dreaming in Asian culture and philosophy. In 2003, the research initiative “Nurturing

the Brain” was launched to focus on the development and maintenance of ‘normal’ brain function. These new efforts encompass embryonic and postnatal maturation as well as education, adult learning, and prevention of mental decline with aging²⁰. The honorary president of the International Brain Research Organization, Dr. Masao Ito, was among the first to embrace the Brain Awareness Week concept, which has seen increasing participation in Japan since its launch nearly six years ago. He also promoted current Organization for Economic Co-operation and Development (OECD) initiatives to link brain science and education in the form of international research networks on literacy, numeracy and life-long learning.

As Professor Takao Hensch wrote in the international neuroethics paper jointly authored with Dr. Illes and others, one of the greatest societal demands in Japan is for accurate information about critical periods in brain development. When is the best time to begin teaching English? Or sports? What is the influence of video games, cell phones, *anime* (Japanese animations) on children? Many of the modern ills emerging among Japanese youth are attributed to excessive technology. Staggering rise in violent crimes, vagrancy and suicide among this sector of the population raise many questions about what can be done for kids who burn out (*kireru*). In response, large cohort studies to follow 10,000 Japanese children over the first several years of life have been launched under the rubric of ‘Brain Science and Education’. It links pediatricians, educators, parents and scientists on a scale that has not been attempted before²¹. Privacy and confidentiality are key issues for the nascent ethics committees across the country.

Scientists in Japan are at the forefront of understanding the cellular and molecular bases of critical periods in brain development²². One need only consider the synchronized, photic seizures induced by an episode of *Pokemon* in nearly 1000 Japanese children to see the relevance of the basic biology of neural plasticity to humans²³. Stem cell research²⁴ is also facing ethical scrutiny but, in general, this largely Buddhist culture views the research as a

positive contribution to society. Similarly, even while Japanese researchers reveal signature changes on functional MRI that accompany second language learning ²⁵, concerns emerging elsewhere about mind reading and neural discrimination have not penetrated this island nation.

Japanese scientists have also been the first to develop MRI imaging techniques for the early detection of amyloid plaque deposits in the living brain well before the onset of dementia ²⁶. Similar advances may motivate the design of brain-machine interfaces (neural prostheses) beyond primary sensory systems ²⁷. As recently introduced in an inaugural symposium on “Neuroethics of Nurturing the Brain” at the Japanese Society for Neuroscience meeting in 2005, a significant issue in these discussions is the definition of an optimal or ideal brain. Both cultural and personal interpretations must be honored, and neuroethics must co-evolve with the science that upholds the importance of individual differences.

In comparison to other international efforts, public engagement activities in Latin America such as Venezuela are limited, although “science for the people” is the phrase that accompanies every letter and every announcement coming from the Ministry of Science and Technology. Although more is still said than actually done, the impact is evident among researchers and advocacy groups who have a new feeling of empowerment and an even deeper sense of urgency and immediateness. In seeking ways in which neuroscience can better improve brain health in developing countries such as Venezuela, imperatives include establishing clear priorities, strengthening the capacity of local institutions, and meeting health needs. But, as many of the translational approaches of neuroscience involve sophisticated technology, will neuroscience unintentionally contribute to the “science divide” between rich and poor countries? Much remains to be achieved on an international scale as an understanding of mutual goals may bring the task of reconciling differences about ethics in neuroscience, brought about by factors such as public understanding, policy, religion and health care, within reach.

Clinical Neuroethics

No doubt, as the public becomes more aware of advances in neuroscience, so does its natural desire for better treatment of disease and quality of life. Given the rapid pace of neuroscience innovation and expanded applications both within and outside academic medicine, international researchers must partner more closely than ever before with physicians in a number of spheres of immediate importance^{28, 29}. Some key examples for this activity, corresponding to the third pillar of neuroethics, are:

Technology transfer: Assuring that that health benefits outweigh risks, and fair access to new or re-emerging technologies, such as transcranial magnetic stimulation (TMS) and electroconvulsive therapy, are balanced against society's pull for new innovation and the academic push for technology transfer³⁰;

Incidental findings: Defining guidelines for managing abnormalities of potential clinical significance that are detected unexpectedly in basic and clinical research³¹;

Regenerative medicine: Critically evaluating the role and implications of molecular and transplant medicine and functional imaging in regenerative medicine, especially for diseases of the central nervous system (CNS)³²;

Prediction: Applying appropriate cautions in the use of neuroscience methods such as brain and gene mapping that may predict for examples, diseases of the CNS in the absence of effective neuroprotection or treatment³³, the potential for recovery from limited states of consciousness³⁴, and poor developmental outcome in children^{35 36};

Self-referred brain imaging: Assuring quality control and appropriate consumer education in the growing industry of functional brain imaging services such MRI and Single Photon Emission Computed Tomography (SPECT)^{37, 38}.

Emerging capabilities from molecular imaging and nanotechnology also raise compelling challenges to which neuroethics can bring reason and resolution.

Learning from the Past, Looking to the Future

In 1597 Sir Francis Bacon wrote, “*Knowledge is power (Ipsa Scientia Potestas Est)*”³⁹. The greatest benefit to international engagement of neuroethics is knowledge; the risks are creating false hopes and expectations by releasing results too early, especially in the context of devastating diseases of the central nervous system. Misunderstandings of oversimplified scientific facts can lead to activism even in matters that are not well understood (e.g., nuclear cell transfer, stem cells). New developments in neuroscience can challenge established values and attitudes and even political views and, as in other areas of life sciences, forestalling progress can be an easy way out. More complex arguments – that failure to act may be at least unethical – are frequently lost. It is thus essential that the evaluation of ethical issues emerging in neuroscience is based on sound research and scholarship. For this task, we can learn from lessons of the past.

Table 1 I shows how new techniques have much in common with gene hunting and gene testing, from which so much of our work on ethical, legal and social implications (ELSI) of research arises. Much remains to be learned, some predictions may prove false, and outcomes may be realized that we could not anticipate. Nonetheless, great benefit lies in mapping out critical issues – from safety to privacy, from monitoring to manipulating human thought – and integrating ethics into all relevant domains early in the research process. As Gindro and Mordini wrote in 1997⁴⁰

“... new findings are already sufficient to address a number of new, puzzling, ethical, legal and social problems, and it is easy to predict that the next decade will be the ‘decade of the ethics of brain research’.”

Conclusion

As neuroscience continuously unlocks the many unknowns of mind and behavior, we must always keep in sight the ultimate target of our work: the betterment of humanity. With an ever-improving understanding of the mechanisms associated with core human attributes and values, there will only be an increasing public interest and concern about neuroscience and the way that new knowledge will be used. In the global task of scientific discovery, patient and public engagement, the only real risk is not to do it at all.

Acknowledgements

NIH/NINDS RO1#045831.

References

1. Zimmer, C. *Soul Made Flesh: The Discovery of the Brain – and How it Changed the World* (Free Press, New York, 2004).
2. Churchland, P. M. *A neurocomputational perspective: The nature of mind and the structure of science* (Bradford Books/MIT Press, Cambridge, MA, 1989).
3. Cranford, R. E. The neurologist as ethics consultant and as a member of the institutional ethics committee. *Neurologic clinics* 7, 697-713. (1989).
4. Marcus, S. J. (ed.) *Neuroethics: Mapping The Field, Conference Proceedings* (The Dana Foundation, 2002).
5. Illes, J. (ed.) *Neuroethics: Defining the issues in theory, practice and policy* (Oxford University Press, Oxford, 2006).
6. Illes, J., DeVries, R., Cho, M. K. & Schraedley-Desmond, P. ELSI issues in advanced neuroimaging. *American Journal of Bioethics* 6, 24-31 (2006).
7. Illes, J. et al. Neuroethics: International perspectives on engaging the public. *Nature Reviews Neuroscience* 6, 977-982 (2005).
8. Marcus, S. *Neuroethics: Mapping the Field* (The Dana Foundation Press, New York, 2002).
9. Garland, B. (The American Association for the Advancement of Science and The Dana Foundation, Washington, D.C., 2004).
10. Illes, J. (ed.) *Ethical Challenges in Advanced Neuroimaging* (Academic Press, New York, 2002).
11. Donway, W. (ed.) *Cerebrum* (The Dana Foundation Press, New York, 2004).
12. McGee, G. *American Journal of Bioethics* (2005).
13. Obot, I. S., Poznyak, V. & Monterio, M. From basic research to public health policy: WHO report on the neuroscience of substance dependence. *Addictive Behaviors* 29, 1497-1502 (2004).
14. Gazzaniga, M. *The Ethical Brain* (The Dana Foundation Press, New York, 2005).
15. Kosfeld, M., Heinrichs, M., Zak, P. J., Fischbacher, U. & Fehr, E. Oxytocin increases trust in humans. *Nature* 435, 571-572 (2005).
16. Damasio, A. R. *Descartes' Error* (Penguin Putnam Pubs, New Jersey, NJ, 1994).
17. Hall, W., Carter, L. & Morley, K. I. Neuroscience research on the addictions: A prospectus for future ethical and policy analysis. *Addictive Behaviors* 29, 1481-1495 (2004).
18. Wolpe, P. R., Foster, K. R. & Langleben, D. D. Emerging neurotechnologies for lie-detection: Promises and perils. *American Journal of Bioethics* 5, 39-49 (2005).
19. Okuma, T. The present and future of sleep research in Asia. *Psychiatry Clin Neurosci* 49, 91-97 (1995).
20. Ito, M. Nurturing the brain as an emerging research field involving child neurology. *Brain Dev* 26, 429-433 (2004).
21. Koizumi, H. The concept of 'developing the brain': a new natural science for learning and education. *Brain Dev* 25, 434-441 (2004).
22. Hensch, T. K. Critical period regulation. *Ann Rev Neurosci* 27, 549-579 (2004).
23. Takahashi, T. & Tsukahara, Y. Pocket Monster incident and low luminance visual stimuli: Special reference to deep red flicker stimulation. *Acta Paediatr Jpn* 40 (1998).
24. Uchida, K. et al. Potential functional neural repair with grafted neural stem cells of early embryonic neuroepithelial origin. *Neurosci Res* 52, 276-286 (2005).
25. Tatsuno, Y. & Sakai, K. L. Language-related activations in the left prefrontal regions are differentially modulated by age, proficiency, and task demands. *J Neurosci.*, 1637-1644 (2005).

26. Higuchi, M. et al. 19F and 1H MRI detection of amyloid beta plaques in vivo. *Nature Neuroscience* 8, 527-533 (2005).
27. Mussa-Ivaldi, F. A. & Miller, L. E. Brain-machine interfaces: computational demands and clinical needs meet basic neuroscience. *Trends Neurosci* 26, 329-34 (2003).
28. Illes, J. Medical imaging: A hub for the new field of neuroethics. *Acad Radiol* 11, 721-723 (2004).
29. Illes, J. & Bird., S. J. Neuroethics: A modern context for ethics in neuroscience. *Trends in Neuroscience* (In press).
30. Illes, J., Kirschen, M. P. & Gallo, M. Ethical challenges for TMS. *Behavioral Neurology* (In press).
31. Illes, J. et al. Incidental findings in brain imaging research. *Science* 311, 783-784 (2006).
32. Illes, J. in *Beyond the Embryo* (Stanford University, Stanford, CA, 2006).
33. Mitterschiffhaller, M. T., Ettinger, U., Mehta, M. A., D., M.-C. & Williams, S. C. R. Applications of functional Magnetic Resonance Imaging in psychiatry. *Journal of Magnetic Resonance Imaging* 23, 851-861 (2006).
34. Kobylarz, E. J. & Schiff, N. D. Functional imaging of severely brain-injured patients. *Neurology* 61, 1357-1360 (2004).
35. Moseley, M., Bammer, R. & Illes, J. Diffusion-tensor imaging of cognitive performance. *Brain and Cognition* 50, 396-413 (2002).
36. Illes, J. & Raffin, J. in *Cerebrum* 33-46 (The Dana Press, New York, 2005).
37. Illes, J. & Kirschen, M. P. New prospects and ethical challenges for neuroimaging within and outside the health care system. *America Journal of Neuroradiology* 24, 1932-1934 (2003).
38. Racine, E., Van der Loos, H. Z. A. & Illes, J. Internet marketing of neuroproducts: New practices and healthcare policy challenges *Cambridge Quarterly of Healthcare Ethics* (In press).
39. Bacon, F. Knowledge is power (*Ipsa Scientia Potestas Est*) (1597).
40. Gindro, A. & Mordini, E. Ethical, legal, and social issues in brain research. *Curr. Opinion in Psychiatry* 11, 575-580 (1998).