Engineering Safe, Secure & Solely Beneficial Biology

Synthetic Biology …

Abstraction

Standardization

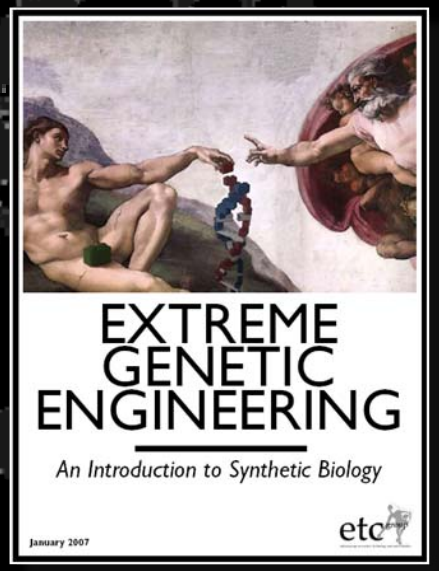
Characterization

… makes applying biology easier

Amb. Georgi Avramchev
Chair of 2008 Meetings
of the BWC

We are looking at a future in which biology can be engineered. Our increasingly finessed control over biology offers unparalleled social, health, economic and environmental opportunities. Beneficial applications are already appearing for energy, drug production, materials and medicine.

… as well as the risks and threats



Ultimately synthetic biology means cheaper and widely accessible tools to build bioweapons, virulent pathogens and artificial organisms that could pose grave threats to people and the planet. The danger is not just bio-terror, but "bio-error,"

SB is value neutral:

how SB is used determines if it will be good or bad

The global ban on malign intent

Article I	Never under any circumstances to acquire or retain biological weapons
Article II	To destroy or divert to peaceful purposes biological weapons and associated resources prior to joining
Article III	Not to transfer, or in any way assist, encourage or induce anyone else to acquire or retain biological weapons
Article IV	To take any national measures necessary to implement the provisions of the BWC domestically
Article V	To consult bilaterally and multilaterally to solve any problems with the implementation of the BWC
Article VI	To request the UN Security Council to investigate alleged breaches of the BWC and to comply with its subsequent decisions
Article VII	To assist States which have been exposed to a danger as a result of a violation of the BWC
Article X	To do all of the above in a way that encourages the peaceful uses of biological science and technology

http://www.unog.ch/bwc

I want to play a game

(Q) Which projects were part of a weapons programme?

1. Ministry of Agriculture and Fisheries: Investigation on Bovine Contagious Abortion at the Veterinary Laboratory
2. Survival of the Foot-and-Mouth Disease virus: Virus in damp hay and bran
3. Effects of insecticides and herbicides on animals
4. Virulence of non-sporulated bacteria via the respiratory tract

(Q) Which were built for biological warfare?

A

Plum Island Animal Disease Centre

B

DSTL Porton Down

C

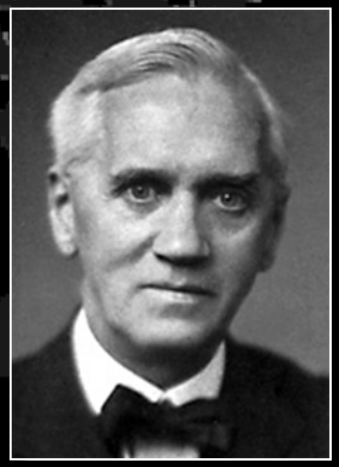
PHLS

UK Public Health laboratory Service

D

Pirbright Institute for Animal Health

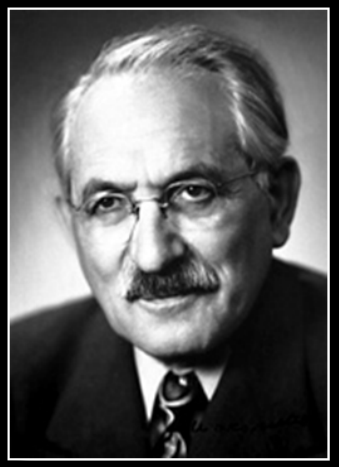
(Q) Which Nobel Prize wining scientist made bioweapons?



Sir Alexander Flemming

Paul Hermann Müller

Max Theiler



Selman Abraham Waksman

In practice, difficult to tell the good from the bad

BIO BRICKS foundation

http://biobricks.org

BIOLOGICAL WEAPONS CONVENTION IMPLEMENTATION SUPPORT UNIT

iGEM

http://2011.igem.org

BIOLOGICAL WEAPONS CONVENTION IMPLEMENTATION SUPPORT UNIT

1. Would the materials used in your project and/or your final product pose:
   a. Risks to the safety and health of team members or others in the lab?
   b. Risks to the safety and health of the general public if released by design or accident?
   c. Risks to environmental quality if released by design or accident?
   d. Risks to security through malicious misuse by individuals, groups or states?

   Please explain your responses (whether yes or no) to these questions.

2. Specifically, are any parts or devices in your project associated with (or known to cause):
   - pathogenicity, infectivity, or toxicity?
   - threats to environmental quality?
   - security concerns?

   If your response to any of the questions above is yes:
   a. Explain how you addressed these issues in project design and while conducting laboratory work.
   b. Describe and document safety, security, health and/or environmental issues as you submit your parts to the Registry.

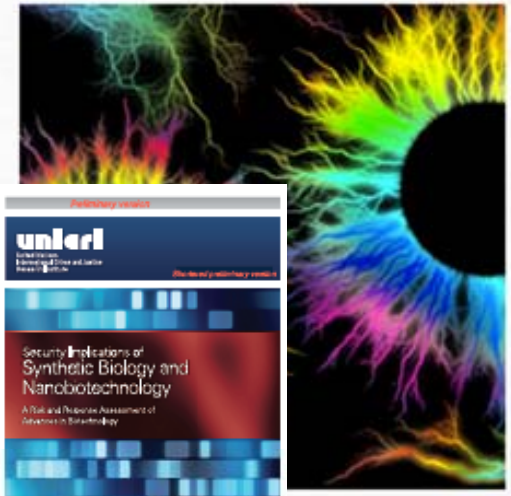
3. Under what biosafety provisions will / do you operate?
   a. Does your institution have its own biosafety rules and if so what are they?
   b. Does your institution have an Institutional Biosafety Committee or equivalent group? If yes, have you discussed your project with them?
   c. Will / did you receive any biosafety and/or lab training before beginning your project?
   d. Does your country have national biosafety regulations or guidelines?

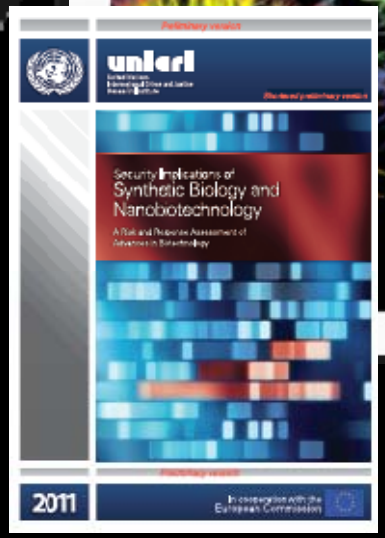
Synthetic Biology and Nanobiotechnology

Risk and Response Assessment Project

unicri
advancing security, serving justice, building peace

SECURITY GOVERNANCE/COUNTER-TERRORISM
LABORATORY





Recent advances in synthetic- and nanobiotechnology offer great promises for human health, environmental protection, and renewable energy sources. These technologies will make it possible to bioengineer new or altered microorganisms, biomolecular components and devices as well as bio-technical hybrids that perform specific functions, such as the production of pharmaceutical drugs, the destruction of cancer cells, the remediation of environmental pollutants, or the generation of biofuels. There exists a great overlap between these two innovations, which are expected to largely converge and to unfold a significant transforming potential within the coming decades.

http://ung.igem.org/wiki/images/e/ec/UNICRI-synNanobio-final-2-public.pdf

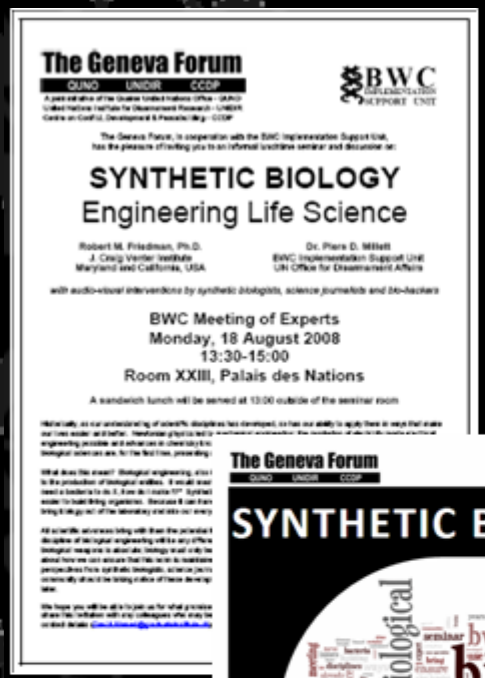
- Elaborate a concept and work towards the coherent establishment of a human-centric, community-based networked approach of existing and new measures and resources on different levels to manage the dual-use potential of biotechnology.
- Reinforce and recognize the value of existing efforts by the relevant communities to consider the implications of their work, thereby taking advantage of existing infrastructure and avoiding duplication.
- To this end, empower individuals engaged in the field; coordinate and integrate existing and new initiatives from various stakeholders; strengthen the science-security link; seek international dialogue on ways to attain a common vision and strategy.
- Support the BWC ISU's adoption of the evolved network approach to biosecurity.

- Foster and actively support concerted and systematic efforts to develop code of conduct values, principles, and standards for dual-use research in the life sciences by individual communities, including synthetic biology and nanobiotechnology.
- Promote and actively support the broad adoption of codes of conduct through information and outreach activities as well as with financial and political leverage.

- Develop a comprehensive outreach strategy for systematic outreach to life science communities and work with them to address dual-use issues of concern.
- Reach out to international partners and foster systematic education efforts and coordination on the international level.
- Also target non-biologists, such as engineers, computational modelers, mathematicians, etc. specifically.
- To this end, seek the support of community peers; foster dialogue between stakeholders; carry the dual-use message to various community events; support or organize events and educational programs specifically pertaining to biosecurity; systematically enter university and other curricula and reach out to life scientists and lab staff early in their careers; ensure the existence of, and promote, web portals with e-learning modules and information on dual-use and biosecurity issues tailored to the needs of various stakeholder communities.
- Foster broader engagement with the general public on the benefits and risks of advances in bio- and nanotechnology, including synthetic biology, and enable a public debate on what society wants, what level of risk it is willing to accept, what kind of rules and (ethical) constraints should be set (by whom), etc.

- Encourage the adoption of a screening framework by all DNA synthesis providers and other relevant actors, and monitor developments in this area. Provide a suitable international forum for the harmonization of current efforts, the geographic expansion of screening practices, and the development of international standards and best practices. If needed, assess the feasibility and utility of mandatory screening of orders and customers (internationally).
- Support the screening initiatives of the DNA synthesis industry by providing them with regulatory and procedural guidelines and establishing a point of contact in government and law enforcement.
- Support the development of a seal of approval to certify compliance with existing best practices for screening DNA orders.
- Actively support the DNA synthesis industry in technical issues: Support the further development of an accurate sequence database; foster the transition from an organism-centric perspective on biosecurity to a sequence- or gene-centric view; work towards the inclusion of oligonucleotide orders in screening practices; encourage the industry-wide sharing of best practices and relevant order and customer information; standardize or provide support with international lists of proscribed persons and companies.

- Consider ways and needs for establishing systematic national and international legal and regulatory frameworks to address the security implications of progress in bio- and nanotechnology.
- Work with various stakeholders towards initiating a process to develop a web of innovative measures as well as organizational structures beyond traditional arms control that could help reduce the misuse of progress in bio- and nanotechnology.
- Strengthen the links between the science and security communities; identify areas of shared interest and projects that offer mutual benefits.
- Uphold and strengthen the norms of the BWC and the CWC and clarify the provisions set forth in both Conventions to provide clear coverage of synthetic biology and relevant nanotechnology developments.
- Support and strengthen the BWC Implementation Support Unit (ISU).
- Support and engage with the AG to ensure that their efforts address relevant developments in synthetic biology and nanotechnology to the fullest extent possible.
- Reinforce efforts to continuously monitor science and technology developments in bio- and nanotechnology in order to identify areas with misuse potential and to strengthen efforts to address such threats.
- Work towards an international consensus on how to address the future international security implications of nanotechnology. To this end, foster the promotion of good practices, reinforce the international portfolio of respective efforts, and support the elaboration of a joint evaluation methodology in nanosafety and -security on a voluntary basis.


The Geneva Forum
QUNO UNIDIR CCDP
BWC IMPLEMENTATION SUPPORT UNIT
SYNTHETIC BIOLOGY
Engineering Life Science
Robert M. Friedman, Ph.D.
J. Craig Venter Institute
Maryland and California, USA
Dr. Piers D. Millett
BWC Implementation Support Unit
UN Office for Disarmament Affairs
with audio-visual interventions by synthetic biologists, science journalists and bio-hackers
BWC Meeting of Experts
Monday, 18 August 2008
13:30-15:00
Room XXIII, Palais des Nations
A sandwich lunch will be served at 13:00 outside of the seminar room


The Geneva Forum
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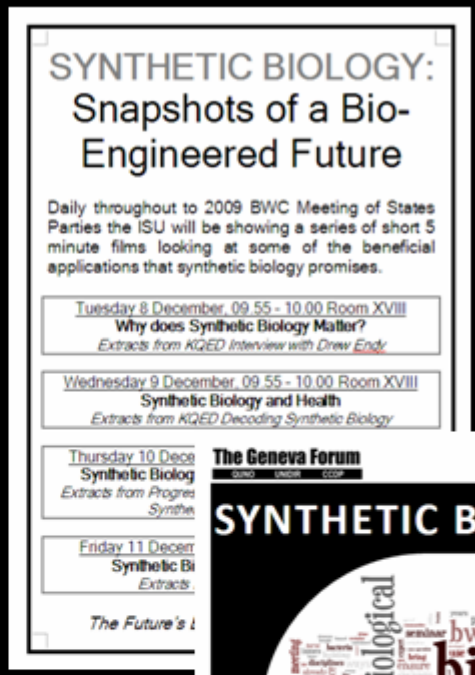
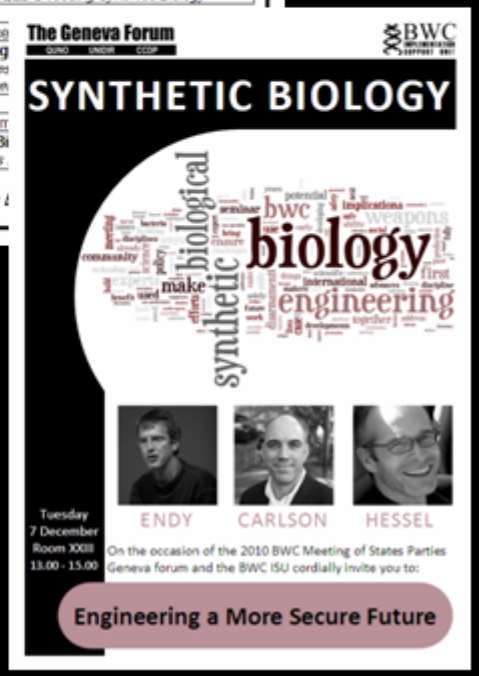
BWC IMPLEMENTATION SUPPORT UNIT
SYNTHETIC BIOLOGY
biology
synthetic
biological
engineering
make
bwc
CALVERT
SCHMIDT
PAUWELS
Wednesday
25 August
Room XXIII
13.00 - 15.00
On the occasion of the 2010 BWC Meeting of Experts
Geneva forum and the BWC ISU cordially invite you to:
Engineering a Safer Future


SYNTHETIC BIOLOGY:
Snapshots of a Bio-Engineered Future
Daily throughout to 2009 BWC Meeting of States Parties the ISU will be showing a series of short 5 minute films looking at some of the beneficial applications that synthetic biology promises.
Tuesday 8 December, 09.55 - 10.00 Room XVIII
Why does Synthetic Biology Matter?
Extracts from KQED Interview with Drew Endy
Wednesday 9 December, 09.55 - 10.00 Room XVIII
Synthetic Biology and Health
Extracts from KQED Decoding Synthetic Biology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biology
synthetic
biological
engineering
make
bwc
ENDY
CARLSON
HESSEL
Tuesday
7 December
Room XXIII
13.00 - 15.00
On the occasion of the 2010 BWC Meeting of States Parties
Geneva forum and the BWC ISU cordially invite you to:
Engineering a More Secure Future

Not ‘are you part of the problem’

But ‘are you part of the solution’?