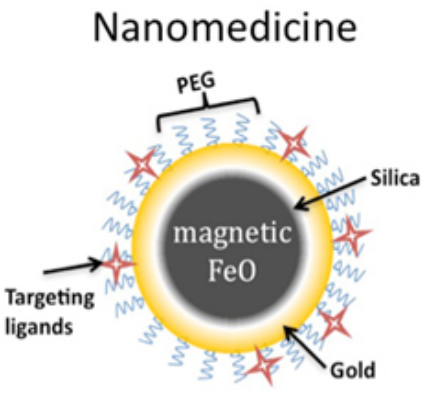
An informative and explanatory article to be posted in a blog

Nanotechnology: where is the medical industry heading?

Over the past century nanotechnology has become a major part of millions of people's lives across the globe. It has given them access to resources that before were previously only available to the military and the extremely wealthy. Today, there is more processing power in a smartphone than there was in a super computer during the 20th century. As a result of this rise in quality and demand of technology, scientists are beginning to adapt it into different areas of society. Examples of this are that there are new media systems that people can watch films on and surf the internet that are less than 5 mm thick, and nanomanufacturing tools that can help assemble a skyscraper to nanometer accuracy. Now as the nanotechnology has progressed even further, the medical industry is becoming a very important branch of it. New nanotechnologies are being tested every day in the medical industry to try and eliminate the epidemics and life threatening conditions like cancer of the modern world.

The current principles of nanotechnology in medicine are simple in that it is trying to cure illnesses by creating alternate and more effective method of introducing medicine into targeted cells in the human body. This can be done in many ways and there are now many varieties of nanotechnology in medicine. One of the current nanotechnologies that are being developed is called 'smart drugs' which involves attaching drugs for treating cancer used in chemotherapy onto tiny proteins that are 1 billionth of a meter in size (hence the name Nano). These proteins (once in the body) are attracted to the sites of tumours or cancerous cells and destroy them with minimal damage to healthy cells. An example of one of these would be glivec which has been proven to work effectively against cancer cells in the treatment of Leukaemia. Previously these drugs would usually have to be taken in through a drip and effect all the cells that they come in contact with and take a huge length of time to be effective. Whilst treatment with 'smart drugs' is much more focussed which makes it more effective, less damaging to healthy cells and possibly most importantly in the future, cheaper because it means that less of the drugs need to be used which means that more people can be treated by the same volume of medicine that would previously cure one person.

Below is a diagram of how nanomedicine can be delivered. The core of magnetic iron oxide means that it can bind to the haemoglobin of the red blood cells and travel around more easily in the body. This mobility means that it can reach affected areas quickly and attack or detect a disease with a high level of accuracy. The targeting ligands bind to any diseased or infected cells and can either deliver the necessary treatment, or show doctors that there is a disease. The PEG on the sides stands for Polyethylene glycol and is a very good compound for forcing slow uptake of the medicine and lengthens its effect on the patient. This is being heavily researched in gene therapy and will be a huge part of nanotechnology in medicine in the future. The gold and the silica make up the structure of the outer membrane of the particle and are used because they are highly unreactive and are



contained in the human body.

In the future, scientists will be able to start using nanotechnology in tandem with stem cells to create proteins that can regrow and create new body parts for amputees and create tiny Nano robots that can be programmed to fight illnesses. This is in its early stages but it is a very promising prospect for world health and the elimination of the current epidemics and help disabled people to live more normal lives. Furthermore they can also be used to treat almost any illness and are much more efficient than our bodies antibodies because the can code for 10 times as many antigens. And can also be used as artificial red blood cells to help patients with bad circulation to have enough oxygen.

As a relatively new branch of medicine, on a social level, it has been welcomed by some people but rejected by others. This is due to the bad reputations that it has received from the film and science fiction industry. Where nanotechnology in the case of the film G.I Joe Rise of The Cobra is used for world terror and used to both control people (turning them into mindless robots in effect) and destroy world famous landmarks. However this is not what any of the nanotechnology in medicine of today and tomorrow are exacting. Despite many efforts, many people are scared of this prospect even with the possible medical breakthroughs that could be discovered from using technology like this. As this technology is developed and it becomes safe to use on humans there will be a huge political and social push to persuade people into believe in the technology and that it is safe and very beneficial for everyone. There will also be many safety measures to ensure the complete safety of nanotechnology before it is mass produced and is widely distributed.

In conclusion Nanotechnology in medicine is a very promising prospect in the medical industry because it is a very good for helping many chronically ill people get better and help everyone never get ill again. Also, Ralph Merkle, a leading scientist in nanotechnology has hypothesised that ‘If we can reduce the cost and improve the quality of medical technology through advances in nanotechnology, we can more widely address the medical conditions that are prevalent and reduce the level of human suffering.’ This is an extremely important point as one of the worst parts of diseases is the human suffering for both the person who is ill and the family and friends of that person who suffer because they care about the ill person. However, while Nanotechnology has much promise it needs to be kept under high security because it is an extremely dangerous prospect at the same due to the possible uses in biotechnological warfare as it would be catastrophic if it got into the wrong hands. However one thing that is clear is that nanotechnology will play a part in the lives of every person on the planet in the future and is a very promising direction for the medical industry despite the possible threats.