



Synthetic Biology

Artificial Life

Applying emerging new technologies due to urgent needs and benefits for individuals and society and not their boundless possibilities

The Human right to live in the evolutionary environment in which mankind has developed

- Loss of respect for life
- Uncertainty
- Clean energy sources
- Targeted medicine
- New chemicals
- Environmental cleanser
- Efficient vaccine production
- Accidental/intentional release
- Uncontrolled proliferation
- Unpredictable new functions
- Crowding out of existing species
- Threats to biodiversity
- Incurable new epidemics
- Bioterrorism
- Artificial biological arms race
- Disruption to ecosystems
- Cross-breeding with natural organisms
- Deepening of social gaps
- Rule of the industries

Synthetic Biology

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Part I

Synthetic Biology the new emerging technology is expected to be changing individual lives as well as society in a revolutionary way that has never been witnessed before.

As yet it is considered the technology of the century. Its foundation consists in the creation of a form of artificial life that has never existed in nature.

Synthetic biologists are not able to imitate the high complexity of natural biological systems.

It is not the aim of synthetic biology to use existing systems or to adapt them to special demands: The goals of the synthetic biologist can be reached much more easily and more effectively with rather primitive artificial living systems.

On account of this state of affairs two different approaches are being used:

The top- down approach consists in the diminishing of the genome from simple natural existing organisms. The result is the so-called minimal genome containing a minimum of properties of life. This cellular chassis is the carrier of defined artificial DNA compartments, added like lego bricks, thus creating a living organism that is to fulfill specific tasks, it can, for example, produce bio-fuels.

The bottom- up approach is more radical. It is the creation of a genome from scratch, that means using the synthetic computer generated DNA or even DNA containing compartments that do not exist in natural living systems, for example saccharides, and amino-acids not existing in nature. This artificial genome will then be inserted in natural cells.

The recent research has tried to replace the function of natural cells by lipid vesicles, to state one example.

Of course, synthetic biology is also able to reconstruct existing and extinct organisms like the polio virus or the Spanish influenza virus that, between 1918 and 1919, killed more than 20 million people world-wide.

The goals of synthetic biology, using artificial organisms, are the quick, easy and cheap production of clean bio-fuels replacing fossil fuels, nearly all kinds of chemicals and tissues, plastics, and all follow-up products of oil, any kind of known and new medicaments, vaccines, new medical diagnostics and therapies, environmental cleansers, improved food supplies, and so on.

The definition of living systems is the same as that of artificial organisms, they are all subject to the same basic rules: self-replication, growth, self-repair, metabolism, signalling, circuits, and the ability to adapt to environmental conditions. The structures of some of the new artificial organisms seem to be similar to the primitive forms from which life on earth has developed.

The properties of all living organisms to evolve is one of the main risks of the industrial application of synthetic biology. Even the insertion of genome killer genes or suicide switches is no guarantee that this behaviour does not get lost in the course of the evolutionary adaption to changing environmental conditions in the following generations. Currently it is not predictable what development released artificial organisms will take. Constructed organisms for useful purposes may revert into pathogens.

Once they have been released, organisms turned into pathogens cannot be taken back any more. We have no methods to eliminate them, especially because their features do in no way relate to those of natural systems, which we are used to deal with successfully. The cellular control mechanisms can lose control not only in artificial organisms but also in biological systems, which is shown by the example of cancer, with its uncontrolled proliferation.

Even with complex biological systems we know the cross-breedings, which means the gene exchange with very different species, and therefore the changing of behaviour. Accidental or intentional release can lead to genetic contamination, such as incurable new diseases and epidemics with the crowding out of existing species, threats of biodiversity, the development of new biological weapons, and the danger of a new arms race with new biological pathogens, now. The current state of the art in research is that it is irresponsible to release artificial organisms. The dimension of possible extreme harms to humans and the environment as well as the impacts on daily life of everyone and societal structure requires a new kind of responsibility with strict rules, transparency, the public right to participation, and independent permanent oversight and controls.

Up to now the producers in the field of synthetic biology have voluntarily given themselves rules which cannot be considered valid enough to become legal rules. The self-regulations of industries are limited by their conflict of interests. Oil companies funding the research in synthetic biology (such as Exxon, BP, Shell, Total) are well-

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known for unnecessarily destroying the environment and cannot be entrusted with self-regulations.

Part II

In the summer of 2010, President Obama appointed a commission for ethics in synthetic biology (the Presidential Commission for the Study of Bioethical Issues – PCSBI). In May 2010 the Craig Venter Institute informed the public that they had succeeded in designing synthetic bacteria with all signs of a living organism: self-replication, and so on.

In its Executive Summary the Commission evaluates this event as “although extraordinary in many ways” it does not amount to creating life as “either a scientific or a moral matter”.

They conclude that the synthetic genome relies on an existing natural host and is to be seen merely as a variant of the genome of an already existing natural host. Thus synthetic biology is seen as a special type of genetic engineering, already established and regulated, so no further regulations will be needed to their mind. A curious interpretation!

Let me ask you one question for clarification: Take a human with clothes and food. Take his clothes and food away from him. Is this naked person still a human, or is he not. Of course, the essence is the decisive factor - not the supplying systems.

On top of this, the US Commission reduces the complex ethical context of synthetic biology to a few practical aspects and a few ethical issues: Nothing is said about ethical issues like respect for life in general, when living organisms can be switched on or off on demand.

The trust in self-regulation or “self-governance” of the producers, as mentioned earlier, seems to be quite strong. The carefree mind of Americans is astonishing : Take for example the yearly iGEM (International Genetically Engineered Machines Competition) to produce artificial compartments or organisms. The best results of this contest will be awarded a prize.

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The contest addresses students and citizens - that means non-professionals - and offers them to purchase stretches of synthetic DNA, free of charge, to create organisms in their garages to take part in the contest.

Remember: A journalist of the Guardian, in 2006, succeeded in purchasing fragments of the virus of the deadly smallpox.

There is a lack of safety control, and malicious usage such as bio-terrorism cannot be excluded. Questioned about the unsolved safety problems – leading US scientists state that the solutions will come automatically in the progress of further acting.

In contrast to this the European point of view is more characterised by the precautionary principle, which means that in case of uncertainty or possible harms a moratorium is rather likely to be called or at least a slower-going policy will be applied.

The US Presidential Commission ignores the impact on economy which will be transformed into a powerful global bio-economy which will have dramatic consequences, especially for developing countries, thus deepening the gap between rich and poor and excluding the voice of those who are affected the most. Contrary to this Europeans seem to have a stronger sensitivity regarding social imbalances. In general, we should not alter our European principles.

What about the democratic societal right to decide about the environment to live in? We demand the acknowledgement of the human right to live in the evolutionary environment in which mankind has developed. Unspoiled nature is a source of recreation and well-being.

Conclusions and Demands:

No wide patenting of living genetically engineered or artificial organisms to avoid monopolies of industries, social imbalances, and an excessive influence on politics.

Admission of processing techniques, not before full information of the public, transparency of all risks, no company secrets concealing risks, public debate and democratic decisions.

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Restriction of technological possibilities to human needs. Replacing the self-governance of producers by independent advisors and public control.

No new constructions or designing of structures of human life, including the early embryonic and fetal stage.

Prohibition of altering human structures of psychology and patterns of behaviour.

Declaring illegal the intentional release of artificial organisms into the environment.

Application only to remove the risk of illnesses and genetic defaults or acquired illnesses however, no new constructions or designing.

The need of synthetic biology must be proved, there must be an objective necessity without alternative possibilities.

We have reached a stage in which technologies for the production of clean and renewable energies are well established. They should not be allowed to be replaced by energy supplies produced by synthetic biology, as long as there are considerable uncertain and unknown risks and unsolved waste problems. There is considerable funding for synthetic biology. However, we should not allow the necessary funding to be withdrawn from the research and production of clean and sustainable energies.

We should not enter a vicious circle which makes me think of Einstein who said: “You cannot solve a problem from the same consciousness that created it”.

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