



Improvement of Medical Techniques Through Nanotechnology



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INTRODUCTION

Nanotechnology is the study and use of objects that measure between 1 nanometer and 100 nanometers (An Introduction to Nanotechnology, 2007). The applications of these technologies in the field of medicine are endless, from delivering drugs with maximum efficiency to removing blood clots. Through nanotechnology, current medical techniques may reach peak efficiency, saving many more lives. Many techniques that are currently in wide use in the medical field, such as the "stent-retriever thrombectomy" procedure, are not as effective and can harm the patient. By combining or altogether replacing these older techniques with nanotechnology, doctors will be able to save many more patients.

There has been a lot of research conducted on applications of nanotechnology, such as improving produce life and improving food packaging. Nanotechnology research in medicine, however, is not nearly as broad as in other fields. Most medical research conducted has been for very specific applications, such as one specific cancer. There is a gap in knowledge for applications that are more broad, such as detection for multiple types of cancer instead of just one or using techniques developed for one purpose on something else.

Research Question:

In what ways will the development of nanotechnology improve current medical techniques to their full potential in efficiency?

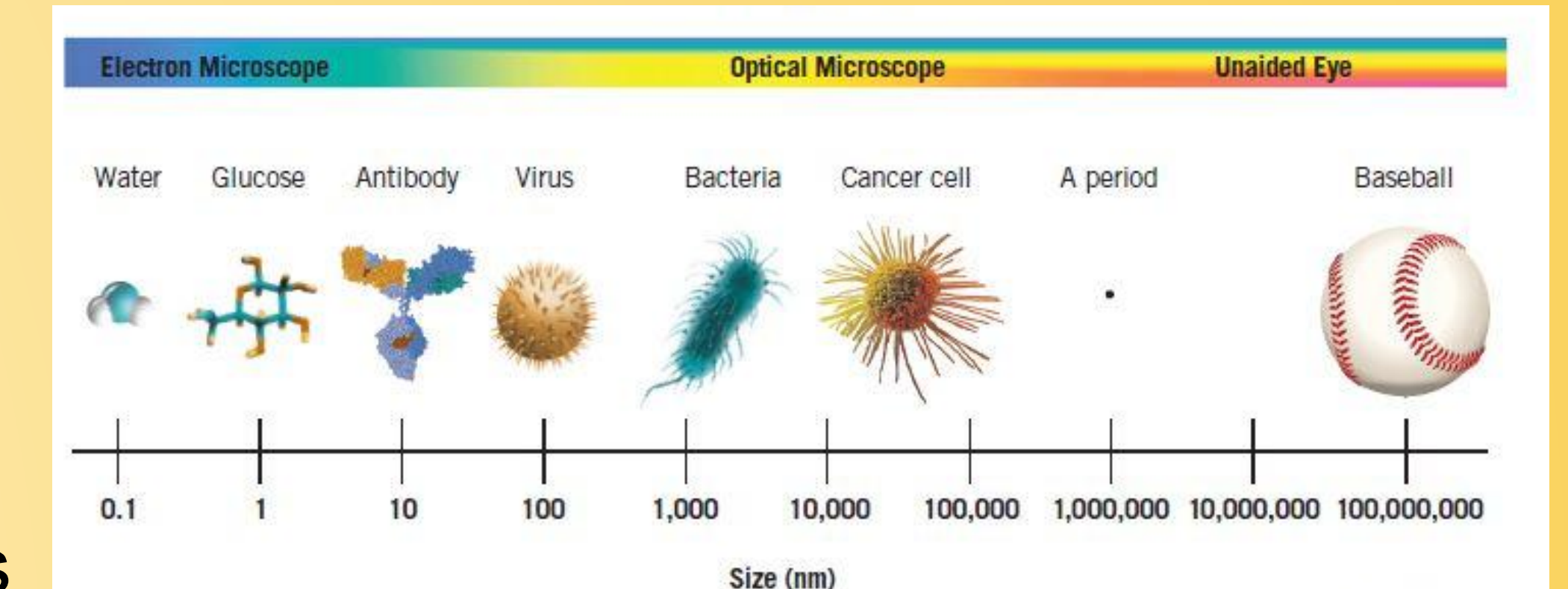


Figure 1. Various objects on the nanoscale.

Figure 2. Techniques such as the ones shown will revolutionize the future of medicine. These nanotech techniques will all increase the effectiveness of the treatment and benefit numerous lives.^{2 6 10 11 14}

Blood Clot Removal²

The current technique is called a stent retriever thoracotomy, and it involves threading a stent through the blood clot and physically dragging it out through the blood vessels.



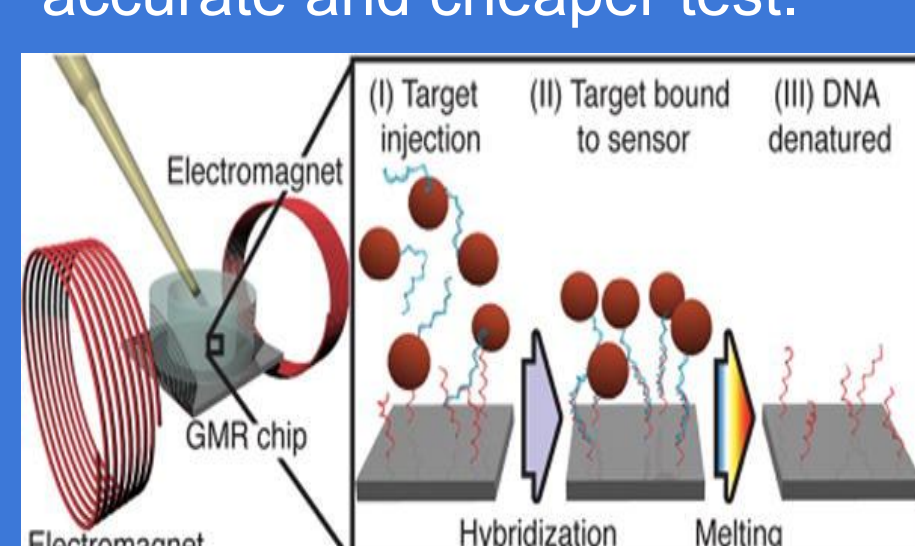
The nanotechnology improved technique involves injecting a shear activated nanotherapeutic (SA-NT) that carries a plasminogen activator (r-tPA) that dissolves blood clots into the bloodstream



Melanoma Detection¹¹

The current technique for cancer detection includes numerous tests that costs up to \$50,000¹⁴. Many of these tests are unnecessary depending on the patient's condition and are just a waste of money and time.

A new cancer detecting technique involves magnetizing DNA such that nanoparticles will attach to it. When heated, the nanoparticles attached to healthy DNA will fall off, while those attached to cancer-causing genes will stay attached, offering one accurate and cheaper test.



Medical Imaging¹⁰

Currently, most hospitals use imaging techniques such as CT scans and x-rays. These imaging machines work by firing wavelengths through the body that can penetrate certain masses but will bounce back from others.



Quantum dots are nanoparticles that are able to be programmed to emit any wavelength. Depending on what the doctors are looking for in the patients, they would be able to program the nanoparticles to emit the wavelength necessary.



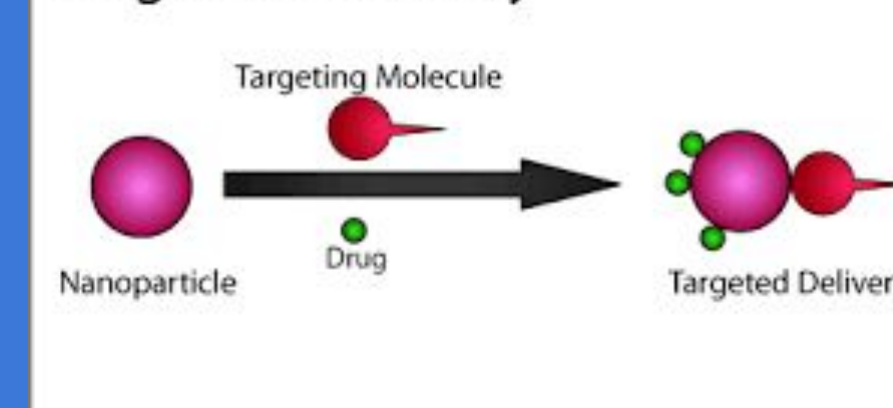
Drug Delivery⁶

Drugs are most commonly administered orally through tablets.



Nanoparticles that carry the necessary drug can be programmed to target a certain organ or muscle that needs it through injection, allowing for higher rates of effectiveness.

Targeted Delivery



ANALYSIS:

Blood Clot Removal:

Using the stent to physically drag out the blood clot may cause a lot more harm in the process. As it is going through the vessels, small fragments of the clot may break off and form multiple micro blood clots throughout the body. By using the nanotechnology method, the risk to the patient is reduced many times as the blood clot is completely dissolved and is removed through the bloodstream.

Melanoma Detection:

Although this technique is only currently being used for one type of cancer, melanoma, it can definitely be expanded in the future. Later on, one test utilizing the same concept could test for a variety of cancers, saving the patient and the doctor time and money.

Medical Imaging:

Since CT scans and x-rays are at set wavelengths, they could interfere and damage tissues that do not need to be scanned. By using quantum dots that can be programmed to cater to the patient's needs, doctors will be able to avoid unnecessary tissue damage.

Drug Delivery:

Without the need to pass through the digestive system, in which much of the actual drug is lost through enzymes, this technique allows direct delivery to the target organ. This yields maximum efficiency with the least hassle.

FUTURE DIRECTIONS FOR NANOTECHNOLOGY

As technology evolves and nanotechnology is further developed, there will be continued research in the medical field. Future research will most likely include looking at ways to improve upon the nanotech medical techniques even further. Perhaps creating a pill patients can swallow containing nanobots that can dissolve a blood clot without need for an incision. The nanotechnology-improved techniques in Figure 2 is an important part of nanotechnology research, as it is one of the world's first looks into what nanotechnology can accomplish. For each of these techniques, scientists will continue searching for ways to improve upon it, most likely in a minimally invasive way for most efficiency. The future is now, the future is small, it is nanotechnology.



ACKNOWLEDGEMENTS / REFERENCES

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