

## Emerging ethical dilemmas in science and technology

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As a new year approaches, the University of Notre Dame's John J. Reilly Center for Science, Technology and Values has announced its inaugural list of emerging ethical dilemmas and policy issues in science and technology for 2013.

The Reilly Center explores conceptual, ethical and policy issues where science and technology intersect with society from different disciplinary perspectives. Its goal is to promote the advancement of science and technology for the common good.

The center generated its inaugural list with the help of Reilly fellows, other Notre Dame experts and friends of the center.

The center aimed to present a list of items for scientists and laypeople alike to consider in the coming months and years as new technologies develop. It will feature one of these issues on its website each month in 2013, giving readers more information, questions to ask and resources to consult.

The ethical dilemmas and policy issues are:

### **Personalized genetic tests/personalized medicine**

Within the last 10 years, the creation of fast, low-cost genetic sequencing has given the public direct access to genome sequencing and analysis, with little or no guidance from physicians or genetic counselors on how to process the information. What are the potential privacy issues, and how do we protect this very personal and private information? Are we headed toward a new era of therapeutic intervention to increase quality of life, or a new era of eugenics?

### **Hacking into medical devices**

Implanted medical devices, such as pacemakers, are susceptible to hackers. Barnaby Jack, of security vendor IOActive, recently demonstrated the vulnerability of a pacemaker by breaching the security of the wireless device from his laptop and reprogramming it to deliver an 830-volt shock. How do we make sure these devices are secure?

### **Driverless Zipcars**

In three states -- Nevada, Florida, and California -- it is now legal for Google to operate its driverless cars. Google's goal is to create a fully automated vehicle that is safer and more effective than a human-operated vehicle, and the company plans to marry this idea with the concept of the Zipcar. The ethics of automation and equality of access for people of different income levels are just a taste of the difficult ethical, legal and policy questions that will need to be addressed.

### **3-D printing**

Scientists are attempting to use 3-D printing to create everything from architectural models to human organs, but we could be looking at a future in which we can print personalized pharmaceuticals or home-printed guns and explosives. For now, 3-D printing is largely the realm of artists and designers, but we can easily envision a future in which 3-D printers are affordable and patterns abound for products both benign and malicious, and that cut out the manufacturing sector completely.

### **Adaptation to climate change**

The differential susceptibility of people around the world to climate change warrants an ethical discussion. We need to identify effective and safe ways to help people deal with the effects of climate change, as well as learn to manage and manipulate wild species and nature in order to preserve biodiversity. Some of these adaptation strategies might be highly technical (e.g. building sea walls to stem off sea level rise), but others are social and cultural (e.g., changing agricultural practices).

## Low-quality and counterfeit pharmaceuticals

Until recently, detecting low-quality and counterfeit pharmaceuticals required access to complex testing equipment, often unavailable in developing countries where these problems abound. The enormous amount of trade in pharmaceutical intermediaries and active ingredients raise a number of issues, from the technical (improvement in manufacturing practices and analytical capabilities) to the ethical and legal (for example, India ruled in favor of manufacturing life-saving drugs, even if it violates U.S. patent law).

## Autonomous systems

Machines (both for peaceful purposes and for war fighting) are increasingly evolving from human-controlled, to automated, to autonomous, with the ability to act on their own without human input. As these systems operate without human control and are designed to function and make decisions on their own, the ethical, legal, social and policy implications have grown exponentially. Who is responsible for the actions undertaken by autonomous systems? If robotic technology can potentially reduce the number of human fatalities, is it the responsibility of scientists to design these systems?

## Human-animal hybrids (chimeras)

So far scientists have kept human-animal hybrids on the cellular level. According to some, even more modest experiments involving animal embryos and human stem cells violate human dignity and blur the line between species. Is interspecies research the next frontier in understanding humanity and curing disease, or a slippery slope, rife with ethical dilemmas, toward creating new species?

## Ensuring access to wireless and spectrum

Mobile wireless connectivity is having a profound effect on society in both developed and developing countries. These technologies are completely transforming how we communicate, conduct business, learn, form relationships, navigate and entertain ourselves. At the same time, government agencies increasingly rely on the radio spectrum for their critical missions. This confluence of wireless technology developments and societal needs presents numerous challenges and opportunities for making the most effective use of the radio spectrum. We now need to have a policy conversation about how to make the most effective use of the precious radio spectrum, and to close the digital access divide for underserved (rural, low-income, developing areas) populations.

## Data collection and privacy

How often do we consider the massive amounts of data we give to commercial entities when we use social media, store discount cards or order goods via the Internet? Now that microprocessors and permanent memory are inexpensive technology, we need think about the kinds of information that should be collected and retained. Should we create a diabetic insulin implant that could notify your doctor or insurance company when you make poor diet choices, and should that decision make you ineligible for certain types of medical treatment? Should cars be equipped to monitor speed and other measures of good driving, and should this data be subpoenaed by authorities following a crash? These issues require appropriate policy discussions in order to bridge the gap between data collection and meaningful outcomes.

## Human enhancements

Pharmaceutical, surgical, mechanical and neurological enhancements are already available for therapeutic purposes. But these same enhancements can be used to magnify human biological function beyond the societal norm. Where do we draw the line between therapy and enhancement? How do we justify enhancing human bodies when so many individuals still lack access to basic therapeutic medicine?

## Story Source:

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