

An Editorial View on the Latest Developments Regarding the Relevance of Xenobots in the Biomedical Research

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Abstract. *In this mini-review we will refer to some very modern perspectives regarding the latest developments regarding the relevance of Xenobots in the biomedical research. In this way, Xenobots are a real scientific enigma, halfway between frog and robot, and they're totally changing the way we think about life and machines. They're like a living, crawling puzzle that scientists are still trying to solve. Thus, we will try to cover aspects by mentioning the Half-frog, Half-robot status of the Xenobots, some ethical issues, their place in the nature and some future perspectives in this area.*

Key words: Xenobots, biomedical research, ethics

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1. The Bigger Picture: "Xenobots: Half-frog, Half-robot, Totally Weird"

Xenobots are a real scientific enigma, halfway between frog and robot, and they're totally changing the way we think about life and machines. They're like a living, crawling puzzle that scientists are still trying to solve. It's more than just making weird, self-healing robots. It's about comprehending life itself - how organisms form, develop and interact. Xenobots thus represent a testing ground for scientists keen to explore the delicate balance between biology and technology.

2. Xenobots are like the pages of a book, assembled from the living words of nature

Xenobots are like the pages of a book, composed from the living words of nature. Just as a book transforms the raw materials of wood into a vessel of knowledge, xenobots reshape the basic cells of African clawed frogs into entirely new life forms. These fascinating entities blur the boundaries between traditional machines and living organisms. They're neither frogs nor robots ; they represent an entirely new category of programmable organism. Like the pages of a book

conveying the wisdom of existence and human experience, xenobots have the potential to unlock the secrets of biology and the limitless possibilities of the future, promising insights into the software of life itself.

The story of Xenobots takes us on an extraordinary odyssey through the fields of science, biology and robotics. It all begins with a groundbreaking collaboration between researchers at the University of Vermont and Tufts University in mid-January 2020. Xenobots, half-machines and half-living organisms, take shape from frog stem cells and cutting-edge artificial intelligence. These tiny creatures, barely a millimeter across and composed of 500-1000 frog embryo cells, transcend the category of traditional machines [1]. The name "xenobots" refers to the African clawed frog, *Xenopus laevis*, whose embryonic stem cells were meticulously used to create them.

The creation of a xenobot begins in the digital world, where a Deep Green supercomputer runs an evolutionary algorithm. This algorithm assembles and tests thousands of models of new life forms. It's like nature meets machine learning. The virtual organisms that demonstrate the desired behaviours then come to life in the laboratory [1]. Once created and deemed safe, xenobots can be deployed for a variety of applications, from environmental cleaning to biomedical tasks, demonstrating the potential of programmable living organisms [2-3].

These living robots possess a unique ability to move and regenerate in the event of damage, opening up intriguing possibilities, such as cleaning up microplastics in waterways or delivering drugs to precise locations in the body.

3. Is it ethical?

A veritable ethical paradox and debate divides researchers into two camps [1]. On the one hand, there are those who worry about the possibility of playing "mad scientist" with biology, fearing the unthinkable. On the other hand, there are those who see these concerns as a brake on scientific innovation. What would happen if xenobots escaped from the laboratory and wreaked havoc in the wild? Or evolve in unexpected and uncontrollable ways? Scientists are cautious, but concerns about manipulating nature remain deep-rooted.

The Xenobot project raises profound ethical questions, blurring the boundaries between life and machines. The simplicity of these bio-robots, devoid of a nervous system but able to operate autonomously, raises debates about the potential risks and ethics surrounding the creation of more advanced versions with cognitive capabilities. We are not in the process of creating a traditional or programmable robot made of metal and plastic, but rather an organism composed of living cells able to construct their own body schema. The moral significance of these creatures depends on their ability to experience pain or suffering. Furthermore, we are concerned about the consequences of attempting to mimic

the algorithm of life, with the potential for unintentional outcomes as these entities interact with the environment.

4.Unanswered Questions and Some Mini Conclusions

These xenobots open up a big can of ethical worms. Are they really alive? Can they feel stuff? Will they escape and take over the world? Can they autonomously generate and potentially give rise to entirely new and unknown life forms? No one knows for sure. There's also the debate about whether we should mess with biology to this extent in the first place.

R E F E R E N C E S

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