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A New Way out of Cancer: Nanotechnology

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Biology 120: Anatomy and Physiology II
December 5, 2017.

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In the United States there were an estimated 595,690 fatalities from cancer in 2016,[1] meaning that there were an average of 1632 deaths per day just in the US. For an extended period of time, modern medicine has been trying to find a cure for cancer. However, it has not been one hundred percent su ing from cancer. Nanotechnology is an advan sues and cells of cancers. It is a technology that works at the macromolecular level, allowing the alteration of matter at a range of 1 nanometer to 100 nanometers.[2] Many devices based on nanotechnology have been developed in order to combat cancer including nanotubes, which can trace and pinpoint regions that have suffered mutations in the DNA.[3] In addition, nanotechnology h developed drugs and methods to combat cancer such as drug immunoconjugates which c increase the efficacy of modern cancer medicine.[4] Therefore, nanotechnology is an effici to save eople dying and suffering from cancer. However, nanotechi an unex afety may be a concern for many people such as the toxicity of nanomaterials, can be dangerous. Societ cer

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Body Paragraphs: double – spaced. No extra space between paragraphs

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[1] Rebecca L. Siegel et al., "Cancer Statistics, 2016", *CA: A Cancer Journal for Clinicians*, 66, no. 1 (January 2016): 9. *Academic Search Complete EBSCOhost*, accessed 16 Jun. 2017. doi:10.3322/caac.21332.

[2] Adam Capon et al., "Perceptions of Risk from Nanotechnologies and Trust in Stakeholders: A Cross Sectional Study of Public, Academic, Government and Business Attitudes", *BMC Public Health* (2015): 1. *Academic OneFile EBSCOhost*, accessed 14 Jun. 2017. doi:10.1186/s12889-015-1795-1.

[3] Elvis A. Martis et al., "Nanotechnology Based Devices and Applications in Medicine: An Overview", *Chronicles of Young Scientists*, 3, no. 1 (Jan. 2012): 69. *Academic Search Complete EBSCOhost*, accessed 14 Jun. 2017. doi:10.4103/2229-5186.94320.

[4] F. Alam et al., "Unique Roles of Nanotechnology in Medicine and Cancer", *Indian Journal of Cancer*, no. 4 (2014): 507. *Academic OneFile EBSCOhost*, accessed 14 Jun. 2017. http://184.71.180.254/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=edsgao&AN=edsgcl.442756825&site=eds-live&scope=site

and nanotechnology is a viable solution because it can be used to increase the efficacy and lower the levels of toxicity of cancer treatment through the many drugs, devices, and methods developed based on this technology.

↔ First of all, many people perceive nanotechnology as a risk to their lives, a study published in 2015 by Capon et al. states that the "Australian public perceives greater risks from manufactured nanomaterials".[5] Nanomaterials and their collateral damage are not yet fully known, and this is why many people do not feel safe using treatments based on nanotechnology. In addition, for a long period of time chemotherapy has been used to treat cancer, and patients are already familiar with how it alters their bodies. Even though there are many disadvantages of using chemotherapy, the side-effects are well-known and this is the reason why many people feel safe using this method. Consequently, a great number of people do not accept nanotechnology because they are afraid. Moreover, it is true that nanotechnology is not completely safe because nanoparticles can be toxic to organs. Even though cancer can be cured, many organs might be damaged by this method. That is to say, nanotechnology is still underdeveloped and it is not safe for use in human beings because it can cause serious side-effects such as lung inflammation.[6] Therefore, it might be safe to say that this treatment should not be allowed into the public since the aftereffects of this technology may be dangerous for patients.

↔ Nevertheless, Nanotechnology is a promising alternative to improve the efficacy of cancer treatment and reduce its side-effects. Firstly, a more appropriate way to eliminate tumor cells is by using Photodynamic therapy because it has low rates of aftereffects. This method uses

[5] Adam Capon et al., "Perceptions of Risk from Nanotechnologies and Trust in Stakeholders: A Cross Sectional Study of Public, Academic, Government and Business Attitudes", 11.

[6] F. Alam et al., "Unique Roles of Nanotechnology in Medicine and Cancer", *Indian Journal of Cancer*, 507.

laser light with a specific wavelength in order to cause a phenomenon known as photo-damage, which transfers energy to an oxygen, inducing the production of a singlet oxygen. This method causes a microvascular injury and blood vessel blockage in a cancer tumor and it eradicates specific tumor cells.[7] This process, known as Photodynamic therapy, allows doctors to eliminate parts of the tumor leaving behind the undamaged tissues. In other words, eliminating tumor cells by using this method is more efficient because it can lower the damage caused in other parts of the body. Secondly, one of the difficulties with

Titles of books, journals, films, newspapers, magazines and website names are *italicised*.

that it not only targets and eliminates cancer cells, but also it causes the elimination of many regular cells in these procedures. The *Iranian Journal of Pharmaceutical Research*, claims that "Common anticancer drugs also influence normal cells and cause severe side effects".[8] However, nanotechnology has already found a way to overcome this issue. There are many devices based on nanotechnology that can precisely target only cancer cells. One such device to treat cancer is known as a nanotube, which can transform light energy into heat and is able to precisely eliminate cancer cells[9] and accurately identify anomalies in the DNA.[10] It means that devices

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[7] Flávia Arruda Portilho et al. "Antitumor Activity of Photodynamic Therapy Performed with Nanospheres Containing Zinc-Phthalocyanine", *Journal of Nanobiotechnology*, 11, no. 1 (January 10, 2013): 6. *Academic Search Complete EBSCOhost*, accessed 16 Jun. 2017. doi:10.1186/1477-3155-11-41.

[8] Mahmoud Jafari et al. "Synthesizing and Characterizing Functionalized Short Multiwall Carbon Nanotubes with Folate, Magnetite and Polyethylene Glycol as Multitargeted Nanocarrier of Anti-Cancer Drugs", *Iranian Journal of Pharmaceutical Research*, 15, no. 2 (Spring 2016): 449. *EBSCOhost*, accessed 15 Jun. 2017. http://184.71.180.254/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=116507078&site=eds-live&scope=site.

[9] Idit Dotan et al. "Engineering Multi-Walled Carbon Nanotube Therapeutic Bionanofluids to Selectively Target Papillary Thyroid Cancer Cells", *Plos ONE*, 11, no. 2 (February 22, 2016): 1-18. *Academic Search Complete EBSCOhost*, accessed 15 Jun. 2017. doi:10.1371/journal.pone.0149723.

[10] Elvis A. Martis et al., "Nanotechnology Based Devices and Applications in Medicine: An Overview", 69.

such as nanotubes can faster diagnose cancer and precisely eliminate the root of the illness. Lastly, there are classes of drugs based on nanotechnology that have higher cancer treatment efficacy. One promising development is drug immunoconjugates, which can increase antitumor effects and decrease the level of toxicity of therapy.[11] The accomplishments achieved through the use of nanotechnology show that it has already made huge progress and surpassed current conventional cancer treatment options.

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It is important to understand that a large number of people ar consequences that nanotechnology can have because it is a new tech might still be discovered. Nanotechnology still unknown to many people and it is not a surprise that they are not well-informed about the topic. The article "Current research on public perceptions of nanotechnology", published in *Emerging Health Threats Journal*, shows that a great number of people do not have any familiarity with nanotechnology.[12] It is challenging to ha cted to accept a science that is not fully understood. In other words, it is clear that many people do not know how nanotechnology could positively affect their health so they assume it will have negative side-effects on their bodies. However, a study shows that public perception about nanotechnology is more positive when people are more knowledgeable.[13] More specifically, it claims that "Higher levels of familiarity

Titles of books, journals, films, newspapers, magazines and website names are ***italicised***.

[11] Pamela Trail et al. "Monoclonal Antibody Drug Immunoconjugates for Targeted Treatment of Cancer, 328.

[12] J. Besley. "Current Research on Public Perceptions of Nanotechnology", *Emerging Health Threats* (December 3, 2010): 7. *Academic Search Complete EBSCOhost*, accessed 14 Jun. 2017. http://184.71.180.254/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=56443563&site=eds-live&scope=site.

[13] Saji George et al. "Awareness on Adverse Effects of Nanotechnology Increases Negative Perception among Public: Survey Study from Singapore", *Journal of Nanoparticle*

with nanotechnology were associated with higher benefit perception in general."[14] In other words, the lack of knowledge may influence their perception of its safety. It means that if those people acquire a better understanding of nanotechnology their minds may change to a positive perception of it and they will feel safer.

The concern about toxicity is not completely misplaced because nanotechnology does have toxic properties. Even though it might be toxic, the side-effects seem to be lower than those from other methods already being used. For example, chemotherapy is less beneficial than nanomaterials because its side-effects are more dangerous than those from nanotechnology. It is true that nanomaterial can be toxic but its efficacy has developed to a level that it can precisely target and treat just the unhealthy part of the body, while the healthy parts of the body remain intact, meaning that nanotechnology has already reduced the level of toxicity of treatments. This proves that the toxicity of nanomaterials is continuing to be reduced and, in the future, it can get to a point where nanotechnology is not going to be toxic at all. This can lead to an effective treatment of cancer that does not have any side-effects, which is exactly the goal of many cancer treatments. Therefore, the advantages of nanotechnology are much higher than the disadvantages, which means that nanotechnology is the key to saving more lives from cancer.

Many people are suffering from cancer, and modern medicines, such as chemotherapy, which are already being used have not been able to save the 595,690 American lives lost in 2016.[15] The large number of people dying from cancer is a medical issue that must be solved, and a promising way to find a solution is by using nanotechnology because it has already

Research, 16, no. 12 (December 2014): 9. *Academic Search Complete EBSCOhost*, accessed 15 Jun. 2017. doi:10.1007/s11051-014-2751-1.

[14] Ibid.

[15] Rebecca L. Siegel et al., "Cancer Statistics, 2016", 9.

improved modern medicine by efficiently decreasing the severe side-effects caused by cancer treatment. This is because nanotechnology successfully treats cancer without damaging the healthy cells of the body while minimizing the toxicity level of the therapy. Therefore, it is safe to say that one way to preserve the life of cancer patients is to use treatments based on nanotechnology because the results are better and the damage is much lower than those from established conventional treatments.

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