DNA Computing

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Since the introduction of integrated circuits in the 1960s, computing has become synonymous to solid silicon chips. It has become a norm to use silicon-made chips in machines. But even with all the success silicon chips and integrated circuits have had, there have been some that have been striving for alternative methods. There have been concepts such as constructing ‘liquid computers’ by the use of DNA and RNA. Instead of having the binary number system encoded, the idea is to broadcast signals using a form of computational blend. This form of computation would be rather slower in comparison to the generic silicon chips. However, through DNA-based computers as small as cells, it can be possible to inject human with this technology and control the activity of cells. This can also lead to advances in treatment of diseases in which human cells are required to fight external viruses. DNA-computing provides an edge that conventional systems do not (Jonoska, 2002).

Circuitry in DNA-Computers revolves around the Watson - Crick Model of base pairing of cells with contains Velcro that attaches the two strands of DNA together. The first experiment on the issue was conducted in 1994 by Leonard Adleman, in which he displayed the application of nucleic-acid strand interactions in computing. Adleman demonstrated by solving a series of traveling salesman problems. These problems included issues such as a network of cities, and fastest and shortest route to a point. Adleman used specifically altered DNA molecules and conventional methods of molecular biology practices. This experiment resulted in several other researchers carrying out their own experiments in order to develop DNA-based logic circuits by using a variety of computing approaches.

Liquid logic also stemmed from DNA computing. A major percentage of research on the subject is carried out at the California Institute of Technology or Caltech, a center which has gained fame for being one of the best research institutes. Caltech has made several developments in the field of liquid logic by connecting logic gates that are capable of basic operations such as OR, AND and NOT. This is done by using a technique called strand displacement. Strand displacement logic circuits receive input commands from floating single DNA and RNA.

Instead of injecting the required components, the researchers have been focusing on altering cells by enabling them to reproduce by providing instructions to the nucleus of the cell. Molecular circuits are becoming increasingly complex and now require new tools to develop, design and debug. Computer-assisted DNA does not, at this point in time, has the technology necessary for successful implementation of the methods of treatment. For this technique to of any benefit, researchers say there are still a few years away from human trails (Condon, 2001).

Despite the massive steps taken forward in this field, there is much left that needs to be understood before we can apply these techniques to humans. Though early in the testing phase, DNA computing requires technological advancements that can assist the process in becoming successful. The idea behind the concept is to help find out potential cures or treatment methods for diseases such as cancer and HIV-AIDS. One thing is for certain, when the technology is available and tests have been deemed successful, mankind’s search for treatment of terminal disease will have taken a significant step toward reducing the number of deaths that result due to these illnesses.

References

Condon, A. (2001). DNA Computing. Berlin: Springer.

Jonoska, N. (2002). DNA computing:. Berlin: Springer.