BIOMOLECULAR COMPUTERS

From phones and tablets to PCs and gaming consoles to supercomputers and smart watches, computers are everywhere and you're using one right now! The thing is, all of these computers function the same way. These computers use what is called as 'machine language', fundamentally composed of ones and zeroes to tell the computer what to do. Like a written language the computer reads word by word or instruction set by instruction set until it understands what to do it then executes it and then moves onto the next step. We call these kinds of computers as 'classical computers'. So you might be wondering that if my computer can only do one task at a time then how I am being able to run multiple things at once? Well, in basic terms a computer CPU is still doing one thing at a time or one instruction set at a time but switching between them really quickly, roughly 2.5 billion times a second for 2.5 gigahertz single-core, single-threaded CPU. So, it actually seems that it is doing a lot of things at once. Ok, that's all fine for running software or a simple program but what if the requirements for your use are much more than that? What if you needed vastly more computing horsepower? The kind that allows you to solve complex equations with almost no bounds, like cryptography or complex simulations of things within our cosmos, advanced mathematical models or just many other applications that we couldn't even dream of today! These kinds of problems can be described or categorized as taking exponentially more time to solve with increasing complexity. Classical computers can't do such things very well, the closest thing we've gotten to is many classical computers slapped together and given the title of 'Supercomputer'. What we actually need is a computer that can actually solve many problems at a same time, called as 'Parallelcomputer'.

This is where Biomolecular computers come into picture of which a brand new feasible solution has just been discovered at the 'Lund University' at Sweden. The results have been published in the proceedings of the national academy of sciences that the bio computing approach uses less than 1% of energy used by current electronic transistors. The result can see the power of today's supercomputer fit into the form factor of a laptop without absurd amounts of power and heat. So here arises a question of what exactly these computers use? Well, these Biomolecular computers use systems of biologically derived molecules such as DNA and proteins to perform computational calculations involving storing, retrieving and processing data. Biological computing has moved to the forefront and possibility of their development has been increased with the expansion of nanobyte technology which can be defined as any type of technology that uses nano scale materials of 1 to 100 nanometers in size. Alright, So how small is 'nano'? Well, if you imagine you take the whole earth and reduce it to the size of football that's about 50 million times smaller and then do the same thing one more time, a football taken down to another 50 million times then you are at the size of what we call a 'nanoparticle'. Their implementation gets scientists, the ability to engineer biomolecular systems so that they can interact in a fashion that can ultimately result in the computational functionality of a computer. Now, let's explore of how these systems actually work. A Bio computer consists of series of metabolic pathways involving biological material that are engineered to behave in certain manner based upon the conditions that are inputted into the system, the resulting pathway of reactions that takes place constitutes an output which is based on the engineering design on the bio computer it can be interpreted as a form of computational analysis. The instructions operate inside of the cell's DNA which acts as a memory unit, the execution is massively parallel as each of the countless strands of DNA can be operating simultaneously, each operating as an independent processor performing at the rate of 20 quintillion operations per joule of energy. In addition to this, these computers have no clock speed and are limited by the movement of electrical signals and RNA interactions within the cell. DNA is stored as code and made up of four chemical bases which exists as a strand of 3 billion bases in a certain order similar to the way in which letters of the alphabet appear in certain order to form a word or sentence, each storing some genetic information. So, just imagine if such a resource could be used to store computational data! High amount of multiple parallel computations involving complex computations can be solved in no time. This is achieved by the fact that millions and billions of molecules interacting with each other simultaneously, which means much smaller and more powerful computers that is much easier and less expensive to build, mainly because some of the crucial components found in this computer are found in nature. They find a lot of future applications in Medical Industry such as genetic recombination, customizing medicines according to a patient's need, In genetic programming, cryptography, In mass data storage, where a single gram of DNA can store up to 2 peta bytes of data equivalent to data stored in 145 trillion CDs implicated as nearly infinite amount of data can be stirred into very little space for a much much cheaper cost, and paves novel ways for data transmission which is more of a sci-fi like where with a simple handshake with friend or colleague can allow you to exchange contact information However, these biomolecular computers has its own downsides. Organic compounds have a short half-life and can decay over time which can render computer inoperable or produce incorrect outputs. The results produced here are hard to analyse. Molecular operations are not perfect and errors occur during a DNA replication. So, computational errors might occur and increase with the complexity of the program.

However, Moore's law states that silicon microprocessor's complexity will double every 18 months and one day this will no longer hold true if miniaturization limits are reached. Hence, we need to find an alternative, a successor to silicon that is not only efficient but also reliable and accurate. Ultimately only time will tell if this method truly becomes all that researchers and the scientists say it will, but regardless it's going to be interesting to witness an alliance of biology and computer sciences filled with futuristic ideas new and radical with performing abilities magical, in an attempt to make life a spectacle.