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Report 13

the Center for Ethics in Science & Technology

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Director's Message

As we approach the end of another year I want to begin this message with an acknowledgement of the most important component of our programs: The audience. Our events owe their vitality to your questions, your insights, and your continued interest. Your contributions remain vital to our mission, which emphasizes a true conversation between the scientific community and the public. Thank you for joining us each month at the Fleet Science Center.

This is a also a good time to highlight some important leadership changes. With Stuart Henry's departure as Co-Director this past Summer, I now find myself as the sole Director for the Ethics Center. While I wish I were up to that task alone, the reality is that programming and development for the Center require far more time, creativity, and energy than I have alone. To help meet that goal, we have re-defined the Executive Committee to now include Kate Callen and David Higgins.

Kate has a distinguished career in journalism, including a role for several years as speechwriter for the president of the University of California. However she has also been a dedicated supporter of the Ethics Center from its earliest origins in 2004.

David, a bioscientist, has been working with the Ethics Center for nearly four years, initially with a focus on our Ethics in Science award program with the Greater San Diego Science and Engineering Fair. In addition to expertise in biotechnology research, David has had significant roles in project management and business development with numerous companies.

To support the Executive Committee, we have created a Strategic Planning Group consisting of highly talented individuals with long-standing, or in some cases new and significant, relationships with the Center: Mary Devereaux, John H. Evans, Chris Frost, Tate Hurvitz, Luisa Kregel, Stanley Maloy, Marilyn Newhoff, Dena Plemmons, and Sandra Sgoutas-Emch. Sandra will serve as a liaison for this group to our Ethics Center Advisory Board. Please join me in welcoming all of these people to their new roles with the Ethics Center.

I will close by noting that the speakers in our programs this year have been particularly exceptional, leading us through conversations on diverse topics including climate change, the study of crime, vaccines, synthetic genomics, and evolutionary computing. If you missed us this time around, please be sure to attend our programs coming up in 2011.

Michael Kalichman

July: *Will we be ready when the petroleum runs out?*

by Ni Sun
Student Intern

> ***"In fact we have used 300 million years of hydrocarbons in the span of 200 years."***

The British Petroleum Deep Water Horizon accident resulted in the largest crude oil spill in US history and will inevitably lead to environmental and economical repercussions for years to come in the Gulf of Mexico. The global reserve of fossil fuels decreases daily; meanwhile, global energy consumption increases. We have all heard these news headlines often enough that they have become cliché. We could pass them off as tabloid journalism but the most current scientific data points to a pressing need for global energy reform.


Stephen Mayfield

Stephen Mayfield, director of the San Diego Center for Algae Biotechnology and the John Doves Isaacs Chair of Natural Philosophy at UC San Diego, gave a talk entitled **"Will We be Ready When Petroleum Runs Out?"** on **July 7th.** Mayfield made it clear that if the world continued to consume non-renewable energy at its current rate, we will run out of all energy reserves by the end of this century. If the global population consumed fossil fuels at the current United States rate we would run out in 40 years. An alternative source of energy that is fiscally viable must be found.

Mayfield told us that petroleum and coal reserves accumulated over 200-300 million years. Which means that "*we have used 300 million years of hydrocarbon in the span of 200 years.*"

During the forum, Mayfield proposed that the advantage of biofuels as an alternative to conventional energy sources are sustainability and productivity. Marine algae, which are used in the production of biofuels, use energy from the sun, which can be considered limitless. Additionally, algae are one of the largest CO2 consumers in the biosphere and would thus help in reducing the global greenhouse gas effect that contributes to global warming.

However, the idea of a complete restructuring of our current energy infrastructure prompted a group discussion on the ethics of this proposal. A transition to full-scale algae production would obviously be a complex process with many problems both anticipated and unforeseen. The question of who would bear the responsibility of funding and facilitating this transition was discussed as the main ethical issue. Despite various opposing views, it was concluded that something should be done to ensure availability of energy for future generations.

August: *Analysis of HIV networks: Can we protect both public health and confidentiality?*

by Kelli Wing
Student Intern

Identifying and tracking the evolution and transmission of the Human Immunodeficiency Virus (HIV) has provided critical data for the understanding and treatment of AIDS. However, there are serious legal and confidentiality issues regarding the tracking of HIV networks.


Susan Little

Dr. Susan Little, Professor of Medicine from UC San Diego, provided background on current HIV networks and transmission tracking at the **August 4th** Exploring Ethics forum on "**Analysis of HIV Networks: Can we protect both public health and confidentiality?"** and raised several questions regarding phylogenetic analysis, public health and legal repercussions.

Phylogenetic analysis calculates the differences within two or more genes estimating their relatedness. Since HIV evolves quickly and can be unique to an individual, phylogenetic analysis creates a comparison between genes and searches for similarities to track transmission. However, unlike human DNA or fingerprints, HIV is not completely or always unique to a single individual. Biologically it does not provide definite "proof" of transmission, and does not rule out the existence of a 3rd party.

Dr. Little noted that tracking HIV transmissions is critical to the understanding and characterization of HIV networks, identifying risk groups, focusing outreach and prevention programs and creating treatment programs. Phylogenetic analysis is also able to identify drug-resistant strains maximizing treatment efforts for newly infected individuals while also identifying people with drug-resistant strains for counseling on the risk of onward transmissions.

The use of HIV transmission and network tracking data raises several ethical issues, including the legal implications for individuals who have transmitted HIV knowingly or unknowingly and public health issues of confidentiality in mapping an HIV network of individuals. Dr. Little stated that the use of such data in public research must have a balance in place between legal protections and individual privacy protections in order for tracking to be effective in prevention opportunities; including HIV testing in risk networks, targeted interventions, and prevention education programs.

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September: *Synthetic Genomics: Who is watching?*

by Kate Callen
Executive Committee

So far, the science of engineering life has constructed synthetic viruses and bacteria from genetic material. What will happen when advanced technologies create plants and animals, even humans? Who will set ground rules, and how?


Robert Friedman

In the **September 1st** Exploring Ethics Forum, **"Synthetic Genomics: Who Is Watching?" Robert M. Friedman** discussed the ethical and social ramifications of manipulating DNA into new life forms. Friedman was reporting from the front lines of synthetic biology. As Deputy Director for California at the J. Craig Venter Institute, he helped lead the institute's recent successful creation of the first cell controlled completely by a synthetic genome.

"I've seen the risks of playing with DNA. But the risks of <u>not</u> playing with DNA are horrendous..."

Emphasizing that "all new technologies raise societal concerns," Friedman reviewed five key concerns about synthetic biology: bioterrorism; safety risks to laboratory workers; environmental impacts; public health; and ethical questions about scientists "Playing God," the headline of a recent cover story in the journal *Neuroscience*.

At present, the threat of synthetic bioterrorism is remote, said Friedman, noting, "You can buy a used DNA sequencer on eBay, but you cannot buy one that is precise enough for the garage bioterrorist." A greater risk, he said, may be mishaps involving "a whole new group of untrained researchers in this field." And "the toughest challenge," he added, "is adequately addressing the environmental questions associated with this new technology when we move outside the laboratories and production facilities."

During an audience discussion of access to research data, Friedman, who advised Congress for 16 years on science policy, said, "Most policymakers come down on the side that the potential for good outweighs the risks of letting information flow freely." He added, "I've seen all the risks of playing with DNA. But the risks of <u>not</u> playing with DNA are horrendous. … What happens if we <u>don't</u> make use of these technologies?"

Toward the close of the forum, Friedman expressed his appreciation for the forum debate. "We don't have a very vibrant discussion of the impacts of technology in the United States," he said. "I can only hope that we see more of this and that we take these issues more seriously."

October: *Will Aerosol Particles Prevent Global Warming?*

by Tiffany Lagare
Student Intern

The **October 6th** Exploring Ethics forum, **"Will Aerosol Particles Prevent Global Warming?,"** explored the possibility of intentionally cooling the planet, not by reducing greenhouse gas emissions, but with various geo-engineering approaches. This forum was the first of a three part series, **"The Ethics of Cooling the Planet through Geo-Engineering,"** with the first program focusing on the use of aerosols as one such method.

Guest speaker **Lynn Russell**, a professor of atmospheric chemistry at the Scripps Institution of Oceanography, gave background information on climate change and then presented a number of ways in which geo-engineering could be approached. One possibility is to have rooftops and buildings painted white to reflect heat away from the surface of the earth, similar to the function of the polar ice caps. Another idea for engineering global cooling is based on seeding the oceans with algae, which would take the necessary CO2 for photosynthesis from surface water.

Aerosol particles, natural and manmade, are emitted all over the planet. These particles increase the amount of sunlight reflected back into space. For example, volcanic eruptions release ash and sulfate particles in the atmosphere. Following the Mt. Pinatubo eruption, global temperatures were lowered. One proposal involves injecting these particles into the atmosphere and stratosphere as a way of decreasing the amount of heat reaching the planet.

After Russell's presentation, **Darrel Moellendorf**, professor of philosophy and director of the Institute for Ethics and Public Affairs at San Diego State University, moderated the question and answer portion of the forum.

One audience member asked Russell how aerosol particles would be removed after being released into the atmosphere. Russell responded that researchers currently rely on the natural fall out of these particles. It may take a year for particles released in the stratosphere to fall, although low level aerosol particles may take only 3-5 days. One concern is that these aerosols may be harmful to the health of human, animal and plant life. Low level aerosols over a region could reflect sunlight away from the surface of the earth, but in the process may reduce crop growth by hindering photosynthesis. It has been suggested that the aerosol particles should be released over bodies of water, but again, concerns were voiced that the fall out might be harmful to sea life and humans living near water. As one possible solution, Russell noted that particles released over the ocean could potentially be made out of sodium chloride or seawater components.

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November: *Five hard questions about geo-engineering a cooler planet*

by Kate Callen
Executive Committee

If we deliberately cool the planet through geo-engineering mechanisms, are we playing God? And how do we deal with the fact that we have only limited knowledge of the effects of these untested technologies?

These were the first two of **"Five Hard Questions About Geo-Engineering a Cooler Plant,"** the **November 3rd** "Exploring Ethics" forum led by **Darrel Moellendorf** of SDSU, who also moderated the previous month's forum. The event was the second of three Center programs on the ethics of manipulating the earth's atmosphere or oceans to counteract global warming. The concept is drastic and risky, but it may become necessary if efforts to reduce fossil fuel emissions continue to fail.

Addressing his first question about whether humans are "playing God," Moellendorf said that fears of human overreach are "a misplaced worry since we're already engaged in this planetary alteration of the climate." On a second question of how to deal "with the fact that our knowledge is limited," he said, because "we're still a long way from being able to assess the intended and unintended consequences... it would be irresponsible at this point to engage in any form of geo-engineering."

The third question was "How should geo-engineering be governed?" The audience consensus was that the international community should forge agreements on the use of such methods, but the prospects of such agreement are presently dim. On the fourth question, "Who has the right to intentionally alter the earth's climate?", Moellendorf outlined a scenario in which "we might all benefit from some rogue company or some rogue state that simply goes out and starts engaging in geo-engineering."

The fifth question asked "Does investment in geo-engineering create a moral hazard?" Such investment could create a false sense of complacency, said Moellendorf, "by giving the global community an incentive to not take mitigation seriously." The most ethical approach to geo-engineering, he concluded, is to "think about geo-engineering as part of a package of responses to climate change, and as the poor relation to the most important part of the package, which is to be serious about mitigating climate change. That's our first and best response."

December: *Ethical choices for innovators: A conversation with David Fogel*

by Kate Callen
Executive Committee

2010's final "Exploring Ethics" forum was an unprecedented off-the-record discussion of actual ethical dilemmas by a San Diegan who is a global leader in artificial intelligence.

David Fogel

"Ethical Choices for Innovators: A Conversation with David Fogel" was the Center's first event to air a tech executive's account of professional ethical challenges he has faced. Fogel, co-founder and chairman of Natural Selection, Inc. (NSI), is a second-generation pioneer of evolutionary computation, which uses Darwinian algorithms from nature to, as he put it, "solve very large problems very well."

If you were there on **December 1st**, you will long remember Fogel's candor and wit. If you weren't, here are some of the insights he conveyed:

"The more desperate the situation, the more likely human beings are to compromise ethics."

The central dilemma in Fogel's presentation involved NSI's efforts to produce a new "evolving tinnitus masking" software for consumer use. The software seeks to alleviate annoying or even debilitating "ringing in the ears" by cloaking it with such external sounds as surf and rain. The path to marketing the product as a medical device runs through the costly and arduous FDA approval process. The path to marketing it as an audio entertainment device is clear, economical, and legal. The news of its availability would quickly spread to millions of tinnitus sufferers, a group that includes Fogel himself. "Even if we made no claims about tinnitus, people would find it," he said. "If you're in despair, you will hunt the Internet at three in the morning."

Because of ethical concerns, NSI has avoided the legal and profitable "entertainment device" route. A Phase I clinical trial showed promising results – 8 of the 16 subjects experienced relief from symptoms – but funding for a Phase II application was turned down. The company is still pursuing all options for federal approval. And it is had to regretfully decline requests from clinical trial subjects for the device that eased their pain. "It helped them, but it was only designated for the clinical trial, so we can't give it to them," Fogel said. When moral principle collides with genuine suffering, he added, "The more desperate the situation, the more likely human beings are to compromise ethics."

Gloria Penner
Host of KPBS Radio's weekly "Editors Roundtable" and "San Diego Week"
Member, Board of Advisors,
Center for Ethics in Science and Technology, 2008-present

Gloria began her career at KPBS Television as director of community relations. She has had many roles in radio and TV journalism, but Gloria is particularly well known for her role in KPBS' election coverage for more than 30 years. She is a frequent moderator of town hall meetings involving candidates and issues. Her awards are numerous, including, but not limited to: 7 Emmys, 5 Golden Mikes, 2 Gracies from the American Federation of Women in Radio and Television, The San Diego Press Club's Harold Keen Award for excellence in journalism. And in 2003, Gloria was the inaugural winner of the newly created "Gloria Penner Award for Civic Service," given annually by the League of Women Voters of San Diego County. Glo-

INTERVIEW

What do you think is the Center's most important achievement to date?
The Ethics Center has successfully brought the intersection of ethics and science to the public through its compelling public forums and its highly successful radio segments on KPBS Radio's "These Days." This has happened because of a well-organized and dedicated leadership and efficient, although undersized, staff. I believe that the achievements thus far are a step toward the future projects that the Ethics Center can undertake with needed support.

What do you see as the most important challenge to the success of the Ethics Center?
There are three important challenges to the Center's success. First, is to clarify why it exists, its goals, and its importance to the community in order to garner needed support from appropriate individuals, organizations and institutions. The second is to restructure its leadership and various advisory boards to provide a clear organizational approach to augment its current operations. And third would be to strive toward a fulltime, dedicated staff to fund raise, promote, direct, and support the functions of the Ethics Center. These do not necessarily have to happen in the order presented.

How would you describe the public reaction to the Center so far?
For those members of the public that have accessed Ethics Center programs and topics, the reaction has been positive and appreciative. But without actual numbers on hand, I would guess that the numbers reached are too small. In order to be a force in the educational community where generations of teachers and students will be confronted with growing ethical questions in an increasingly science-oriented culture, the Ethics Center reach to those audiences must be accelerated.

Why have an Ethics Center?
It is abundantly and sometimes sadly clear that the over-riding questions about what are ethical practices and ethical behaviors in our society do not get asked. It's equally clear that when they are asked, the answers are not satisfying or applicable in a society where "the bottom line," power and control are the motivators. An Ethics Center can be a starting point for focusing attention on where we are and what is needed to change behaviors and attitudes that do not benefit the public good.

What is unique about having an Ethics Center in San Diego?
San Diego prides itself on being an incubator for businesses, especially for science-based enterprises. It is also the home of three major higher learning centers and multiple other smaller colleges and universities. It is still considered by many to be a younger region - more like a teenager than a mature adult. What better medium for developing a major Ethics Center that can help shape what that teenager will become when it grows up!

the Center for Ethics in Science & Technology

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"We are interested in the challenges faced by our society in determining how best to balance the risks and benefits associated with the development and application of the products of science and technology."

- Dr. Michael Kalichman, Director and Co-Founder

We're on the web:

www.ethicscenter.net

AIS Workshop

In October of this year, the Center for Ethics in Science and Technology co-sponsored the annual meeting here in San Diego for the Association for Integrative Studies.

In conjunction with that meeting, a special workshop was scheduled immediately before the October 6th Exploring Ethics program, the first in a series of 3 programs on the subject of geo-engineering. The purpose of the workshop was to share our experience in creating and maintaining our Ethics Center. The workshop was facilitated by Michael Kalichman, Ethics Center Director. Participants had arrived from throughout the country. The discussion focused first on the history of the Center, and then moved to concrete discussion of how the Center is organized, the kinds of activities and programs that we have presented, and the varying measures of success for our Center. Although it was clear that the creation of our Ethics Center was in part possible because the San Diego region is unusually collaborative and rich with science and technology, an important part of the discussion was to address strategies for creating similar Centers in other regions.

Upcoming Exploring Ethics Forums

Reuben H. Fleet Science Center

Wednesdays, 5:30-7 pm

- January 5th-*Human embryonic stem cells: Do unfertilized human eggs offer another way?*
- February 2nd-*Should patients have a voice in FDA drug approval?*
- March 2nd-*The Ethics of Cooling the Planet through Geo-Engineering, Part III*