



Henry Greely is the Deane F. and Kate Edelman Johnson Professor of Law at Stanford University, Stanford, CA. He has long worked on legal and ethical issues in the biosciences. E-mail: hgreely@stanford.edu

On Neuroethics

HUMAN SOCIETY IS THE SOCIETY OF HUMAN BRAINS. OF COURSE THOSE BRAINS ARE encased in, affected by, and dependent on the rest of the body, but our most important interactions are with other people's brains, as manifested through their bodies. On 3 November 2007, the Society for Neuroscience begins its 37th annual meeting. Since 1970, the event has grown into one of the world's largest scientific meetings, drawing more than 30,000 scientists to discuss brains. This surge in attendance comes from an explosion in knowledge: We know almost infinitely more than we did 37 years ago, even though we still understand little.

Our new knowledge has begun to spill out from the laboratory into society as neuroscience raises new ethical, legal, and social concerns. Some, using journalist William Safire's term, talk of "neuroethics." Others reject that term or question whether it really is a new area. But that is less important than the real questions being raised. Some of those questions entail the ethics of conducting neuroscience research. The brains of "normal" people in some imaging studies yield clinically significant findings disconcertingly often: 8 to 10% of the time in some studies. What kind of information and follow-up do we owe those people? Other studies may have military implications: Suppose brain stimulation created an indefinitely awake and alert soldier or pilot? Will neuroscience be a new source of dual-use technologies such as those we worry about for biological or chemical warfare? Other researchers are studying "the neuroscience of ethics," as philosophers and neuroscientists explore how brains make decisions when confronted with moral dilemmas. The implications are unclear, but the work is fascinating.

For me, the most exciting questions involve how neuroscience might change society. If we could reliably predict that certain adolescents will eventually be diagnosed with schizophrenia, what use should we make of that information? If learning how brains make decisions could reliably indicate malign intent, should we use that information in criminal decision-making? What if we produce a pill that enables people in early stages of dementia to make, retain, and retrieve declarative memories? Should it be used by healthy people, such as premedical students?

Alas, some of this is not speculation. Already, at least one company is selling functional magnetic resonance imaging services for lie detection. Some foreign hospitals are performing psychosurgery for drug addiction. And judges and juries are being asked to make decisions based on beautiful "pictures" of people's brains. People working in neuroethics need both to point out when unproven new technologies are being used recklessly and to explore the social consequences of effective new technologies. In both cases, we need to maximize the benefits of the applications of neuroscience and minimize their harms.

Some good things are happening along this line. The Neuroethics Society was founded last year to promote the study of these issues. The Dana Foundation has been supporting these efforts for several years, often with the American Association for the Advancement of Science; and in October 2007, the MacArthur Foundation announced a major project on Neuroscience and Law to fund research in these intersecting disciplines. Through these efforts and independently, professors of law, education, business, and philosophy are coming together with neuroscientists, psychologists, neurosurgeons, and psychiatrists to discuss the implications for society of this expanding science of the brain.

But more needs to be done. The U.S. Human Genome Project had a program for studying the ethical, legal, and social implications (ELSI) of genetics, but no similar program exists for neuroscience, although we are our brains far more truly than we are our genomes. The ELSI program may not be the right model, but funds are essential to promote this kind of research, particularly by medical school researchers who depend on grants. In these days of tight federal budgets, money is hard to get. But to fund science without supporting work on its social consequences will ensure that the neuroscience revolution brings far too much social pain and chaos along with its scientific and medical breakthroughs.

– Henry Greely

10.1126/science.1150557

