A CASE STUDY :

Synthetic life

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Evolution is a wellspring of creativity; 3.6 billion years of mutation and competition have endowed living things with an impressive range of useful skills. But there is still plenty of room for improvement. Scientists are setting in recent years to buttress the foundation of genetic engineering with what they call synthetic biology.

Synthetic biology is a new area of biological research that combines science and engineering in order to design and build ("synthesize") novel biological functions and systems. We will then devise new control elements and add these new modules to the existing genomes or build up wholly new genomes. This would be a field with the unlimited expansion potential and hardly any limitations to building "new better control circuits" and..... finally other "synthetic" organisms.

The work on restriction nucleases not only permits us easily to construct recombinant DNA molecules and to analyze individual genes, but also has led us into the new era of synthetic biology where not only existing genes are described and analyzed but also new gene arrangements can be constructed and evaluated. (First International Meeting on Synthetic biology was held in 2004).

Synthetic biology includes the broad redefinition and expansion of biotechnology, with the ultimate goals of being able to design and build engineered biological systems that process information, manipulate chemicals, fabricate materials and structures, produce energy, provide food, and maintain and enhance human health and our environment. One aspect of Synthetic biology which distinguishes it from conventional genetic engineering is a heavy emphasis on developing foundational technologies that make the engineering of biology easier and more reliable.

It allows inexpensive large-scale changes of codons in genetic systems to improve gene expression or incorporate novel amino-acids. Synthetic biology is greatly aided by basic technologies of reading and writing of DNA (sequencing and fabrication) Synthetic biologists make use of DNA sequencing in their work in several ways. First, large-scale genome sequencing efforts continue to provide a wealth of information on naturally occurring organisms. This information provides a rich substrate from which synthetic biologists can construct parts and devices. Second, synthetic biologists use sequencing to verify that they fabricated their engineered system as intended. Third, fast, cheap and reliable sequencing can also facilitate rapid detection and identification of synthetic systems and organisms.

With synthetic life, we're re-designing the cell chromosomes; we're not creating a whole new artificial life system. They must transplant the synthetic genome into another cell so that it can use the existing machinery to "boot up" and start growing and reproducing. We're simply re-writing the operating software for cells - we're not designing a genome from the bottom up - you can't drop a genome into a test tube and expect it to come to life.

Steps to synthetic life:

2002: synthetic virus created- a lab version of polio.

2007: A genome from one cell is placed in another.

2008: Publication of synthetic genome study.

Creating a synthetic genome:

Small blocks of DNA were chemically synthesized. These were grown up in a bacterium, and knitted together into bigger pieces, so-called "cassettes" of genes. Several large chunks of DNA that were joined to make the circular genome of a synthetic version of *Mycoplasma genitalium.*

– In 2007, scientists put genome from one organism into cell of another, taking over cell's machinery.

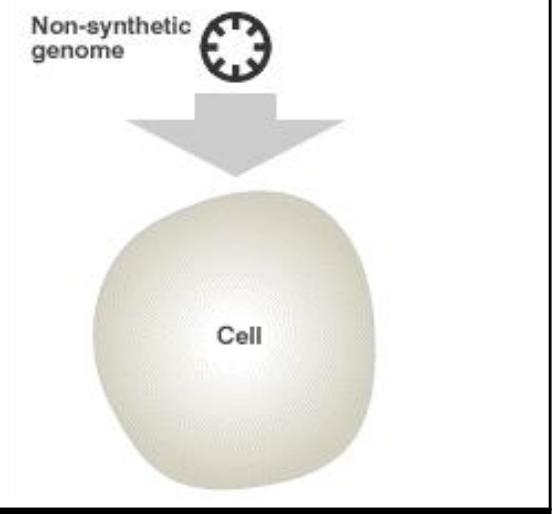

Fig. 1 :

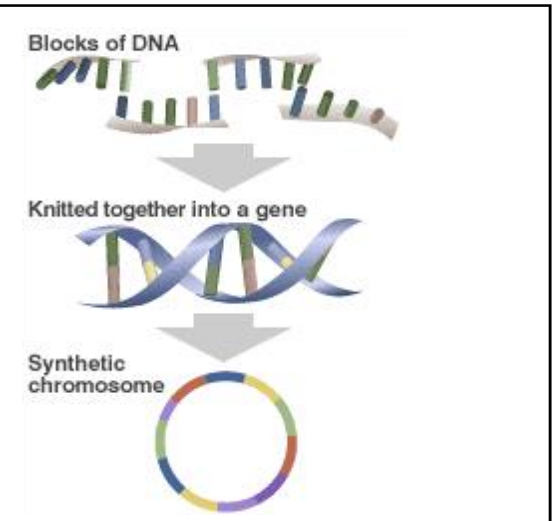

Fig. 2 :

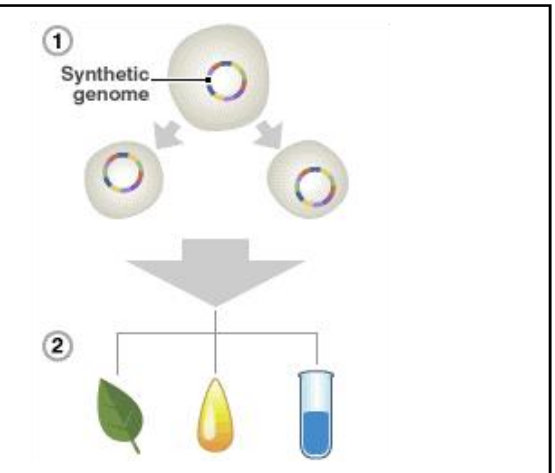

Fig. 3 :

– Bacterial synthetic genome was built up chemically by sewing together short DNA segments.

– Synthetic genome to be put (1) into cell, reproduce and (2) create plants for biofuels and petrochemical substitutes.

Synthetic genomics is a nascent field synthetic biology that uses aspects of genetic modification on pre-existing life forms with the intent of producing some product or desired behavior on the part of the life form so created.

Synthetic genomics is unlike genetic modification in the sense that it does not use naturally occurring genes in its life forms. It may make use of custom designed base pair series, though in a more expanded and presently unrealized sense synthetic genomics could utilize genetic codes that are not composed of the four base pairs of DNA that are currently used by life.

The development of synthetic genomics is related to certain recent technical abilities and technologies in the field of genetics. The ability to construct long base pair chains cheaply and accurately on a large scale has allowed researchers to perform experiments on genomes that do not exist in nature. Coupled with the developments in protein folding models and decreasing computational costs the field synthetic genomics is beginning to enter a productive stage of vitality.

The micro-organisms synthesized in such a way, can become efficient producers of non-polluting fuels such as hydrogen. Other synthetic bacteria could be made to take up greenhouse gases.

A critical limitation in synthetic biology today is the time and effort expended during fabrication of engineered genetic sequences. To speed up the cycle of design, fabrication, testing and redesign, synthetic biology requires more rapid and reliable *de novo* DNA synthesis and assembly of fragments of DNA. Synthetic biologists are mainly interested in building genetic devices within living cells, so that the systems can move, reproduce and interact with the real world. Ultimately, it's an amazing piece of science if handled for constructive purposes and can create WONDERFUL MIRACLES…!!! .

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