

## Background Document

### Synthetic Biology – Global Societal Review Urgent!

Synthetic biology (the attempt to create artificial living organisms) should be self-regulated say scientists at Berkeley assembly. Civil Society organizations say "No!"

"If biologists are indeed on the threshold of synthesizing new life forms, the scope for abuse or inadvertent disaster could be huge." *Nature*, October 2004

Scientists working at the interface of engineering and biology - in the new field of "synthetic biology" - worry that public distrust of biotechnology could impede their research or draw attention to regulatory chasms. Synthetic biologists are trying to design and construct artificial living systems to perform specific tasks, such as producing pharmaceutical compounds or energy. In October 2004, the journal *Nature* warned, "if biologists are indeed on the threshold of synthesizing new life forms, the scope for abuse or inadvertent disaster could be huge." An editorial in that same issue suggested that there may be a need for an "Asilomar"-type conference on synthetic biology. In light of these concerns, scientists gathering at "Synthetic Biology 2.0" (May 20-22, 2006) at the University of California-Berkeley hope to make "significant progress" toward a "code of ethics and standards."<sup>1</sup> Their actions are intended to project the message that the synthetic biologists are being pro-active and capable of governing themselves as a "community." In their view, self-governance is the best way forward to safely reap the benefits (both societal and financial) of synthetic biology. Civil Society organizations disagree.

"There are two ways of dealing with dangerous technologies," says Tom Knight, a leading figure in synthetic biology at the Massachusetts Institute of Technology. "One is to keep the technology secret. The other one is do it faster and better than everyone else. My view is that we have absolutely no choice but to do the latter." – *New Scientist*, 18<sup>th</sup> May 2006

Go here to read about the Synthetic Biology 2.0 conference, and the proposals for self-governance: [http://syntheticbiology.org/SB2.0/Biosecurity\\_resolutions.html](http://syntheticbiology.org/SB2.0/Biosecurity_resolutions.html)

**What is synthetic biology?** The products of synthetic biology could be at least one order of magnitude more potent and invasive than those from conventional biotechnology. Barely six years old, synthetic biology attempts to construct unique and novel organisms - from the bottom up. Unlike today's genetic engineering which "cuts and pastes" existing genes between species, synthetic biology rewrites the code of life to create new DNA modules programmed to self-assemble with other modules to create designer organisms (mostly viruses and bacteria) capable of functions normally associated with mechanical

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<sup>1</sup> Stephen M. Maurer et al., "From Understanding to Action: Community-Based Options for Improving Safety and Security in Synthetic Biology," Goldman School of Public Policy, University of California at Berkeley, available on the Internet: <http://syntheticbiology.org/Documents.html>

production lines. There are already many synthetic biology companies receiving funding from government, military and private interests. At least 39 gene synthesis companies are manufacturing artificial DNA and parts of DNA (oligonucleotides). Most of the US-based work is in the Boston area (where the Massachusetts Institute of Technology is located), around Berkeley, California and at Craig Venter's Institute for Genomic Research in Maryland.

Much of synthetic biology is still 'proof of principle' research that involves gimmicks such as microbes blinking in coordinated rhythm or light-sensitive bacteria that can capture a photographic image. Some of the work, however, comes with breathtaking implications for biodiversity and life. Researchers in California and Florida, for example, have taken standard four-letter DNA (A,C,G,T) and built on a fifth and then a sixth letter— making it theoretically possible to create species of unbelievable complexity.

**Synthetic Biology – Why Worry?** By seizing control of the genetic code to make entirely new organisms and viruses, synthetic biology has the potential to hugely extend and heighten the risks of genetic engineering and make vastly more problematic scenarios possible...

- **Biosafety:** While genetic engineering moves one or two existing genes between species, synthetic biology builds entirely new genomes nature has never seen. Biosafety regimes are woefully inadequate and unprepared for these developments. Synthetic biologists talk of reducing genetics to “standard parts” or “BioBricks” - but life is not electrical engineering or computer code writing. Mistakes could prove lethal and beyond recall.
- **Biowarfare:** Synthetic biology allowed scientists to reconstruct the 1918 Spanish flu virus that killed 50-100 million people. Researchers routinely work with parts of Ebola, dengue, smallpox, West Nile and other pathogens. Predicting the outcome of new combinations of DNA will be impossible but could lead to the creation of entirely new disease organisms which are attractive to aggressors. While many governments make some pathogens illegal to produce or export, pieces of pathogens could be produced, purchased and re-engineered.
- **Geo-engineering:** the US Department of Energy and the governments of at least 25 other countries are actively pursuing weather and climate modification technofixes assuming that the Kyoto Accord will fail and that the only option will be earth engineering. DOE's past initiatives have involved the use of iron nanoparticles to moderate ocean temperatures. Craig Venter now seeks to use synthetic biology to produce new organisms to sequester carbon dioxide and mitigate climate change.
- **Economics:** synthetic biology is a capital-intensive technology likely to have massive downstream impacts on marginalized peoples if it is adopted and promoted. Impacts will come first in agriculture and health but then in geo-engineering climate change. Synthetic microbes programmed to make industrial substances could potentially de-stabilize South economies and employment.
- **Ethics:** there are enormous ethical complexities involved with the creation of new artificial life forms. Should we engineer life in this way when the environmental

- and human safety questions are so enormous?
- Control: like biotech, companies are already patenting critical synthetic biology technologies and processes. Although some in the synthetic biology community may be advocating for open-source biology, others such as Craig Venter have a long biopiracy record profiting from human and non-human gene sequences. Because the science can be privatized and monopolized it becomes more attractive to companies seeking profit rather than addressing social needs.

**Synthetic Biologists promote self-governance:** Because building new life forms from scratch goes far beyond genetic engineering (GE), synthetic biologists fear the global controversy that surrounded GE will arise to hamstring their own work. In reaction, researchers are developing media strategies, holding "town hall" meetings and drafting their own version of the Asilomar declaration.

On 22 May, scientists attending Synthetic Biology 2.0 will vote on a proposed "voluntary" code to prevent biosecurity risks. The code has been developed without societal - or even governmental - input; it doesn't recognize the precautionary principle; and, addresses only biosecurity risks. The scientists acknowledge the dangers of synthetic biology in the hands of "evildoers," but they overlook the possibility, and even likelihood, that members of their own community won't be able to control or predict the behaviour of synthetic biology products.

The proposed interventions to be discussed and voted on at Synthetic Biology 2.0 include:

- Requiring gene synthesis companies to adopt "best practices" (or risk boycott);
- Creating a "black watch" registry of problematic synthetic materials referred to as "agents of concern" and / or a list of suspicious users
- Creating a hotline for biosafety and biosecurity issues to be used by researchers;
- Establishing an ethical obligation within the community to investigate/report dubious behavior or "experiments of concern;"
- Endorsing biosafety- and biosecurity-enhancing technologies ("inherently safe organisms").

Synthetic biologists say there will be tremendous societal benefits to their work such as environmental remediation, new drugs to combat diseases such as malaria and new energy sources. But broad socio-economic, health and environmental risks (beyond bioterrorism) are not on the table. The synthetic biology community has also ignored blatant conflicts of interest - most of the scientific leaders in synthetic biology have established their own synthetic biology start-ups. Synthetic biology must not be governed by those seeking to profit from it.

**Synthetic Biology 2.0 - Asilomar 2.0?** Rather than accepting (as popularly assumed) a moratorium on genetic engineering, the 1975 Asilomar meeting laid out the ground rules by which scientific research could proceed. Ultimately, Asilomar created a public image of scientific responsibility and ethical behavior that delayed the development of

appropriate government regulation and explicitly avoided any discussion of wider social and economic impacts. Asilomar proved to be the wrong approach then, and it is an unacceptable model to address synthetic biology now.

### **Open Letter from Civil Society**

In response to the proposed voluntary code that is being discussed at Synthetic Biology 2.0, Thirty-five civil society organizations have issued a joint letter calling on the synthetic biologists to withdraw from this self-governance approach. The letter emphasizes that:

- Society - especially social movements and marginalized peoples - must be fully engaged in designing and directing societal dialogue on every aspect of synthetic biology research and products. Because of the extraordinary power and scope of synthetic biology technologies, this discussion must take place globally, nationally and locally
- Scientific self-governance doesn't work and is anti-democratic. It is not for scientists to have the determinant voice in regulating their research or their products
- The development of synthetic biology technologies must be evaluated for their broader socio-economic, cultural, health and environmental implications not simply for their misuse in the hands of 'evildoers.'

The organizations that have signed the open letter work in over sixty countries and include scientists, engineers, environmentalists, farmers, social justice advocates, trade unionists and biowarfare experts:

### **List of Organizations Signing the Open Letter**

Acción Ecológica (Ecuador) - [www.accionecologica.org](http://www.accionecologica.org)  
California for GE Free Agriculture - [www.calgefree.org](http://www.calgefree.org)  
Centro Ecológico (Brazil)  
Clean Production Action - [www.cleanproduction.org](http://www.cleanproduction.org)  
Cornerhouse UK - [www.thecornerhouse.org.uk](http://www.thecornerhouse.org.uk)  
Corporate Europe Observatory - [www.corporateeurope.org](http://www.corporateeurope.org)  
Corporate Watch (UK) - [www.corporatewatch.org](http://www.corporatewatch.org)  
EcoNexus - [www.econexus.info](http://www.econexus.info)  
Ecoropa  
Edmonds Institute - [www.edmonds-institute.org](http://www.edmonds-institute.org)  
ETC Group - [www.etcgroup.org](http://www.etcgroup.org)  
Farmers Link - [www.farmerslink.org.uk](http://www.farmerslink.org.uk)  
Friends of the Earth International - [www.foe.org](http://www.foe.org)  
Foundation on Future Farming (Germany) - [www.zs-l.de](http://www.zs-l.de)  
Foundation Science Citoyennes (France) - [www.sciencescitoyennes.org](http://www.sciencescitoyennes.org)  
Gaia Foundation - [www.gaiafoundation.org](http://www.gaiafoundation.org)  
GeneEthics Network (Australia) - [www.geneethics.org](http://www.geneethics.org)  
Genewatch (UK) - [www.genewatch.org](http://www.genewatch.org)

GRAIN - [www.grain.org](http://www.grain.org)  
Greenpeace International - [www.greenpeace.org](http://www.greenpeace.org)  
Henry Doubleday Research Association (UK) - [www.gardenorganic.org.uk](http://www.gardenorganic.org.uk)  
Indigenous People's Biodiversity Network  
International Center for Technology Assessment - [www.icta.org](http://www.icta.org)  
International Network of Engineers and Scientists - [www.inesglobal.com](http://www.inesglobal.com)  
Institute for Social Ecology - [www.social-ecology.org](http://www.social-ecology.org)  
Institute for Bioethics, Culture and Disability - [www.bioethicsanddisability.org](http://www.bioethicsanddisability.org)  
International Union of Food and Agricultural Workers - [www.iuf.org](http://www.iuf.org)  
Lok Sanjh Foundation (Pakistan) - [www.loksanjh.org](http://www.loksanjh.org)  
National Farmers Union (Canada) - [www.nfu.ca](http://www.nfu.ca)  
Oakland Institute - [www.oaklandinstitute.org](http://www.oaklandinstitute.org)  
Polaris Institute - [www.polarisinstitute.org](http://www.polarisinstitute.org)  
Pakistan Dehqan Assembly  
Practical Action - [www.practicalaction.org](http://www.practicalaction.org)  
Quechua Ayamara Association for Sustainable Livelihoods (Peru) - [www.andes.org.pe](http://www.andes.org.pe)  
Research Foundation for Science, Technology and Ecology (India) - [www.navdanya.org](http://www.navdanya.org)  
Social Equity in Environmental Decisions – SEEDS (UK)  
Soil Association - [www.soilassociation.org](http://www.soilassociation.org)  
Sunshine Project - [www.sunshine-project.org](http://www.sunshine-project.org)  
Third World Network - [www.twinside.org.sg](http://www.twinside.org.sg)