Living Computers
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Ever wondered if those sci-fi movies of biological computers could ever be real? Back in 2008 this crazy fantasy became real. It's not a field of humans being used as a power source but rather many small computers designed to compute a simple looking yet difficult task.

Every so often we hear of E.coli striking someone down, usually not fatal, but sick regardless. This time Escherichia coli is being programmed to become a battalion of computers. Normally when we think of computers we resort to the norm: silica-based chips, electrical wires, computer case, etc. But this time the computer is a real life organic living system. E.coli combined with a specific protein from salmonella bacteria create millions of little computers within a drop of water.

DNA is found to have an enormous capacity to store data within a small space. Each protein segment can be used as a place holder (0 or 1; in binary) by segment inversion (forwards and backwards). Taking this into account E.coli DNA can be segmented by the Hin complex protein from salmonella to get a “flipping” reaction in the DNA chain.

To examine the computing power of this created bacterium, a group of researchers created a way to program the E.coli to perform “The Burnt Pancake Problem.” This problem involves having pancakes that are varied in size, with each having a golden size and a burnt side, that need to be reordered by “flipping” The flipping takes place by a spatula (Hin protein complex) that allows for the pancakes to be flipped simultaneously or individually. Since this technology is still in its infancy stage the researchers limited the number of burnt pancakes to two allowing for eight possible solutions.

The Hin/hix recombinase protein obtained from the bacteria, salmonella tryphimurium, was specifically chosen because it dumbs down the efficiency of DNA inversion. In vitro inversion can take place under a minute while the Hin complex allows the inversion to take place over a period of one day (roughly twenty four hours). Also the complex was chosen because at random it can take the separate segments and flip them around in a DNA chain. The protein is also used in a second way. Once the proper permutation is acquired, the hin/hix recombinase releases a resistance to a controlled antibiotic. The amount of time that the colony takes to obtain a resistance reflects the number of flips that the pancakes have taken.

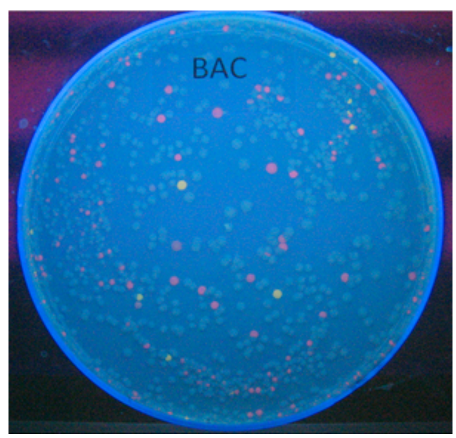
Even though the solution to a two pancake problem is relatively simple, the researchers commented that this system has shown tremendous potential in creating computers that can mimic natural evolution, be easily reproduced once the proper DNA is obtained, and ability to compute more complex tasks. As bacteria are living organisms, they reproduce, which leads to more powerful computers.

This field of study leaves a lot of room for improvement since it is a very young study. Just last year the same group of researchers designed the same E.coli bacteria to compute the Hamiltonian Path Problem. This is where a “person” travels through different “cities” but can only pass through each city once. They used three cities and found that the same bacterium can compute this properly.

Also a different group two years ago had taken rat brain cells and added certain proteins to make them “rewire” themselves. With this accomplished they were able to observe that the “brain” was able to control an F-22 flight simulator.

With the world of technology evolving so rapidly the prospects of where this new concept of biological computers could go are endless. Perhaps the future of cyborgs and terminators are upon us. Let's hope they aren't all naked Arnold Shwarzeneggers sent back in time.

Hamiltonian Path Problem



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