Synthetic life: The world's first man-made jellyfish

Superficially a "jellyfish" and genetically a rat, Medusoid is the latest step towards a greater understanding of synthetic tissue therapies

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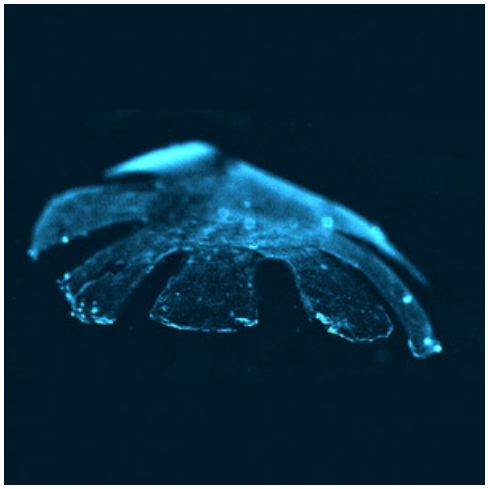

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Say hello to Medusoid, the world's first artificial jellyfish. Super-fast, gritty crunch and tastes just like chicken. It's the sort of creature that wouldn't go amiss washing up on Gorillaz' imagined plastic beach.

The pseudo-jellyfish has been created by US scientists working at Harvard and the California Institute of Technology. The project was undertaken as part of research into biological pump systems, which jellyfish utilize to achieve movement.

Anatomically speaking, in terms of complexity, jellyfish are definitely at the lower end of the spectrum of the animal kingdom. Quite simply, they consist of a jelly like substance, overlain with muscle cells. Add to that a few tentacles and a central oral cavity and you've got yourself a jellyfish. The simultaneous contraction of the muscle results in propulsion through the water.

The artificial jellyfish, named Medusoid, was constructed using silicone as a base to mimic the 'jelly' in a jellyfish, onto which was printed layers of rat heart cells.

Kit Parker, co-author of the paper and a biophysicist at Harvard University, said when describing the project: "Morphologically, we've built a jellyfish. Functionally, we've built a jellyfish. Genetically, this thing is a rat".

In order to create a jellyfish capable of swimming, the two groups at Caltech and Harvard had to carry out a great deal of arduous research into the key mechanics that contribute to jellyfish propulsion. They needed to understand the arrangement of muscles in a jellyfish, how their muscles work to achieve movement and the fluid dynamics of movement through water. Once these components were understood, they set about making themselves the creature.

Upon completion, Medusoid was literally jolted into swimming by passing an electric current through

water. The electrical stimulation of the heart cells caused simultaneous contractions, providing propulsion almost identical to what a real jellyfish would achieve with its own muscle framework.

The work is a huge step forward in the field of synthetic biology and the team hopes that their work will have a serious impact in medicine, particularly in regenerative tissue therapy.

Prior to the project, Kit Parker noticed that jellyfish pump water in a remarkably similar way to how the heart pumps blood. By learning how to deconstruct and reverse-engineer a jellyfish, the researchers were aiming to achieve greater understanding of the workings of biological pumps, in particular the workings of the heart.

Cardiac disease is the leading cause of death in many well-developed countries. Through better understanding of cardiac mechanisms, scientists hope to be able to repair damaged tissue and even create replacement parts, possibly even on the scale of an entire artificial heart. The work carried out by the teams at Harvard and Caltech should vastly improve scientists grasp on understanding the heart so that new treatments can be developed.

Tissue therapies have an advantage over current transplant treatments as they utilize cells harvested from the patient and so have a far smaller risk of rejection. They would also help to ease the problem of discrepancies between the numbers on transplant lists and organ availability. Continued progress in this area has the potential to save many lives.

There are even indications that the scientists believe they can get one up on nature with John Dabiri, professor of bioengineering at Caltech, saying "we're seeing ways in which we can probably improve on the natural biological performance of jellyfish. The process of evolution missed a lot of good solutions."

For now, the group plans to make more modest improvements to future marine creations. In the pipeline is a brain like structure that would enable the jellyfish to perform more complex behaviors such as move in a desired direction, actively seek out food and move towards sources of light. They also plan to make an artificial jellyfish from human heart cells. This would provide an effective platform for testing of newly developed heart drugs.

The creation of medusoid takes the field of synthetic biology to heights that would never have been contemplated not too long ago. The customary view of the field until now has centered on the genetic manipulation of living cells to produce desired features – e.g. bacteria made to produce human insulin. What the collaboration between Harvard and Caltech has done is take this a whole lot further to the point of engineering an entire organism. The Medusoid project has revealed exciting new horizons for this relatively nascent field of science that shows a great deal of promise for the future.

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