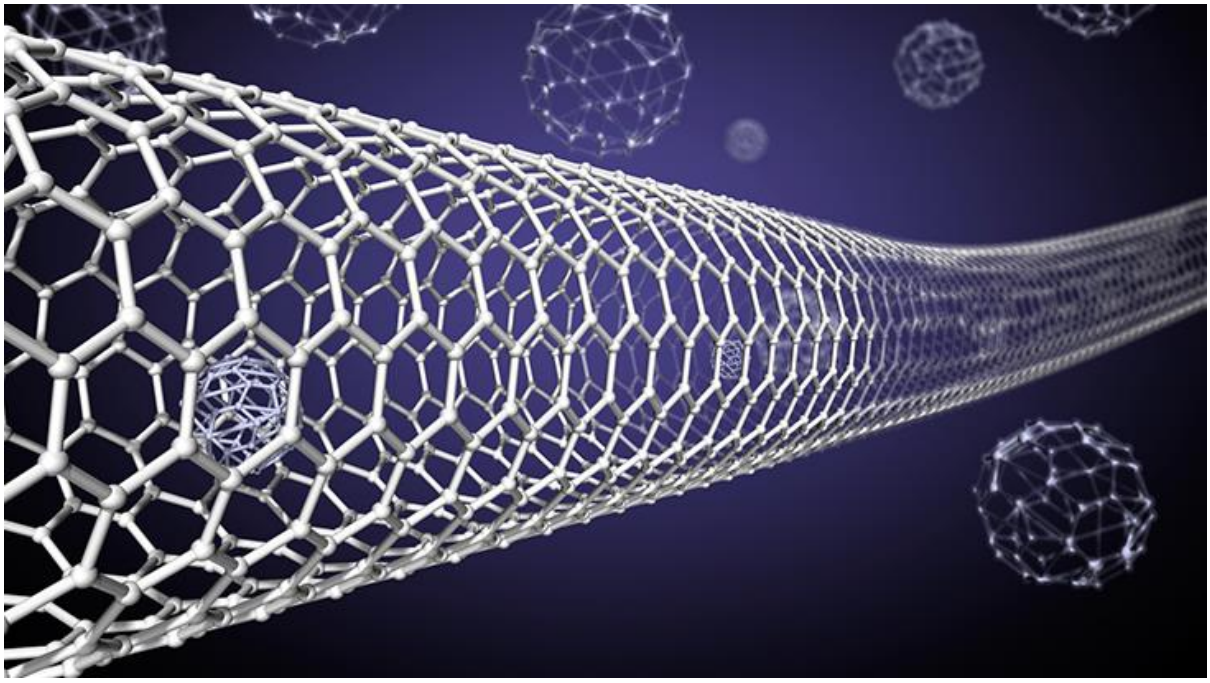
ECU JOONDALUP GROUP BROCHURE

Nanotechnology Past, Present and Future

SCI1125 Professional Science Essentials

Lachlan Burr, Josh Light, Tom Foster and Ryan Hinrich

4/24/2016



Our brochure is highlighting our nanostructures have always shaped life from nature to manmade nanostructures from the Past, Present and Future.

History of Nanotechnology

Modern Nanotechnology was born from Richard Feynman's lecture which was presented in 1959, he talked about manipulating matter at an atomic matter. The next breakthrough in nanotechnology was the proposal of the nanometer was first proposed by Richard Zsigmondy and he was the first to measure particles using a microscope. The term nanotechnology was first used by Japanese scientist Norio Tanaguchi when he was describing semiconductor processes occurring on a nano level in 1964. He supported the idea that nanotechnology consists of processing, separation, consolidation, and deformation of materials on a nano scale. In the 1980's the so called "golden era of nanotechnology began, a group of scientists from the Massachusetts Institute of Technology (MIT) used ideas from Feynman and Tanaguchi to propose the idea of an "assembler" on the nanoscale that would be able to build structures from molecules and atoms of arbitrary complexity. The development of carbon nanotubes advanced the science of nanotechnology, their novel properties were useful in a variety of technologies like electronics and optics. In the year 2000 American President Bill Clinton advocated further funding into the field of nanotechnology. A large component of the development of nanotechnology was the innovations of technology and in 2003 President George Bush approved the Century Nanotechnology Research and Development Act. This legislation prioritised research into the field of nanotechnology and created the National Technology Initiative (Hulla, Sahu, & Hayes, 2015). In 1931 Russian scientist Ernst Ruska developed and built the world's first electron microscope which was capable of magnifying to 400x. Today's electron microscopes are able to magnify up to 10,000,000x and are vital to the development of nanotechnologies (Tourney, 2012).

Figure 1 Scanning Electron Microscope (serc.carleton.edu, 2016)

Figure 1 Early Electron Microscope (www.microscopy.ethz, 2016)

Nanotechnology in Nature

Mankind has only recently discovered nanotechnology compared to nature, which has been building upon the foundations of the technology for billions of years on the molecular scale.

Cancer Treatments

Nature plays a crucial role in nanotechnology projects and research. Nature has led to incredible discoveries in research, like possible ways to cure cancer patients, which is being closely studied by Oncologists. The idea of Nanotechnologists, whom study cellular biology, is to engineer minute vessels perhaps 100 nanometres wide, which can carry small amounts of does of anti-cancer drugs.

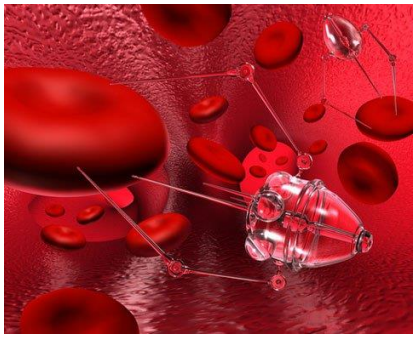


Figure 1. (Dean Wilson, 2012

Aquaporins

Microscopic crystals, roughly one nanometer wide, are used as incorporated vacuum cleaners on the surface of the lotus leaf. These microscopic crystals help with keeping the leaf's surface clean, by using water droplets to wash away dirt and dust off of the surface of the leaf. This keeps the leaf clean and protects it at all times. In plants, as well as some animals, specific pores, called aquaporins, regulate the movement of water into and out of cells; this is a crucial role in survival. Plants use these aquaporins to extract water from the soil into the roots.

Figure 2. 'Inspired by Nature' (2014)

Gecko's

Gecko lizards have been known to be able to walk up walls and stick to ceilings. The reason that gecko's are able to do this is because of nanotechnology. Microscopic, hair-like technology on the bottom of the lizard's feet gives them the ability to do this. The tiny technology creates an enormous amount of surface area on the lizard's feet, which outweighs the animal's body weight, essentially giving it the ability to dismiss the laws of gravity.

Figure 3. (Colin Stuart, 2011)

Continuing research into the evolution of nanotechnology is revealing a lot more about nature that previously, was unrecognized. The continuing discovery of nanotechnology will benefit scientists with research to help solve many problems using nature's nanotechnology.

Nano-manufacturing and applications

Most advantages of nanotechnology rely on the way that key structures of nanoscale materials yield particular properties, significantly broadening the all round utilized toolboxes of materials science. Utilizing nano-technological materials can viably be made to be more grounded, lighter, more solid, more receptive, more sifter like, or better electrical conductors, among many other qualities ("Benefits and Applications", n.d.) Researchers are investigating the idea of putting certain atomic scale components together that will spontaneously "self-assemble," from the base up into requested structures. This is only a theory but maybe one day, this dream that researchers share, could become a reality.

The basics of nano-manufacturing

Nano-assembling is assembling utilizing nano-scale materials in order to deliver the up and coming era of items that give higher execution at a lower cost, as well as enhanced supportability for the 21st century. Nano-fabricating exploits the novel properties of nano-scale materials to make synergistic, utilitarian items (“What is nanotechnology,” n.d.).

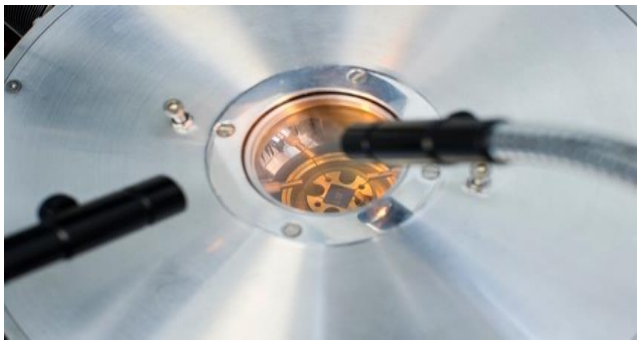


Figure 2(Herring, 2012)

Constructing nanoapplications

Nano-producing involves atomic assembling, which is the fabrication of complex, nano-scale structures by method of non-biological, mechanical assembling techniques. Nano-fabricating has been applied to products such as gauze, tennis balls, body armor, batteries, medical and bio-medical equipment, solar panels, pregnancy tests, and many more items ("The 9 Best Nanotechnology-Powered Products", 2010).

Figure 3(“Exponent,” n.d.)

The benefits of nano applications:

Nano-manufacturing additionally incorporates the examination, advancement and integration of top-down procedures and progressively complex base up procedures (two essential techniques). In more basic terms, nano-fabricating prompts the generation of enhanced materials and new items (nano.gov, n.d.). This could lead to more jobs being available in the future for students and researchers who are interested nano-technological research.

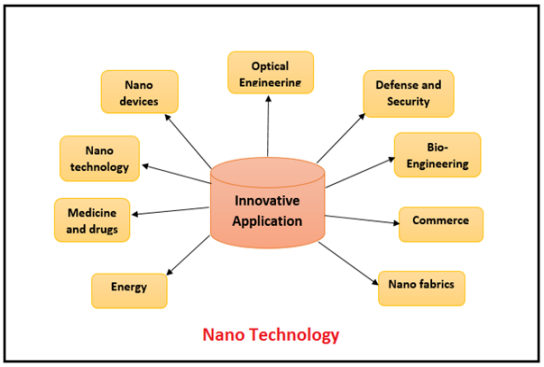


Figure 4 (civilserviceindia.com, 2016)

Nanotechnology, The Future and Beyond

The anticipated effect of nanotechnology has been touted as a second revolution which will be bigger than the huge industrial revolution (Khan,2016). After seeing exactly how quick nanotechnology has advanced in the course of the most recent 40 years we can just envision where the following 40 will take us. We have focused on everyday objects that at some point will have the nanotechnology treatment to become easier and better to use. Just this past month the Iowa State University has released the **invisible radar skin (figure 1) that soaks up radar waves to be invisible to detection**. (Iowa State University, 2016)

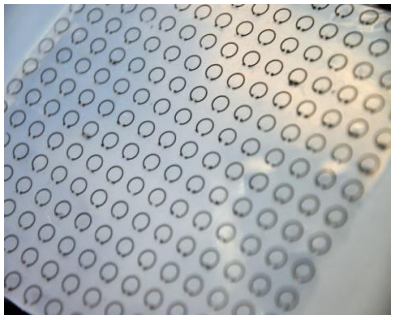


Figure 5. (Iowa state University,2016)

Highly Complex GPS

Future components are on the front line of getting to be smaller than ever. PC's will utilize nanotechnology to shrivel the extent of silicon chips, expand speed and power. This can be shown by the Orion Payload; a revolutionary GPS designed by Massachusetts Institute of Technology which is the size of two small coins shows how far nanotechnology is advancing in the short time it's been available to us. This will bring about a revolution of the PC showing the true power of what a computer do. (Sahoo,Parveen & Panda, 2007)

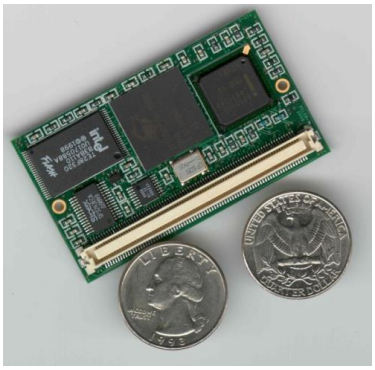


Figure 6. (Orion Payload, 2016)

Smart Contact Lenses

The latest research of nanotechnology in the field of material incorporates delivering fabrics with unique properties installed in them. Samsung has just recently patented in South Korea for a wearable contact lens which will allow the user to have augmented virtual reality and the ability **to monitor blood sugar levels and heart rate** without having to wear visible eyewear like the Google Glass. (Yeung, 2016)

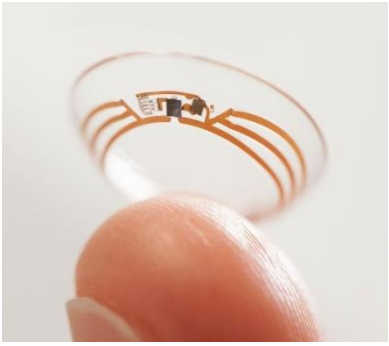


Figure 7. (www.HypeBeast.com, 2016)

The Future and Beyond

We can determine that nanotechnology will change material substances, human life and more significantly than numerous improvements of the past. They can possibly achieve noteworthy advantages, for example, enhanced wellbeing, better adapt resources and to diminish natural contamination for example oil spills by using microorganisms to eat the oil spill. (Mahajan, 2011)

Figure 8. (www.news.xinhuanet.com, 2016)

References

Are There Natural Nanotechnologies? (2015). HowStuffWorks. Retrieved from http://science.howstuffworks.com/natural-nanotechnology.html

Benefits and Applications. Nano.gov. (n.d.). Retrieved from http://www.nano.gov/you/nanotechnology-benefits

Exponent. (n.d.). [Photograph]. Retrieved from http://www.exponent.com/consumer_products/

From Nature to Nanotech. (2014). Nise Network. Retrieved from http://www.nisenet.org/catalog/programs/biomimicry_nature_nanotech

Herring, A. (2012). A custom probe station that varies temperature and atmospheric pressure to measure the electrical properties of materials at the Center for High- rate Nanomanufacturing. [Photograph by Brooks Canaday]. Retrieved from http://www.northeastern.edu/news/2012/08/a-small-scale-solution-with-a-large-scale-impact/

Inspired by Nature. (2012). [Photograph]. Retrieved from http://www.greenshieldfinish.com/inspiredByNature.htm

Mexico, U.S. to evaluate oil-spill impact on Gulf of Mexico. (2016). News.xinhuanet.com. Retrieved 22 April 2016, from http://news.xinhuanet.com/english2010/world/2010-05/12/c_13290509.htm

Hulla, J., Sahu, S., & Hayes, A. (2015). Nanotechnology: History and Future. Human and Experimental Toxicology, 34(12), 1318-1321. http://dx.doi.org/10.1177/0960327115603588

Iowa State Engineers develop flexible skin that traps radar waves, cloaks objects- News Service- Iowa State University. (2016). News.iastate.edu. Retrieved 13 April 2016, from http://www.news.iastate.edu/news/2016/03/04/meta-skin

Khan, A. (2016). Ethics and Nanotechnology, 1-14. http://dx.doi.org/http://dx.doi.org/10.1109/ETHICS.2014.6893462

Liddle, J. A., & Gallatin, G. M. (2016). Nanomanufacturing: A perspective. ACS Nano*, 10*(3), 2995. doi: 10.1021/acsnano.5b03299

Mahajan, Y. (2011). *Nanotechnology-based solutions for oil spills*. *Nanowerk.com*. Retrieved 22 April 2016, from http://www.nanowerk.com/spotlight/spotid=20215.php

Manufacturing at the Nanoscale. Nano.gov. (n.d.). Retrieved from http://www.nano.gov/nanotech-101/what/manufacturing

'Manufacturing at nanoscale', Report of the National Nanotechnology Initiative Workshop, 2002-2004, NIST - Gaithersburg, MD

Massachusetts Institute of Technology (2016) http://www.mit.edu/people/jhow/orion/Jan01/OrionPL_dev.htm

Nanotechnology has numerous applications. (2016). [Photograph] Retrieved from http://www.civilserviceindia.com/subject/General-Studies/notes/awareness-in-the-fields-of-nano-technology.html

Nanotechnology in Everyday Life. (2011). [Photograph]. http://www.theguardian.com/nanotechnology-world/nanotechnology-in-everyday-life

Nanotechnology Inspired by Nature. (2015). Nanomagazine. Retrieved from http://www.nanomagazine.co.uk/index.php?option=com_content&view=article&id=114:editorial-nanotechnology-inspired-by-nature&catid=47&Itemid=151

Scientists Working on Using Nanobots to Cure Cancer. (2012). [Photograph]. Retrieved from http://vr-zone.com/articles/scientists-working-on-using-nanobots-to-cure-cancer/17337.html

Sahoo, S., Parveen, S., & Panda, J. (2007). The present and future of nanotechnology in human health care. *Nanomedicine: Nanotechnology, Biology And Medicine*, *3*(1), 20-31. http://dx.doi.org/10.1016/j.nano.2006.11.008

Schulz, P. (2013). Nanotechnology: a slightly different history. Ciência Hoje, 308, 26-29.

Stuart, C. (2011). Nanotechnology in Everyday Life. The Guardian. Retrieved from http://www.theguardian.com/nanotechnology-world/nanotechnology-in-everyday-life

The 9 Best Nanotechnology-Powered Products | DiscoverMagazine.com. (2010). Discover Magazine. Retrieved from http://discovermagazine.com/galleries/zen-photo/n/nanotech-products

Tourney, C. (2012). Probing the history of Nanotechnology. Nature Nanotechnology, 7, 205-206.

Yeung, H. (2016). *Samsung Patents Smart Contact Lens Technology With Built-In Camera*.*Hypebeast*. Retrieved 13 April 2016, from http://hypebeast.com/2016/4/samsung-smart-contact-lens-camera