

Week 1: Introduce Yourself

Week 2: Fill out a synthetic biology survey such as ours: and discuss

Week 3: Scope and definition of Synthetic Biology

1. Synthetic biology community webpage, <http://syntheticbiology.org/> and here http://openwetware.org/wiki/Synthetic_Society/Distinguishing_and_defining_Synthetic_Biology
2. "The Ilulissat Statement Synthesizing the Future a vision for the convergence of synthetic biology and nanotechnology" Robert Austin, Philip Ball, Angela Belcher, David Bensimon, Steven Chu, Cees Dekker, Freeman Dyson, Drew Endy, Scott Fraser, John Glass, Robert Hazen, Joe Howard, Jay Keasling, Hiroaki Kitano, Paul McEuen, Petra Schwille, Ehud Shapiro, and Julie Theriot, The Ilulissat Statement Synthesizing the Future a vision for the convergence of synthetic biology and nanotechnology *Kavli Futures Symposium 'The merging of bio and nano: towards cyborg cells'*, http://www.kavlifoundation.org/news/pr_062507.html, 2007, http://www.kavlifoundation.org/assets/docs/ilulissat_statement.pdf, http://www.eurekalert.org/pub_releases/2007-06/cuns-scf062507.php, Kavli Foundation Webpage
3. Synthetic Biology 2nd, 3rd June 2008, scientific discussion meeting summary, web royalsociety.org <http://royalsociety.org/displaypagedoc.asp?id=31191>
4. Rawls, R. 'Synthetic Biology' Makes Its Debut (2000) chemical and engineering news 78, 17 49-53, <http://www.stanford.edu/group/kool/>,
5. ETC Group. Extreme Genetic Engineering: An Introduction to Synthetic Biology, 2007, <http://www.etcgroup.org/upload/publication/602/01/synbioreportweb.pdf>
6. YouTube - iGEM - Drew Endy Defining Synthetic Biology www.youtube.com/watch?v=XIuh7KDRzLk
7. van Est R, de Vriend H, Walhout B 2007. The world of synthetic biology. Rathenau Institute, The Hague Netherlands http://www.synbiosafe.eu/uploads///pdf/BAP_Synthetic_biology_nov2007%5B1%5D.pdf

Week 4: Envisioned high income countries synbio applications:

A list will be produced in the first two days. Day three a poll will be taken as to what issues the students see with each product/application and the poll will be discussed the rest of the week

1. Read Program of the Synthetic Biology conferences 1.0-4.0
Synthetic Biology 1.0 http://syntheticbiology.org/Synthetic_Biology_1.0.html;
Synthetic Biology 2.0 <http://pbd.lbl.gov/sbconf/>;
Synthetic Biology 3.0

- <http://www.syntheticbiology3.ethz.ch/>; Synthetic Biology 4.0 <http://sb4.biobricks.org/>
2. Read through the different iGEM competition projects. iGEM 2004 <http://partsregistry.org/cgi/htdocs/SBC04/index.cgi> ; iGEM 2005 http://parts.mit.edu/wiki/index.php/Igem_2005 ; iGEM 2006 <http://www.igem2006.com/jamboree.htm> ; iGEM 2007 http://parts.mit.edu/igem07/index.php/Main_Page ; iGEM 2008 http://2008.igem.org/Main_Page
 3. European Commission Framework Programme 6. SYN BIOLOGY. An Analysis of Synthetic Biology Research in Europe and North America., 2005, http://www2.spi.pt/synbiology/documents/SYNBIOLOGY_Literature_And_Statistical_Review.pdf
 4. European Commission 6th Framework Programme, NEST-New and Emerging Science and Technology. Synbiology: An Analysis of Synthetic Biology Research in Europe and North America, 2006, <http://www2.spi.pt/synbiology/documents/news/D8%20-%20Synthetic%20Biology%20Research%20Assessment.pdf> ,
 5. Synbiology: An Analysis of Synthetic Biology Research in Europe and North America project. SYN BIOLOGY An Analysis of Synthetic Biology Research in Europe and North America Final Report on Analysis of Synthetic Biology Sector, 2006, <http://www2.spi.pt/synbiology/documents/news/D11%20-%20Final%20Report.pdf>,
 6. Synthetic Biology 2nd, 3rd June 2008, scientific discussion meeting summary, web royalsociety.org <http://royalsociety.org/displaypagedoc.asp?id=31191>
 7. Synthetic biology community, Synthetic Biology Applications, <http://syntheticbiology.org/Applications.html>, 2007, http://openwetware.org/wiki/Keasling:_Synthetic_Biology_Class._Synthetic_biology_community
 8. ETC Group. Extreme Genetic Engineering: An Introduction to Synthetic Biology, 2007, <http://www.etcgroup.org/upload/publication/602/01/synbioreportweb.pdf>
 9. European Commission 6th Framework Programme, NEST-New and Emerging Science and Technology Synbiology, Keyword Database of the synthetic biology literature , <http://www.synthetic-biology.info/>, 2007, <http://www2.spi.pt/synbiology/..Synbiology>

Additional optional reading:

10. Institute for the Future, The Future of Science and Technology, 2005-2055; Promising Applications of Synthetic Biology, <http://humanitieslab.stanford.edu/2/282>, 2007, <http://humanitieslab.stanford.edu/deltascan/Home..Institute> for the Future,
11. Synbiology, Synthetic biology info, <http://www.synthetic-biology.info/links.html>, 2007., Synbiology webpage (Europe)
12. Jay Keasling, (2006) in *Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2005 Symposium* (National Academy of

Engineering, Ed.) pp 83-89, National Academy of Engineering.
<http://www.nap.edu/catalog/11577.html>

13. Paras Chopra, a. A. K. Engineering Life through Synthetic Biology (2006) *In Silico Biology* 6, 401-410 http://www.paraschopra.com/publications/synbio/synbio_review.pdf.
14. Directorate-General for Research Directorate S - Implementation of the 'Ideas' Programme., SYNTHETIC BIOLOGY A NEST PATHFINDER INITIATIVE, 2007, RTD Info <ftp://ftp.cordis.europa.eu/pub/nect/docs/5-nect-synthetic-080507.pdf>.
15. The Economist., Synthetic biology Life 2.0, 2006, The Economist, http://www.economist.com/science/displaystory.cfm?story_id=7854314.
16. Neil Savage, Building Better Biofuels Startup LS9 is developing microbes that produce hydrocarbons, <http://www.technologyreview.com/Biztech/18827/>, 2007, http://synthesis.typepad.com/synthesis/2007/06/the_need_for_fu.html.
<http://www.technologyreview.com/Biztech/18827/>, 2007,
http://synthesis.typepad.com/synthesis/2007/06/the_need_for_fu.html.
<http://www.technologyreview.com/Biztech/18827/>, 2007,
http://synthesis.typepad.com/synthesis/2007/06/the_need_for_fu.html.
<http://www.technologyreview.com/Biztech/18827/>, 2007,
http://synthesis.typepad.com/synthesis/2007/06/the_need_for_fu.html.
<http://www.technologyreview.com/Biztech/18827/>, 2007,
http://synthesis.typepad.com/synthesis/2007/06/the_need_for_fu.html.
<http://www.technologyreview.com/Biztech/18827/>, 2007,
http://synthesis.typepad.com/synthesis/2007/06/the_need_for_fu.html.
17. Parliamentary Office of Science and Technology Postnote January 2008, Number 298 Synthetic Biology, <http://www.parliament.uk/documents/upload/postpn298.pdf>
18. Synthetic biology inches toward the mainstream Author: Cherise Fong Publication: CNN Date: Friday, October 17, 2008 <http://www.agbios.com/main.php?action=ShowNewsItem&id=10122>
19. Synthetic biology: Coming soon to a gas tank near you? <http://gristmill.grist.org/story/2008/10/10/134457/82>
20. Commodifying Nature's Last Straw? Extreme Genetic Engineering and the Post-Petroleum Sugar Economy (ETC Group) http://www.etcgroup.org/upload/publication/pdf_file2/703

Week 5: Implication of Envisioned low income countries synbio applications .

A list will be produced in the first two days. Day three a poll will be taken as to what issues the students see with each product/application and the poll will be discussed the rest of the week

Week 6: Implication of Envisioned Health and human body related synbio applications

A list will be produced in the first two days. Day three a poll will be taken as to what issues the students see with each product/application and the poll will be discussed the rest of the week

Week 7: Business of synbio

1. Bhutkar, A. Synthetic Biology: Navigating the Challenges Ahead (2005) THE JOURNAL OF BIOLAW & BUSINESS 8, 2 19-29 www.openwetware.org/images
2. Rai A, Boyle J (2007) Synthetic Biology: Caught between Property Rights, the Public Domain, and the Commons. PLoS Biol 5(3): e58
doi:10.1371/journal.pbio.0050058
http://biology.plosjournals.org/perlserv/?request=get-document&doi=10.1371/journal.pbio.0050058&ct=1/0/02/Aj_bhutkar_synth_bio_jbb_2005.pdf
3. Special Feature: Opportunities in Synthetic Biology, By Elisabeth Pain October 17, 2008
http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2008_10_17/caredit.a0800151
4. Industry Association Synthetic Biology <http://www.ia-sb.eu/>
5. On the Economics of Synthetic Biology: Is Openness Feasible?" Joachim Henkel, Steve Maurer, Technische Universität München, UC Berkeley
<http://www.syntheticbiology3.ethz.ch/proceedings/Henkel%20Maurer%20-%20On%20the%20economics%20of%20SB%20SB3.0%202007-06.pdf>
6. The Perils of the Coming Sugar Economy Hope Shand ETC-Group
<http://www.fpif.org/fpif.txt/5583>

Week 8: Biosafety and Biosecurity synbio issues

1. Tara O'Toole, Hearing on "Project BioShield Reauthorization Issues",
http://www.upmc-biosecurity.org/website/resources/hearings/content/Hearings_2006/20060406bioshldreauth.html, 2007, http://www.upmc-biosecurity.org/website/resources/hearings/content/Hearings_2006/20060406bioshldreauth.pdf, Center for Biosecurity
2. Report on the workshop Technical solutions for biosecurity in synthetic biology held on April 03rd, 2008 in Munich Dr. Hubert Bernauer, Jason Christopher, Dr. Werner Deininger, Markus Fischer, Philip Habermeier, Dr. Klaus Heumann, Prof. Stephen Maurer, Dr. Heinz Schwer, Peer Stähler, Tobias Wagner
http://www.synbiosafe.eu/uploads///pdf/iasb_report_biosecurity_syntheticbiology.pdf
3. Links to weapon conventions go here
<http://www.bioethicsanddisability.org/bioweapon.html>
4. The Sunshine Project News Release 30 October 2006 Bedfellows at the Biosecurity Board <http://www.sunshine-project.org/publications/pr/pr301006.html>
5. ADDRESSING BIOSECURITY CONCERNS RELATED TO THE SYNTHESIS OF SELECT AGENTS NSABB

<http://www.biosecurityboard.gov/pdf/Final%20NSABB%20Report%20on%20Synthetic%20Genomics.pdf>

6. Diffusion of synthetic biology: a challenge to biosafety Markus Schmidt,
<http://www.springerlink.com/content/838234qr720218w8/fulltext.pdf>
7. *From Understanding to Action: Community-Based Options for Improving Safety and Security in Synthetic Biology* Stephen M. Maurer, Keith V. Lucas & Starr Terrell
http://syntheticbiology.org/SB2.0/Biosecurity_resolutions.html
8. Synthetic Biology & Biosecurity Awareness In Europe Dr. Alexander Kelle
http://www.synbiosafe.eu/uploads/pdf/Synbiosafe-Biosecurity_awareness_in_Europe_Kelle.pdf
9. A Tale of Two Studies Ethics, Bioterrorism, and the Censorship of Science by MICHAEL J . SELGELID
<http://www.synbiosafe.eu/uploads///pdf/Tale%20Two%20Studies%20Final%20Printed.pdf>

Week 9: Synbio risk assessment discourse

1. Synthetic Biology Risks and opportunities of an emerging field, International Risk Governance Council
http://www.irgc.org/IMG/pdf/IRGC_ConceptNote_SyntheticBiology_Final_30April.pdf ; <http://www.irgc.org/Synthetic-biology-genomics.html>
2. Risk Assessment of Synthetic Genomics: A Biosafety and Biosecurity Perspective Diane O. Fleming
<http://dspace.mit.edu/bitstream/handle/1721.1/39654/Fleming%20Biosafety%20Biosecurity.pdf?sequence=1>
- 3.

Week 10: Ethical and social implication of synthetic biology

1. Huib de Vriend and Rinie van Est. Constructing Life Early social reflections on the emerging field of synthetic biology, 2006, 10: 90-77364-11-0, <http://www.rathenau.nl/showpage.asp?item=2106>, <http://www.rathenau.nl/misc/showfile.asp?F=MDBERTAwRTcwMEVCMDBFNjAwRDkwMEI5MDBEQjAxMTcwMERGMDBGRDAwRjUwMEY2MDBGQjAwRTgwMEVFMDBFMDAwRTYwMEQ2MDA3NzAwQzAwMTAyMDExMTAwRkYwMDc1MDBCODAwRDUwMEQ5MDBERjAwQzEwMTBEMDBEODAxMTIwMEM2> ,
2. Oliver Morton, Life Reinvented,
<http://www.wired.com/wired/archive/13.01/mit.html> , 2005., Wired Magazine
3. Synthetic Biology Social and Ethical Challenges, Andrew Balmer & Paul Martin Institute for Science and Society University of Nottingham
http://www.bbsrc.ac.uk/organisation/policies/reviews/scientific_areas/0806_synthetic_biology.pdf

4. Summerschool: The Ethics of Synthetic Biology
http://www.ethicsandtechnology.eu/index.php/news/comments/summerschool_the_ethics_of_synthetic_biology/;
http://www.ethicsandtechnology.eu/images/uploads/Ethics_of_synthetic_biology.pdf
5. ETHICS: Do We Need "Synthetic Bioethics"? Erik Parens,* Josephine Johnston, Jacob Moses1 Science 12 September 2008: Vol. 321. no. 5895, p. 1449
6. THE ULTIMATE RIGHT TO LIFE DEBATE: SYNTHETIC BIOLOGISTS KNOW THE MEANING OF LIFE, BUT DO THEY KNOW THE MEANING OF SYNTHETIC BIOLOGY? <http://lifeboat.com/ex/synthetic.biology>
7. Science Daily, First Bacterial Genome Transplantation Changes One Species To Another,
<http://www.sciencedaily.com/releases/2007/06/070628232413.htm>, 2007., Science Daily webpage
8. LF A-Prize, <https://lifeboat.com/ex/a-prize>, 2007., Lifeboatfoundation webpage
9. Synthetic Society Synthetic Society Working Group (SSWG)
http://openwetware.org/wiki/Synthetic_Society
10. Cho, M. K., Magnus, D., Caplan, A. L., and McGee, D. (1999) *Science* 286, 2087, 2089-2087, 2090.
11. The Societal Aspects of Synthetic Biology: A Priority Paper First draft Markus Schmidt, Helge Torgersen, Agomoni Ganguli-Mitra, Alexander Kelle, Anna Deplazes, Nikola Biller-Andorno
http://www.synbiosafe.eu/uploads///pdf/priority_paper_SB4.pdf

Week 11: International and Canadian laws and regulations impacted by envisioned synbio applications

1. Convention for Biological Diversity (CBD) Convention on Biological Diversity, Convention on Biological Diversity (CBD), <http://www.cbd.int/default.shtml>
2. Universal Declaration on Bioethics and Human Rights 19 October 2005 http://portal.unesco.org/en/ev.php-URL_ID=31058&URL_DO=DO_TOPIC&URL_SECTION=201.html
3. Some example Canadian Statutes
- 4.

Week 12: Synbio governance

1. *BioBricks or BioConflicts? Building Public Trust in European Governance of Synthetic Biology*
http://www.allacademic.com/meta/p_mla_apa_research_citation/2/0/8/8/9/pages208890/p208890-1.php **Fletcher, Amy. and Allen, Christopher. "BioBricks or BioConflicts? Building Public Trust in European Governance of Synthetic Biology" Paper presented at the annual meeting of the American Political Science Association, Hyatt Regency Chicago and the Sheraton Chicago Hotel and Towers, Chicago, IL, Aug 30, 2007 <Not Available>. 2008-10-08**
http://www.allacademic.com/meta/p208890_index.html
2. Synthetic Genomics | Options for Governance
<http://www.jevi.org/cms/fileadmin/site/research/projects/synthetic-genomics-report/synthetic-genomics-report.pdf>
3. Michele S. Garfinkel, Drew Endy, Gerald L. Epstein, and Robert M. Friedman
 Synthetic genomics: Options for governance *Industrial Biotechnology*. December

2007, 3(4): 333-365. See also

http://www.thehastingscenter.org/uploadedFiles/Publications/Briefing_Book/synthetic%20biology%20chapter.pdf

4. Syns of Omission: Civil Society Organizations Respond to Report on Synthetic Biology Governance from the J. Craig Venter Institute and Alfred P. Sloan Foundation http://www.etcgroup.org/upload/publication/pdf_file/654
- 5.

Week 13: Feedback from Students