Numéro 10
Avril 2019

JS²

Je Science donc J'écris

Dossier spécial: Le premier trou noir pris en photo

What is synthetic biology?

"What I cannot create, I do not understand," said Feynman. This quotation could sum up the principle of synthetic biology. Indeed, synthetic biology is about understanding biology by building DNA sequences to create new biological systems or redesigning the existing ones to improve them.

Does this definition seem complicates? Don't panic, we will explain it step by step ... Biology is the science that studies the living. In biology, to understand a system such as a living being, we use the principle of analysis: we take this system to pieces in order to understand it. The principle of synthesis is the opposite of analysis: we assemble several elements to build a complex system that we study afterwards. Therefore, synthesis is a powerful method of research which consists in understanding through construction. The question you're probably asking yourself is, how do you build in biology? The answer is simple, by manipulating the essential brick of life - DNA.

To build in biology, synthetic biology is inspired by engineers according to three concepts: The first concept is standardisation is based on the use of bio-bricks as building tools. Bio-bricks are DNA sequences that have a well-defined structure and function. There are different levels of complexity. Individual bricks can be assembled together to form what is called a device. In turn, the devices can be assembled to form a system. In fact, bio-bricks are comparable to Legos that are assembled to form a construction.

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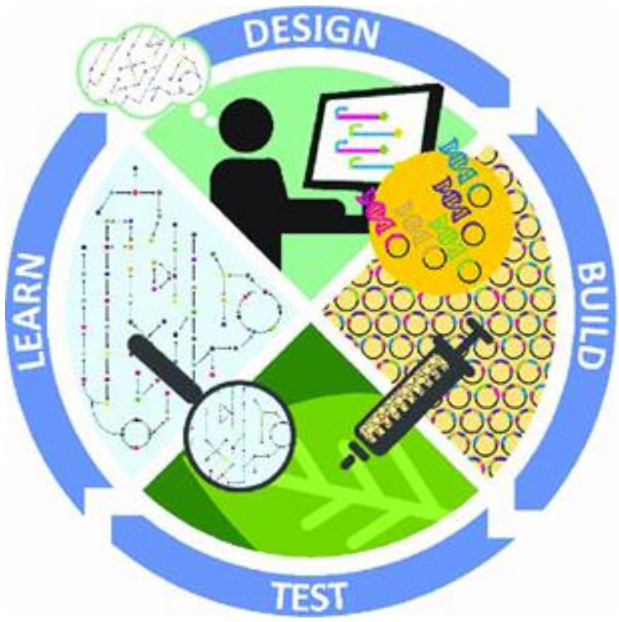

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These more or less complex assemblies may be incorporated into some living organisms, such as plants, bacteria or fungi. In the second concept, it is decided to limit reflection to a certain level by ignoring useless details. For example, when you use Excel, Word or a website, you don't need to understand all the levels of computer language that make it up to use it. This is the principle of abstraction. Finally, the third and final concept is iterative rational design. Adapted to synthetic biology, this principle is described by the "Design, Build, Test, and Learn" method. More simply, it refers to the different steps to be taken when solving a problem. The first step is to design, using computer models, the different bio-bricks or to modify the existing ones.

In the second "Build" stage, they are synthesized, assembled and transferred to the host organism. Then comes the third stage of "Test", where we carry out various tests on this organism to study the effects of our constructions. Finally, in the final "Learn" step, data is collected and analyzed. Depending on the results, a new cycle can start with new constructions.

Now that we have explained to you the principle of synthetic biology, here are some examples of applications. The goal of synthetic biology is to solve current problems through genetic construction. Therefore, there are lots of these applications. You can have an organism that makes a molecule that is not naturally produced. A well-known example is the creation of a yeast producing artemisinin, a molecule used to treat malaria. Synthetic biology also applies to a completely different field, the bio foundries, which are replacing oil and chemicals with more natural and environmentally friendly compounds from plant biomasses.

In the future, we can also consider a completely new kind of medicine, called personalized. For example, a patient whose illness is due to genetic or functional dysfunction could regain health. Through synthetic biology, the defective system can be restored through a synthetic circuit, directly implanted in one of the patient's cells.

Synthetic biology is therefore a discipline of the future, but its use raises a set of debates and ethical questions...

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