Synthetic Biology: Scientific Progress or Ethical Dilemma?

A symposium presented by the IUPS Ethics Committee
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*“The engineering of biology: the deliberate (re)design and construction of novel biological and biologically based systems to perform new functions for useful purposes, that draws on principles elucidated from biology and engineering.”¹.

* Merges disciplines: mathematics, biology, engineering, chemistry, physics and computer science
* Tackles challenging medical problems providing both health and economic benefits
* Targets biotechnologies with specific and less expensive approaches
* Creates applications in diagnostics, therapeutics, vaccines, biomaterials, biofuels, etc.

Dr. Francois Kepes, Research Director
Systems & Synthetic Biology, CNRS
Epigenomics Project, Genopole®
* Synthetic biology will be
  * a rational approach for engineering tissues and nano-technology
  * the basis for constructing non-invasive or permanently implanted biomolecular sensors coupled to biomolecular calculators and curative technologies that will be able to synthesize desired remedies on the spot
* Gene sequencing will be routine

*Vision for the 21st Century*
* How should these new technologies be regulated and managed?

* What are the appropriate governance structures that will advance the benefits and safeguard society?

* Who should be involved in developing oversight?
The technology:
* A means of studying very bad diseases and disorders in less complex organisms therefore potentially reducing the use of whole animal research by conducting studies in simpler systems

The concerns:
* ‘Humanizing’ animals in the course of biomedical research
* Potential to increase animal suffering by transferring harmful human disorders to non-human animals

International Oversight and Guidance (International Council for Laboratory Animal Science):
* Assess the degree to which the level of harm inflicted on animals is mitigated by significant beneficial findings
* Animal research which adheres to the 3-Rs principle: reduce, refine and replace

Professor Tom Baldwin
Department of Philosophy, University of York
International Concerns

* Biosafety and biosecurity in access and ownership of biological materials and innovation

* Synthetic biology being used for the benefit of humankind

* IP and Ownership
* The products:
  * Strings of nucleotide sequences; new drugs; biological scaffolding

* The Challenge:
  * Protectionism vs Enabling key technologies

* The Approaches:
  * IP protection to open-source

* The Future:
  * New legal entity(ies) to address new concepts in biology and biotechnology

* Intellectual Property

Dr. Djims Milius, Academic Associate
Department of Human Genetics, Faculty of Medicine, McGill University
* Defining the resource:
  * Synthetic biology organisms as a form of genetic resource – International Convention of Biological Diversity

* Ownership strategies:
  * State sovereign rights based with national governments
  * Free access approach favoring those with the ability to access
  * Common heritage of mankind approach involving universal management
  * IP rights based on patent law

Dr. Catherine Rhodes, Research Fellow, Institute for Science, Ethics and Innovation, University of Manchester
*The important role of non-scientists in techno-scientific decision-making bodies - a collective responsibility in oversight

*Helping society understand new science
  * Issues raised by synthetic biology have an impact on the entire biomass, from single cells to biofuels
  * Projects have social, ecological and economic consequences
  * Revolutionizing the science of biology itself

Dr. Dorothée Benoit-Browaeys
Déléguée générale de VivAgora
Paris, France
The introduction of Synthetic Biology techniques in physiological studies offers -
- the excitement of innovation and discovery
- the challenges of providing safeguards for its impact in order to become a resource for all
- Advancement of the science will require involvement at all levels of society and governance will include national and international participation

**Concluding Remarks**
Speakers and members of the IUPS Ethics Committee in attendance (from left to right): F. Kepes, T. Baldwin, P. Moody-Corbett, C. Rhodes, T. Godfraind, D. Browaeys-Benoit, D. Milius, A. Anand

Details of the symposium are available in the accompanying article