



## **Artificial animate matter for hardware-based artificial intelligence**

*A scientific research project aimed at the creation of free-willed intelligent machines*

My name is [Dmitry Kukuruznyak](#). I am a principal materials scientist at the [Animate Condensed Matter Company](#). I create artificial animate matter that works like biological neural matter.

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**I wish to establish a new research project for the development of hardware-based artificial intelligence, and seek sponsorship for this initiative. This offer is primarily addressed to corporations and government agencies making long-term investments in robotics and [strong artificial intelligence](#). I also appeal to the academic and research institutes developing the physical theory of life and intelligence.**

The hardware-based AI is a completely new kind of computing machines, in which a man-made animate material body serves the function of a neural network. In this case, the actions of the brain are not simulated by computer. Instead, they happen in reality, in the animate-like material body. Because of this, the hardware-realized AI works much faster than any computer-simulated AI.

The artificial animate bodies process information like real animate creatures. They can deal with more intricately organized information objects and handle complex concepts. But most importantly, they can have their own independent will. For this reason, their development can lead to the creation of self-guided sentient terminators, able to reproduce on their own.

*The details of my proposal are found below. More information about my company can be found ([in English](#)) or ([in Russian](#)). My personal website is [here](#). My scientific views and accomplishments are described [in this document](#). This document can be downloaded in [PDF format](#).*

## **What is animate matter and how it is different from inanimate matter**

Animate subjects differ from inanimate objects in that they produce voluntary movements, making constructive changes to themselves and their surroundings.

Even unicellular organisms produce their own constructive movements, which carry out several vital functions: They transfer precursors and control chemical transformations; they construct cellular structures; and they implement the regulated exchange of matter between the organism and the environment. By these actions, the cell restores its structure and enables its further actions.

[The constructive actions of the living matter emerge at the subatomic scale.](#) Within the chemically transforming molecules, the interacting charged valence electrons and nuclei rearrange atoms, and reconstruct chemical bonds, setting their molecules in orderly motion.

The molecular structure of living matter is ordered in such ways that the molecules transform jointly, producing collective movements. In inanimate matter, on the other hand, the transforming molecules work at cross-purposes. Consequently, the inanimate matter makes only random Brownian motions, which do not produce any constructive actions above the atomic scale.

[The Animate Condensed Matter Company](#) makes artificial animate matter from non-biological raw materials. We rearrange their molecular structures, inject suitable metabolites, and start the desired collective transformations. By modifying the structures of the artificial animate bodies, [we make them perform various useful tasks](#). In addition to the experimental research, we develop the theory of orderly movements of living matter.

## **What is the physics of the animate state**

The contemporary chemistry, thermodynamics, and chemical kinetics cannot adequately describe living matter because [they take into account only random indiscriminate molecular movements](#). [1]

We are currently working on developing a new theory describing orderly reconstructions of orderly arranged material bodies. These bodies contain transforming elements, which perform constructive actions on their neighbors; these elements exchange special signals, adjust to each other, coordinate their efforts, and combine into large collective transformations. This theory should explain the actions of the animate matter at all length scales from the orderly molecular motion, to the collective behaviors of multicellular organisms.

We concentrate on two areas. Firstly, we develop the theory of self-sustaining collective chemical reactions. They occur when the living body extracts chemical precursors from the environment, delivers them at the required addresses within its body, achieving specific metabolic transformations, which then cause new orderly actions. [2] Secondly, we develop the theory of autonomous actions of neural networks. Our aim is to explain the emergence of the mind. [3]

## **What is the hardware-based artificial intelligence**

The final goal of our company is [to fabricate the artificial brain that reproduces the actions of living neural networks](#).

Our artificial brain is a specially constructed animate condensed matter body, which generates sequences of autonomous reconstructions. These actions are determined by the structure of the body, by its chemical composition, and by the ongoing chemical transformations. [4]

Simultaneously, the animate-like working body registers external signals, and adapts its actions accordingly. Specifically, it chooses the most suitable response action, and adapts this action to the current situation.

The elaboration of the action occurs when a vast number of subatomic charged particles (i.e. valence electrons and nuclei) jointly solve the many-body problem by collective atomic permutations and reconstructions of the chemical bonds. While doing so, they take into account all the obstacles and constraints imposed by the body itself and the environment. From this point of view, the animate brain is the most intricate computing machine, which takes into account a colossal number of factors simultaneously.

The assimilation of external signals (aka recognition), are also complex actions, accomplished by the reconstructions of the cerebral body. They involve a vast number of elementary events interlinked by the enormous amount of cause-and-effect connections. For this reason, the living organism perceives the surrounding world as a cohesive picture.

Because all the calculations are done in a real material body, and because they begin at the subatomic level, they are very fast. The hardware-realized artificial intelligence can be much more powerful than any computer-simulated AI.

Most importantly, the artificial animate brain has its own free will. It does not respond to all requests indiscriminately. Instead, it chooses which call to respond at a given moment. Its decisions are based on [the principles of least effort and greatest benefit](#). [3] It does not ignore the obtained requests (even though, it can). Instead, it keeps them in mind, planning to execute them at a more convenient time.

In short, we can create a new kind of artificial intelligent species, which can behave almost like humans. In the beginning, they will be less intelligent. However, in the future, they could surpass our intelligence and become our main competitors.

### **The challenges of living-like intelligent creatures**

The Animate Condensed Matter Company was created to evaluate the efforts and resources needed to produce commercial living-like artificial brains. We have done the necessary research, reaching the following conclusions.

The artificial animate organisms can be created at the present stage of development of science and technology. They will be fabricated applying the methods used for manufacturing integrated circuits, albeit with significant modifications. A separate challenge is to create suitable broadband connections linking the artificial brain to the outside world.

In most cases, we could not predict all the actions (reactions) of a given artificial animate body with a known structure. It means that, most likely, the development of the artificial brain will not proceed through intelligent design. Instead, the synthetic animate life forms will develop through evolution and artificial selection. This approach implies manufacturing of a wide variety of different artificial animate species, followed by their testing, and choosing the best performing samples. The selected specimens will then be used for the fabrication of next generations of the animate forms. This implies the construction of a large ecosystem of the artificial animate organisms with different properties. At some point in the future, the development of this ecosystem will require significant resources.

Presently, our project is at the stage proof-of-concept experiments. It does not require considerable financial and technical resources. Now the biggest challenge is the lack of well-trained professionals capable of developing the project. However, this is an inevitable consequence of the novelty of the approach.

The successful development of the project will require parallel efforts in the animate matter theory, experimental materials science, and fabrication technologies. Particular emphasis should be placed on the education and training of the qualified scientific and technical personnel. This suggests that the

project should be developed in cooperation with large academic institutions engaged in teaching at the undergraduate and graduate levels.

The development of hardware-based artificial intelligence is not a short-term project. It does not imply quick returns on investments, and cannot be funded by venture capital. It can create a substantial economic value. However, it is not exactly a commercial enterprise. Rather, it might be regarded as an infrastructure project, comparable to the development of a new generation of telecommunication networks. Perhaps, it cannot be launched without government support.

On the bright side, the country that first obtains the sentient artificial beings will gain considerable scientific and technological advantages over competitors.

### **What I can do**

I can organize a fully integrated research program that will coordinate basic scientific discovery, early-phase trials, and product development.

I invite interested individuals, organizations, and research institutes to participate in funding and supporting this project in exchange for a share in the ownership of the intellectual property rights.

The hardware-realized artificial intelligence may lead to the rise of intelligent self-guided robots, able to reproduce on their own. The potential stakeholders can gain control over this technology at the early stages of development.

### **References**

- [1] Dmitry Kukuruznyak. The Animate State of Matter Hypothesis. 2020. [\(hal-02913591\)](#)
- [2] Dmitry Kukuruznyak. The Physics of Life. Part I: The Animate Organism as an Active Condensed Matter Body. 2017. [\(hal-01575989v2\)](#)
- [3] Dmitry Kukuruznyak. The Physics of Life. Part II: The Neural Network as an Active Condensed Matter Body. 2017. [\(hal-01575993v2\)](#)
- [4] Dmitry Kukuruznyak. The Physics of Life. Part 3: The Artificial Animate Materials. 2020. [\(hal-02541236\)](#)

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