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To predict the future of computing in biology

The availability of computing power in biology begs the question what is its purpose. A complete answer to this question is impossible at this stage, but we can make some interesting conclusions. Obviously the computing power of the human brain is put to use in order to process sensory inputs, model reality and coordinate the behavior of the body in order to modify reality. We might suppose that the computing power in a cell is used to a similar end, processing its many inputs, modeling reality and coordinating its behavior. In that our behavior can range from on a continuim from instinctive to consciencious it is likely that some cellular processes are more knee jerk than others.

The important implication of this line of reasoning is that the mechanistic response pathways that we have thusfar modeled in cells are likely to represent the primitive end of thier spectrum of behavior. Those responses that rely on subtle and complex computations would be difficult to model and hence escape our theory. However, since we are aware of the capacity for cells to produce extremely rich computationally dependent behaviours, we should like a way to interact with these process. While modeling these processes will be slow, we might take a shortcut in capitalizing upon them by utilizing the communication pathways of the cell.

The world models models of animals, as stored in neurons, must be translated into various forms, chemical, visual, and auditory in order to be communicated between animals. While it would be considered an extrememly difficult task to model the behavior and reproduce an artificial dog sitting, we have developed the ability to train this complex behavior to an auditory command. Human - Human interactions show the most advanced forms of these interactions that we are aware of. We can express a myriad of neuronally stored world models via spoken/written language to one another in a way to coordinate our behaviour. It would be useful to find mediums of interaction with cells to coordinate thier behavior.

Cells in direct contact may share a range of chemical and electric signals between one another, while cells in the same organism may exchange chemical signals through various circulatory systems. Even cells sepperated by vast distances are connected by a network of DNA/RNA exchange through viruses. These known forms of communication between cells suggest potential mediums to attempt communication. Electric and Viral forms offer the most tantalizing prospects for communication because of thier speed and ubiquity.

Our ability to work with small scale voltages means that we are reaching a technological point where we might measure and induce charge in and array of ion channels on a single cell. Because cells use electricity as a means of communication at a macroscale, it would come as no surpise that electric charges are used a communication channel at much smaller scales (where whole cell depolarization is unnesecarily loud for the type of communication occuring). The allure of this approach is its potential for rapid back and forth. After setting up the system a scientist might test various signals for reproduciable and computationally rich responses. Said responses could be used to begin to build an electric language that might serve our purpose of communicating with cells.

Viral interaction offers a slower, but more sure means of cellular communication...

\*to communicate we must begin to learn the programming language, or design some sort of API to have access to its elements

Trautter notes that the conditionals set up by proteins are not obvious from their underlying sequence which I can use as an argument for why RNA computing is more promising than protein computing. The fact that DNA changes are slower than RNA changes is also a good argument for RNA’s superiority (Trautteur 2007)

Trautteur, G. (2007). "Does the Cell Compute?" LECTURE NOTES IN COMPUTER SCIENCE **4497**: 742.