Xenobots

Living robots known as Xenobots have the potential to completely alter the fields of robotics and biotechnology. They may be created to carry out a variety of duties, from medicine delivery to environmental monitoring, because they are composed of living cells that have been engineered to carry out certain functions. The creation of Xenobots has been facilitated by developments in synthetic biology, which have allowed scientists to design new biological systems and alter existing ones to meet certain requirements.

An approach for developing synthetic creatures that can adapt to various situations by changing their body form and function is presented in the paper "A scalable pipeline for constructing reconfigurable organisms" by Kriegman, Sam, et al. This pipeline, known as the OpenWorm platform, is built on a modular structure that enables the integration of various sensor, actuator, and control algorithm types to develop organisms with particular behaviors.

Three key parts make up the OpenWorm platform: a software framework, a hardware platform, and a simulation environment. The simulation environment enables researchers to simulate the behavior of diverse creature kinds and test different control algorithms in an artificial environment. The hardware platform is built on a modular architecture that enables the combination of various sensor, actuator, and control algorithm types to produce organisms with particular behaviors. A standardized interface for managing and interacting with the hardware platform is provided by the software framework.

Kriegman developed Xenobots, a synthetic lifeform that can move, self-repair, and even carry out basic functions like moving small items, to showcase the possibilities of the OpenWorm platform. Living cells are organized into specified forms by a computer program to create Xenobots. The required form is then achieved by allowing the cells to develop and self-organize. Kriegman was able to regulate the Xenobots' movements by sending electrical signals to the cells.

By creating a variety of reconfigurable creatures with various forms and capabilities, such as a soft robot that can hold and release items and a worm-like robot that can move, the authors show the efficiency of their pipeline. They also demonstrate how this process may be used to improve an organism's architecture for certain functions, like navigating difficult environments.

The development of synthetic creatures has certain ethical concerns, and responsible innovation is required in this area. They believe that by enabling researchers to test their ideas virtually before implementing them physically, the OpenWorm platform offers a foundation for creating safe and moral synthetic creatures.

A new platform for building synthetic living machines is being developed, according to an article titled "A cellular platform for the production of synthetic living machines" by Blackiston, Douglas, et al. and it was published in Science Robotics in 2021. The Xenobots 2.0 platform employs frog skin and heart cells to build biological devices that can carry out specified functions.

Blackiston state that the Xenobots 2.0 platform expands upon the initial generation of these lifeforms they produced. The latest version has a more advanced design approach that enables the development of machines that are both more advanced and durable. The scientists were able to develop Xenobots with the ability to move, transfer goods, and even work together to complete a task.

The method used for developing these living devices is further described in the article. The Xenobots' bodies were made from frog skin cells, while the muscular tissue that allows for movement was made from heart cells. Before assembling the individual cells into the final shape using microsurgery procedures, the researchers designed and simulated the machines using computer algorithms.

The potential uses of this technology are covered by the authors in their conclusion. They propose a number of applications for Xenobots, such as medication delivery, environmental cleanup, and even space exploration. They also stress the necessity for responsible use and control of this technology and understand the moral concerns of the development of new life forms.

Overall, the Xenobots developed utilizing the OpenWorm platform show the promise of synthetic biology for producing new life forms with new purposes and behaviors. To ensure responsible innovation, the scientific world must address the significant ethical issues raised by this technology. The Xenobots 2.0 platform is a significant development in this area and offers exciting possibilities for further study and invention.

References

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