NEUROETHICS: PRESIDENTIAL ADDRESS INDIAN ACADEMY OF NEUROSCIENCES SILVER JUBILEE CONFERENCE, VARANASI, INDIA

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Introduction

It is a unique privilege to deliver a Presidential Address for a second year in a row, that too at the Silver Jubilee Conference of the Academy. It further adds to the sanctity of the occasion when it happens to be at this venerable institution of learning established by a great visionary, Mahamana Shri Madan Mohan Malviyaji. I am doubly blessed to deliver this oration in the holy city of Varanasi with the longest uninterrupted tradition of education-longer than any other city in the World. Let me once again thank the Academy for this rare honour.

As you all know Neurosciences research is a continuum of study from the molecular to the behavioral level. It encompasses the body of research directed towards understanding the molecular, cellular, intercellular processes-mediated through electrochemical signals, in the nervous system, integrated to sub serve behavior. The spectacular advances in neurosciences in the last couple of decades have made it possible to not only explore but also to modify the function of human brain, even human mind and consciousness at such levels that it has aroused concerns about their ethical implications. It is generally recognized that recent advances in neurogenetics, brain mapping, imaging, neural implants, transplants and emerging technologies of brain – machine interface, deep brain stimulation, psychosurgery for aggressive behavior, pharmacological or genetic attempts for enhancing human mental capacity have already alarmed ethicists. Some thinkers consider these to pose far more threat to human dignity and autonomy than cloning (1). The profound accomplishments in the neurosciences in 1990s have also given rise "to thorny moral and ethical quandaries not previously faced by our discipline (2).

To meet the ethical challenges of these investigations has led to the evolution of the new discipline i.e. Neuroethics (3). While most of the ethical concerns related to neurosciences could be covered under the broad discipline of Bioethics, but as I will elaborate later, there are unique ethical aspects specific to the professional conduct and research related to Neurosciences. Let me first define the term Neuroethics as it is viewed by different experts.

Definition

The term Neuroethics was coined by William Safire to describe, "the field of philosophy that discuss the rights and wrongs of the treatment of, or enhancement of, the human brain" (4).

Gazzaniga defined it as, "the examination of how we want to deal with the social issues of diseases, normality, mortality, life style, and the philosophy of living informed by our understanding of underlying brain mechanisms". "It is – or should be – an effort to come up with a brain based philosophy of life" (5).

More simply, "Neuroethics is concerned with ethical, legal and social implications of neuroscience research findings and with the nature of neuroscience research itself". (6).

To Illes and Bird definition I would like to add the professional conduct while dealing with the unfortunate victims of neuro-psychological disorders.

Historical Perspectives

While the term Neuroethics might have been coined recently ethical concerns have been expressed for many years especially in respect to psycho-surgery, consent for treatment of psychiatric patients, the inhuman practices in mental asylum, maintenance of confidentially of personal information gathered during professional interaction with the patients etc. Already in 1959, a Commission set up by UNESCO observed that progress in the physical sciences has far outstripped our understanding of even the most elementary brain mechanisms, upon which such progress is based and stressed that the "universe of the brain was relatively unexplored". We have no doubt this has advanced a lot since then. However, the recent developments in the field of neuroscience research have added new dimensions to the ethical concerns. These have aroused global interest. Thus in 1995, UNESCO Commissioned a study on Ethics and Neurosciences. Prof. Jean-Didier Vincent, as its Rapportour, submitted its report to UNESCO. A conference organized by DANA Foundation along with UCSF & Stanford University in the USA in 2002, primarily devoted to "Neuroethics-Mapping the field including neuroscience and law and neuroscience and religion(7). In addition to devoting special attention to the subject in the American Journal of Bioethics, a new journal on Neuroethics has been initiated. Farah summarized some of the emerging issues in Neuroscience(8).

Scope of Neuroethics

- Neuroethics will overlap substantially with traditional issues of bioethics and genetics and extend beyond to concerns related to brain, behavior, self and consciousness.
- The intimate connection between our brain and behaviors, as well as the peculiar relationship between our brain and ourselves, generate distinctive question that beg for the interplay between ethical and neuroscientific thinking.

Thus Neuroethics has two major subdivisions,

- Ethics of Neuroscience
- Neuroscience of Ethics

Ethics of Neuroscience

- The ethical issues concerned with pursuit of neuroscience research.
- Evaluation of ethical, social and legal impact of these studies.
- Ethics of practice of neurosciences-neurology, neurosurgery, psychiatry and cognitive sciences.

Neuroscience of Ethics

Exploring the neural basis of ethical, moral, spiritual traits, human nature and self.

Interpretation of philosophical notions of free-will, self control, personal identity, intention, empathy, altruism, value judgment on the basis of emerging knowledge of brain function.

Recognizing that human behavior is controlled by our brain and that ethics constitutes a part of our behavior, it is not surprising that neuroscientists have been looking for neural basis of ethical and moral behavior. The nearly 150 years old examples of Phineas Gage, who following an injury to the frontal lobe lived with his physical capacity intact and his cognitive faculties unimpaired – became incapable of making moral choices, supports this view(9). This has been further strengthened by Antonio Damasio in his studies. (Descartes' Error: Emotion, Reason and Human Brain)"(10).

However, it must be emphasized, "There are no moral "centers" of the brain- though extensive neural systems are indeed involved- and that although genes impel our ethical behaviors they do not compel such behaviors which varies with our culture, our living situation, and the health of our brain"(11).

Patricia Churchland of University of California San Diego- "Neuroscience, still does not know the neural basis of morality".

Time won't permit me to elaborate this any further. This is not to say that damage to the brain will not result in moral impairment.

Why is there a need for specific discipline?

Notwithstanding some overlap with the existing UNESCO Declarations (Human Genome, Human Genetic Data, Bioethic and Human Rights), ethical issues related to Neurosciences have several unique concerns not covered in to in these earlier declarations.

Farah pointed out that, "At the start of the 21st Century, neuroscience has developed to a point where (like genetics) it, too, may have profound effects on society, extending far beyond the research laboratory or medical clinic ……. (it) concerns the biological foundations of who we are, of our essence…….. Yet until recently there has been little awareness of the ethical issues arising from neurosciences"(12).

Neuroscience research and its applications involve a much larger group of scientific community than biologists and biomedical scientists. It concerns psychologists, cognitive scientists, other natural sciences, technologists, robotics experts, engineers, information & computer scientists and ethologists. There are emerging new disciplines of Neuroeconomics, Neuromarketing, Neuroaesthetics not covered by the commonly accepted disciplines of Bioethics.

Understanding the historical foundations of ethics in neuroscience, its connection to other areas of modern science and bioethics, and the vital role that neuroethics must have, are key to illuminating its future(6).

With an ever-increasing understanding of the brain mechanisms associated with core human attributes and values. There is an increasing public interest in the results of neuroscience research and the ways in which that new knowledge will be used. "Neuroethics has surfaced, and is here to stay" (13).

While the neurosciences do bring hope, notably in the area of mental health, they are also a particularly dangerous terrain for genetic manipulation and for the use of pharmacology and computer science for behavioral ends. As a possible instrument of encroachment on human liberty and dignity, the neurosciences may also turn out to be a poisoned chalice on which the worst form of ideology may thrive (14).

Some Areas of Special Ethical Concerns

Clinical Practice: In addition to the general principles of biomedical ethics, there are some special areas of ethical concerns:

a) Consent for participation in research or treatment of brain compromised individuals e.g., demented, psychotic

b) Misuse of Psychoactive drugs:-Prozac, Ritalin, modafinil

c) Risks associated with implantable devices; Transcranial Magnetic stimulation for altering behavior; Revival of ethical concerns of psychosurgery.

d) Use of predictive diagnostic techniques for conditions for which currently no prophylaxis or therapy is available e.g. genetic or imaging procedures which predict the possibility of disease at some future date.

e) Genetic or pharmacological intervention to:

i) alter behavior

ii) neuroaugumentation of healthy, normal individuals-e.g. memory-a form of eugenics. Use of drugs for memory enhancement by students, army personnel, drugs for interfering with sleep by long distance truck drivers, and their possible addiction and long term toxic effects. The ethical concerns related to chemical or technological enhancements would these make us less human or "post human" (15).

Informed Consent

In clinical practice besides the usual ethical considerations as recently summarized in the Universal Declaration on Bioethics and Human Rights by UNESCO e.g. respect for human dignity and human rights, to maximize benefits and minimize any harm, ensuring the autonomy and individual responsibility, respect for human vulnerability and personal integrity, privacy and confidentiality, non-discrimination and non-stigmatization etc, special attention is required to the question of informed consent.

Any preventive, diagnostic and therapeutic medical intervention and even more so scientific research, on human subjects requires prior free and informed consent of the person concerned. This poses ethical concerns specially in case of infants, children, psychiatric challenged individuals or patients with dementia. Resort may have to be taken to obtain consent of the legal representative and in certain cultures of the community leader. For this purpose some legislation may be required.

Definition of Death: Till recently death implied complete cessation of cardio-pulmonary function. However, with advances in critical care medicine life can be artificially prolonged with intensive care management. In addition the need for organ harvesting for transplantation death has now universally been equated with brain-death. This raises important questions regarding definition of brain-death-whether it implies irreversible loss of whole brain function or the brainstem function alone. While in most countries, including India, legally acceptable procedures to establish brain death have been laid down, the debate on the subject is not over yet as will be evident from a recent round-table discussion organized by the Pontificial Academy. (16).

Ethical Issues Related to Beginning and End of Consciousness: Even more difficult than the determination of brain-death and under certain circumstances even related to it is the question of determining the beginning (in case of embryos) and end (in cases of chronic vegetative state) of consciousness. This has acquired emotional, religious and legal implications when deciding issues related to medical termination of pregnancy, embryonic stem cell research, in vitro fertilization, biomedical cloning. As Gazzaniga recently commented, central to many of the ethical issues of our time is the question, "When should society confer moral status on an embryo"(5)? It is interesting to note that at an interactive meeting of the International Bioethics Committee of UNESCO, leaders of diverse religious expressed very differing views. It may be mentioned from a purely neuroscience perspective we could argue that life begins with a sentient being. Thus fourteen days of foetal life is the age many neuroscientists accept as the beginning of human life worthy of moral status because it marks the beginning of brain function. While it may sound irreverent I am persuaded to argue that if we all agree, as we do now, that brain death is death, then how can an embryo constituted by a mass of cells but without any brain be considered as living person. Be as it may, for the time being it is obvious that currently this ethical dilemma remains unresolved.

Similarly ethical dilemma, is created in respect of decisions to withdraw life support system particularly in persons in persistent vegetative state etc. A recent report by Nicholas Schiff has heightened this debate(17). Using the new imaging techniques called diffusion tensor imaging Nicholas Schiff and Colleagues from the Weill Medical College of Cornell University N.Y., on a patient in a persistent vegetative state demonstrated the astounding growth of new axons, rewiring the brain nineteen years after the insult resulting in this state, in ways never thought possible before. They suggested that there is a compelling evidence that some patients in a supposedly permanent vegetative state may actually show signs of awareness, a finding that could force a review of how such patients are treated.

Ethical Issues related to Neuroimaging & Brain Mapping; Brain Finger Printing

Imaging for lie-detection: The greatest advances in the field of neurosciences in recent years have been in the field of the neuroimaging. While these are of immense value for disease diagnosis and therapy, these are also the source for major ethical concerns when used for exploring human thought, behavior, personality and decision making. Illes and Bird pointed out that, "Recent fMRI studies demonstrated the possibility of obtaining measurements of biological correlates of complex human processes such as existential thought and decision making, moral and non moral social judgment, love and altruism, personality and human complications. Do these studies demonstrate a definite neural basis of morality or consciousness? Certainly not". (see below) (6,18).

Issues of Personal Responsibility for Criminal Offence

"Issues of free-will: Did the defendant carry out the crime freely and by choice or was it inevitable because of the nature of his brain or past experience. Already lawyers have starting to defend their client by attributing responsibility for crime to brain disorder or past damage. Any abnormality revealed by brain imaging comes in handy for them to support their argument. Defense lawyers are looking for that one pixel in their clients brain scan that shows abnormality, a predisposition to crime or malfunction, thereby arguing, "Harry didn't do it. His brain did it". It has been suggested that a large proportion of inmates on death row may have damaged or injured brain. If this is confirmed how would it affect our views about moral and legal responsibility and in fact judicial system.

Diagnosis of behavioral dispositions, motivations or beliefs with the help of new imaging, genetic and electrophysiological techniques. In what cases can such information be used ethically? What are the consequences of reliable but not perfect, diagnosis techniques of exploring human thought and intent. Stephen Morse warns that the colourful images of the brain such as those produced by functional magnetic resonance imaging (MRI) might blind people to the fundamental legal assumption that "people are conscious, intentional and potentially rational agents" and therefore responsible for their actions(19). He cautions about the use of neuroscientific evidence either in assessing responsibility or in determining punishment for criminal acts. Immense human benefit has accrued as a result of introduction of new neuron-imaging techniques specially MRI and fMRI, but the same could be utilized for brain mapping in which case they raise ethical issues.

Wolpe et al argued that recent advances in neuron-imaging can gain access to the seat of a person thoughts, feelings, intention and knowledge(20). These have been used to develop reliable brain-imaging lie-detection technologies. These raise difficult

ethical and legal questions. They proposed that "we would need to define the parameters of a person's right to 'cognitive liberty', the limits of the state's right to peer into individual's thought process with or without his or her consent, and the proper use of such information in civil, forensic and security setting". Daniel Langleben found differences in brain activations when people were lying versus when they were telling the truth(21). Farwell who developed the technology of the Computerized Knowledge Assessment (CKA) utilizing P300 response in an EEG and called his method "brain fingerprinting". While some investigators have questioned the absolute reliability of these data, others warned that we may be entering the era of brain incrimination, many have raised the questions about its implications for our constitutional rights to privacy and to freedom of speech and thought. According to Helen Phillips "brain imaging has already delved into our personal lives. Among other things, it has been used to investigate love, personality traits, political leanings, racial prejudice, tendency to violence, deception, moral reasoning……..

Studies are even beginning to encroach on legal issues such as whether we are responsible for our actions, whether it is possible to predict who is likely to commit a crime and whether people are lying or have false memories"(22).

Greene and Cohen argued that neuroscience will probably have a transforming effect on the law…… new neuroscience will change the law, not by undermining its current assumptions, but by transforming people's moral intuitions about free-will and responsibility (23). In their view, "neuroscience will challenge and ultimately reshape our intuitive sense(s) of justice. They concluded, "Neuroscience is unlikely to tell us anything that will challenge the law's stated assumptions. However, we maintain that advances in neuroscience are likely to change the way people think about human action, and the criminal responsibility……". This will further complicate the debate on free will and determinism in respect to human behaviour and responsibility for crime. Those interested in the subject of law and the brain are referred to a recent volume of the Philosophical Transactions of the Royal Society London (Vol 359, 2004).

Ethical Issues Related to "Brain Enhancement"

Already a number of techniques exist that have their objective the enhancement of the intellect of the off springs. It is claimed that the stunning advances in genetics will make enhancement possible relatively soon. This raises the spectra of a new form of eugenics. If selecting for intelligence, temperament and other psychological factors is on the horizon, we should begin now to think about the social implications of having such power. Should parents be allowed to genetically engineer their children? No less a person than James Watson believes that "genetic enhancement should be a matter of choice".

Leave aside the issue of possibility of genetic manipulations for brain enhancement in future there is already a more immediate concern in respect to pharmacological attempts to achieve the same. As pointed out by Gazzaniga in the chapter on "Shaping the Smart Brain with drugs : Memory Enhancers, Nootropes, Noos-mind and Tropein", many 'smart drugs' are in clinical trials and could be in market in less than five years(5). Nobel Laureate Eric Kandel's company Memory Pharmaceuticals is working to produce a drug based on enhancing a protein CREB. The drug MEM1414 is already in clinical trial. Some drugs currently available to patients with memory disorders may increase intelligence in the healthy population. Should this be permitted? Is their use for normal individuals ethical?

There is enough evidence already about the gross misuse of psychoactive drugs, Ritalin, Modafinil. The pharmacological advances that will surely stem for the ongoing researchers will present the following question: When can drugs be ethically used to enhance normal capacities, rather than just to treat deficits?(3). Fukuyama believes that, "chemical and technological enhancement make us less human or 'post human'(14). Farah questions, "How does the enhancement of the individual affect society, and what kinds of policy might we adopt to best manage these society-wide effects? She adds, we have ambitious college students turbo charging their attention with dopaminergic drugs and military-aimed at creating "enhanced war fighters"(24). Today athletes using steroid are disqualified from international competition. In future, would the students using "memory enhancers" be disqualified from the examination, on the grounds of unfair competition?

Neuroscience in Ethics

In the end let me briefly present the less understood but an area of profound implications for neuroscientists to explore i.e. the role brain plays in human behavior, implies that it may be responsible for our ethical behavior. As mentioned earlier this view finds support in the 150 years old example of one Phineas Gage who following an injury to the frontal lobe lived with his physical capacity intact and his cognitive facilities unimpaired but incapable of making moral choices (8). This line of thinking can also be gleamed from the work of Antonio Damasio in his book Descarte's Error: Emotion, Reason and Human Brain he described one of his patients-Elliot- (and other similar ones) with similar problems in respect to "understanding moral situation to making a moral choice". He proclaimed that, "unsurprisingly, I believe that what we call ethics today depends on the working of brain systems" (10). Damasio goes on to clarify, "Although certain systems in the brain are clearly related to moral behavior, they are not set by genes to operate for the purposes of morality and ethics. These systems are indeed dedicated making or to creativity". However, let it be categorically stated that there are no moral "centers" of the brain. Anderson et al have described the long-term consequences of early prefrontal cortex lesion (25). The patients manifested defective social and moral reasoning in adult life.

There is voluminous literature on "behavioral brain" which is directly or indirectly implicated in ethical behavior. Plaff discussed some of the ethical aspects of such studies in his book, "Ethical Questions in Brain and Behavior: Problems and Opportunities"

(26). Without going into the details, the recent imaging techniques have shown "lighting up" of insula when people crave for drugs, feel pain, anticipate pain, empathise with others, listen to jokes, see disgust on some one's face, are shunned in a social settings, see someone cheat and decide to punish them. The neural underpinnings of responsible behavior, moral reasoning, consciousness, and spiritual experience have all been the subject of neuroscience research. Behavioral traits have not only be studied by psychiatrists, psychologists, cognitive scientists and specialists in neuroimaging, but more recently increasingly by genetists (27). These researchers have also apparent implications for such metaphysical concepts as morality (24). Illes and Raffin pointed out that fMRI studies that probe into our deepest thoughts, define or engagement in complex cognitive behaviors across the life span and provide measures of our ability to make judgments that invoke phenomenon like rational decision making and consciousness(2). These reflect the neural basis of cognitive profiling. The well known neurological syndrome-Kluver-Bucy-due to bilateral amygdaloid lesions, results in abnormal sexual behavior, which could be considered unethical. Lesion of the hypothalamus results in 'rage'-obviously an antisocial and hence unethical behavior. Patients with Asperger's syndrome do not recognize others as having feelings and minds. This raises the question if they have neuroconscience. These are just a few examples which prompt us to presume that certain regions of the brain, or as Damasio says systems in the brain, are intricately linked to ethical behavior. Emotions, decision making, responsible behavior all involved in ethical practice have been neuroscientifically explored. We believe that emotions play an important role in moral cognition (28). The questions like how values are represented and what system in the brain promotes morality are yet to be answered. Damasio proclaimed, "Unsurprisingly I believe that what we call ethics today depends on the working of certain systems of the brain(10). But the very fact that these are being explored and some may even be modifiable genetically, or technologically if not today, but in near future. This may some day result in a better understanding of the biological basis of moral cognition (3).

Futuristic Issues

Issues related to brain-machine interaction, neural basis of spirituality, beliefs and religion-its impact on society (we are still debating the relative significance of evolution and intelligent design) (29). Imaging studies suggested that our brain responds selectively to race. Do these changes reflect social or merely perceptual judgments? Will the biologizing of the moral undermine its status as moral? How will a better understanding of the biological basis of moral cognition and behavior modify our philosophical ethical frame work? (3,30) can brain scans of a racist, liar or psychopath accurately tell whether that person will persecute fib or kill? While most neuroscientists answer these in the negative there is an increasing concern that some images may be used to make dangerous legal or social judgment about people's behavior (30).

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Addendum to Paper on Neuroethics

The author will be obliged if the members of Indian Academy of Neurosciences could spare a few minutes of their busy time to answer the following question and E-mail the same to tandon@nbrc.ac.in

1. Are you interested in this subject?
2. Is there a specific aspect of it which interests you?
3. Is there a specific issue about which you would like to know more?