Back to online version

Science print version

Scientists a step nearer to creating artificial life

· New progress towards synthetic organism
· Hope of fuels, drugs and ways to fight pollution

More on...

Science
Science news

James Randerson, science correspondent
The Guardian Thursday September 6 2007

To the untrained eye, the tiny, misshapen, fatty blobs on Giovanni Murtas's microscope slide would not look very impressive. But when the Italian scientist saw their telltale green fluorescent glint he knew he had achieved something remarkable - and taken a vital step towards building a living organism from scratch.

The green glow was proof that his fragile creations were capable of making their own proteins, a crucial ability of all living things and vital for carrying out all other aspects of life.

Though only a first step, the discovery will hasten efforts by scientists to build the world's first synthetic organism. It could also prove a significant development in the multibillion-dollar battle to exploit the technology for manufacturing commercially valuable chemicals such as drugs and biofuels or cleaning up pollution.

The achievement is a major advance for the new field of "synthetic biology". Its proponents hope to construct simple bespoke organisms with carefully chosen components. But some campaigners worry about the new technology's unsettling potential and argue there should be a moratorium on the research until the ethical and technological implications have been discussed more widely.

One of the field's leading lights is the controversial scientist Craig Venter, a beach bum turned scientific entrepreneur who is better known for sequencing the human genome and scouring the oceans for unknown genes on his luxury research yacht. The research institute he founded hopes to create an artificial "minimal organism". And he believes there is big money at stake.

In an interview with Newsweek magazine earlier this year, Dr Venter claimed that a fuel-producing microbe could become the first billion- or trillion-dollar organism. The institute has already patented a set of genes for creating such a stripped-down creature.

Ultimately, synthetic biologists hope to create the most efficient form of life possible, with the fewest genes needed to allow the organism to grow, replicate and proliferate. But researchers have approached the problem from two radically different directions. Dr Venter's team is starting with one of the simplest forms of cellular life known to science - the bacterium Mycoplasma genitalium, which causes urinary tract infections. By

stripping out each of its 482 genes and observing the effect on the organism they have calculated that a core of 381 are vital for life.

In contrast to this top-down approach, Dr Murtas, at the Enrico Fermi research centre at Roma Tre University in Italy, and Pier Luigi Luisi aim to build a living thing from the bottom up. "The bottom-up approach has the possibility of creating living systems from entirely non-living materials," said Tom Knight, an expert in synthetic biology at the Massachusetts Institute of Technology.

"That's the real power of synthetic biology ... If you can take it apart into little bits and pieces and shuffle things around and put it back together and it still works, you can have much more confidence that you really understand what is going on."

The Italian team's advance is to make simple cells which are essentially bags made up of a fatty membrane containing just 36 enzymes and purified ribosomes - microscopic components common to all cells which translate the genetic code into protein. The primitive cells are capable of manufacturing protein from one gene.

The team chose a fluorescent green protein found in jellyfish because it was easy to see, using a microscope, when the protein is being made. "We are trying to minimise any system we put in place for the cell," said Dr Murtas. "We can prove at this point that we can have protein synthesis with a minimum set of enzymes - 36 at the moment." He hopes the project will teach him about the earliest stirrings of life in Earth's primeval slime some 3.5bn years ago.

"It's impressive work," said Prof Knight. "Protein synthesis is a wonderful place to start, partly because it is so well understood and ... you can figure out what is going wrong relatively easily. But there is a lot more involved in making cells that are alive ... I think the bottom-up people have a long way to go."

Dr Murtas acknowledges that his bags of enzymes are a long way from a fully functioning cell, but it is an important proof of principle - being able to make proteins is key for the cell to acquire new functions. Giving it the ability to grow, divide, partition components into daughter cells correctly and replicate DNA will be a major challenge, though. The team will report the work in the journal Biochemical and Biophysical Research Communications.

Dr Murtas is now working on making cells which are capable of division - crucial if they are to be truly alive. As the membrane grows, the team hope it will reach a point where the cell becomes too big and so gives rise to a pair of daughter cells.

In June, Dr Venter's research team announced that they had discovered how to carry out a "genome transplant". They showed they could move the genetic recipe of one species of Mycoplasma bacterium into another closely related species.