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Controlling Graphene Nanopores: Sequencing DNA

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The study of genetics and our DNA sequence has been proven to be beneficial in numerous ways. Currently, the only downfall fell into play when the cost was being tallied for the resources required to sequence DNA. When cost is being evaluated many question whether the benefit outweighs the cost, but what if I told you there was an alternative. Not only is this alternative less costly, it is also just as effective. Would you believe me? A few questions may arise when first starting to understand this article. The first question might be what is sequencing DNA? What is the importance of sequencing DNA? How much money is the new process actually saving us? Does it really work? Throughout this article I plan to answer all of the about question and tell you exactly what the new process is like and why it is important. Discussion will cover the basics of the article and in conclusion the current problems that could possible arise will be conversed.

Introduction

In order to understand the relevance of this article I found it necessary to fully understand DNA sequencing, its importance, and the current cost needed. DNA sequencing is the process of reading the nucleotide bases in a DNA molecule. In other words, this is used to determine the order of four bases (adenine, guanine, cytosine, and thymine) is a particular strand of DNA. Medical personnel use this process to make decisions and it can be used to further biological research. Most people know that the first DNA sequencing or reading was done during and by the Human Genome Project. What people may not know is that is cost $2.7 billion. Since the Human Genome Project researchers have put a lot of time and money into trying to reduce the cost.

The above image shows how a strand of DNA looks once is has been untwisted. This image also allows one to see how the base pairs are put together. Typically the DNA would replicate from the point of separation to form two new strands of DNA. In the case of DNA sequencing, they break down the strands of DNA to find disease or be able to predict where the problem lies and how they could possibly prevent it.

Recent Progress

Scientists have discovered that by shrinking the size of the graphene to less than one nanometer it would be possible for the graphene to thread and read a DNA strand. By using this as a tool, graphene is a much more cost effective tool. Graphene is formed by sheets of bonded carbon atoms. This is also believed to be one of the strongest materials ever measured.

Once researchers discovered how thing and strong the material is, they began to search for a way to control its pore size. Sequencing DNA at a cheap cost would allow and enable scientists or doctors to predict numerous aspects of life. They could better diagnose a disease or tailor a drug to match and individual's genetic code. This nanomaterial's goal would be to reduce the cost to less than $1,000 per person. When the cost of sequencing DNA is lowered by a large amount it becomes much more effective for doctors to use it.

The above image shows a study done my a team of researchers. They decided to use an electron beam from an advanced electron microscope. This team also used *in-situ* to heat the sample up to 1200 degrees Celsius. During this test the team was able to shrink the spores. These techniques also won't work without one or the other. These are transmission electron microscope images of a nanopore in graphene. One the left is an image of an original pore and on the right is a pore after going through treatment. Pores will either shrink or grow depending on the temperature.

Discussion

A few problems would now arise. One being the management of the growing or shrinking of the pore. Scientist would have to make sure they had the process perfected to where they were shrinking all the pores and not growing them. Along side of that, researchers know the pore size could be controlled but can it be prototyped. Controlling graphene would put us one step closer to making all of this happen. Advancements made medically could have the possibility to become limitless.

References

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