NANOTECHNOLOGY IN MEDICINE SCIENCE AND PATIENT OBSERVATION

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ABSTRACT:

Interacting with biological molecules, therefore at nanoscale, nanotechnology opens up a vast field of research & application. Interactions between artificial molecular assemblies or Nano-devices and biomolecules can be understood both in the extracellular medium and inside the human cells. Operating at nanoscale allow to exploit physical properties different from those observed at micro-scale such as the volume surface ratio.

The investigated diagnostic applications can considered for in vitro as well as for in vivo diagnosis. In vitro, the synthesized particles and manipulation or detection devices allow for the identification, capture, and concentration of biomolecules. In vivo, the synthetic molecular assemblies are mainly designed as a contrast agent for imaging and recognition.

Keywords: Nano devices; Nano material; Nano medicine; Nano pharmaceutics and Drug delivery

INRODUCTION

Advancement in the field of nanotechnology and its applications to the field of medicines and pharmaceuticals has revolutionized the twenty-one century. Nanotechnology [1] is the study of extremely small structures and biomolecule. The prefix “Nano” is a Latin Greek word which means “dwarf”. The word “Nano” means very small or we can say miniature size. Nanotechnology is the treatment of individual atoms, molecules, biomolecule or compounds into structures to produce materials and devices with special properties. Nanotechnology involve work from top down that means reducing the size of large structures to smallest structure egg. photonics applications in Nano electronics and Nano engineering, top-down o, which involves changing individual atoms and molecules into nanostructures and more closely resembles chemistry biology. Nanotechnology deals with materials in the size of 0.1 to 100 manometer; however it is also inherent that these materials should display different properties such as electrical conductance chemical reactivity, magnetism, optical effects and physical strength, from substance materials as a result of their small size. Nanotechnology works on matter at dimensions in the nanometre scale length (1-100 nm), and thus can be used for a broad range of applications and the creation of various types of Nano materials and Nano devices. Robotics and automation technology has played an extremely important role in the progress of human civilization. A famous example in the automotive industry, where full robot automation is generally found for car body assembly, press tending, , coating and to some extent for engine and power assembly [11], considerably improving the efficiency of automotive production since 1970s [12]. In recent years, many self-determining robotic systems at the microscale have been developed for diverse biomedical applications, such as assembly of vascular-like microtube [13],3Dmorphologicalandmechanical characterization of single plant cells [14], cell motility analysis cellular sample preparation [16], tissue- and organ-level physiology [17], and drug discovery [18]. The applications of R&A technology conversely promote the development of automation science and engineering. Now the requirements of personalized cancer diagnosis & treatment present automation with new opportunities. Currently, clinical drug susceptibility tests for individual patients are mainly dependent on manuallabor,involving several steps (e.g.,biopsy tissue extraction,cell culturing, tumour cell isolation & identification, drug addition, again cell culturing, and diverse biochemical assays) and each step takes a long time (often several days) [19]. If the time of clinical drug susceptibility test can be shortened by introducing automation technology, it will undoubtedly be of important significance for personalized cancer treatment.

Nanotechnology in medicine: the ideal scale

The aim of nanotechnology may be broadly defined as the comprehensive monitoring, control, construction, repair, defence and improvement of all human biological systems, working from the molecular level using engineered devices and nanostructures, ultimately to achieve medical benefits. In this context, nanoscale should be taken to include active components or objects in the size range from one nanometre to thousands of nanometres. These may be included in a micro-biological device (that have a macro-interface) or in a biological environment. The focus, however, is always on Nano-interactions within the framework of a larger device or directly within a sub-cellular system.

Nanoscience's and nanotechnologies implying
studying and working with matter at ultra-small scale. One nanometre is one-millionth of a millimetre and a single human hair is around 85,000 nanometres thick. Therefore, nanomedicine operates at the same size scale – about 100 nanometres or less than it – that biological molecules and structures inside living cells operate. A typical protein size lies between 3 to 10 nanometres, while red blood cells are a standard size of about 6000-8000 nm.

- analysing rare samples like some biopsies.

ACTIVE TARGETING

In the horizon are nanoparticles that will actively target drugs to cancers cells, based on the molecules that they express on their surface/volume. Molecules that bind particular cellular receptors can be attached to a nano-particle so that it especially targets cells expressing this receptor. Active targeting cells can even be used to bring drugs into the cancers cell, by inducing the cells to absorb the nano-carrier. Active targeting can be combined with passive targeting to further reduce interaction of carries drugs with healthy tissues. Nano-technology enabled active and passive targeting can also increase the efficiency of a chemotherapeutic, achieving more significant tumour and cancer reduction with lower drug doses.

Destruction from within

Moving away from conventional chemotherapeutic agents that activate normal moleculars mechanisms to induce cells death,

Is the nanoscale really adequate for medical technologies

Some physical laws are different at nanoscale, and this may be favourable or not for applications:

- The surface and volume ratio of particles becomes very large when size decreases, so that nanoparticles have a huge surface suitable for chemical interactions with biomolecules for instance. Moreover, (biomolecule)chemical reaction time are much shorter (it decreases sharply with sample size) and accordingly analytical devices are faster and more sensitive.

- The ultra-small size of the sensing part of a (micro)analytical device, with Nano pillars, Nano beads, can be possibly exploited for device miniaturization. Smaller devices offer a lower invasiveness can even be implanted within the body.

- Another advantage of the ultraminiaturisation of the sensing part lies in the ultra-small size of the biological sample required for measurement. This becomes a important feature for

researchers are exploring ways to physically destroy cancers cells from within. One such technology—Nano shells is being used in laboratory to thermally destroy tumours and cancers from the inside. Nano shells can be designed to absorb light at different wavelengths, generating heat (hyperthermia). Once the cancer cells take up the Nano shells (via active targeting), scientists apply near-infrared light that is absorbed by the Nano shells, creating an intense heat inside the tumours that selectively kills tumour cells without disturbing neighbouring healthy cells. Similarly, new targeted magnetic nano-particles are in developed that will both be visible and invisible through Magnetic Resonance Imaging (MRI) and can also destroy cells by hyperthermia.

Drug Delivery (mechanical) Devices

Implanted drug delivery devices can make benefits of nanotechnology. Examples are De-bioStar or Eg, fabricated by the Swiss company De-biotech. The Nano pum is a miniaturized drug delivery pump based on MEMS chips can be implanted for accurate dosing of various therapeutic compounds with dedicated delivery profiles. The Nano pump has been tested for instance for insulin delivery. The precision of nano-fabrication and micro techniques enable design and fabrication of ultra small devices with reservoirs, actuators, pumps to control accurately the release of pharmaceutical ingredients. Some parts of these micro systems are at nanoscale. Due to their small size and low invasiveness, these drug delivery devices can be implanted within the body, even in brain.

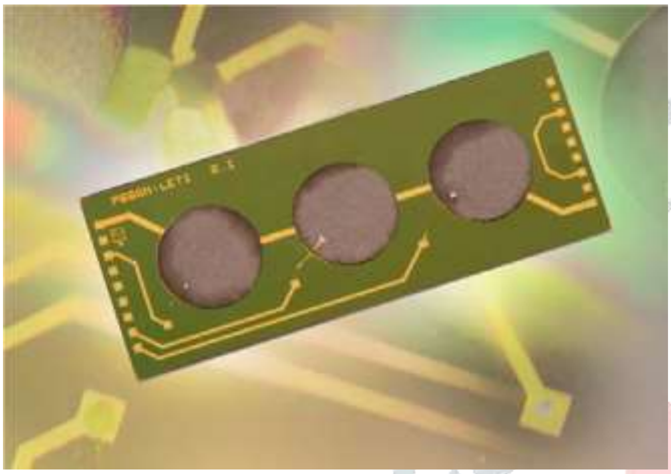

Fig 8: DELICE miniaturised pump technology for drug delivery. Credit: CEA-Leti

BIOMATERIALS

Mammalian cells behave in vivo in response to the biological signals they receives from the surrounding environment, which is structured by nano-metre scaled components. Therefore, materials used in repairing the human body have to reproduces the correct signals that guide the cells towards a desirable behaviour. Nano-technology is not only an best tool to produce material structures that mimic the biological ones but also holds the promises of providing efficient delivery systems. The application of nano-technology to generative medicine is a vast topic. It covers the fabrication of materials, such as nano-particles for tissues engineering, and surface nano patterning to elicit specific biological responses from the host tissue.

Future biomaterials must continuously enhance tissue regeneration while minimizing immunes response and inhibiting infection. While promoters of tissues engineering promised to develops materials that can trigger tissues generation for the entire body, such promises have yet not become reality. However, tissue engineering experience recently great progress due to the emergence of nano-technology. Specifically, it has been now well established that enhanced tissue regeneration can be achieved on almost any surface and volume by employing novel Nano-textured surface features. Numerous types of studies have reported that use of nanotechnology allows to accelerate various regenerative therapies, such as those for the bone, brain therapy vascular, heart, cartilage, bladder and brain tissue. Various Nano-structured polymers and metals (alloys) have been investigated for their bio compatibility properties.

Advantages of nanotechnology in medicine

- The First advantage, which is small size for medicine devices, achieved great success in medical field.
- By this advantage the treatment and detect the diseases become easier than using traditional devices, which have big sizes. Also, those devices with mini sizes facilitated surgical procedure.
- The surgeons can control those devices inside patient's bodies. By using iot and machine learning On the other hand, those devices proved its effectiveness in vitro by small devices, which called lap on ship. This lap on ship works as laboratory.
- The main goal of Nano-technology in medical field is that correct diagnose and early detection for diseases to effective treatment without side effects.
- Also evaluate the effective treatment by non-invasively methods. There is no doubt that nanotechnology become corner stone in medical field. Therefore many applications for nano-technology in cancer for fight pain, suffering and death.

Conclusion

Nanotechnology has and will continue to revolutionize the world through its remarkable functions, especially in the world of medicine. Wherever there is new technology, however, there is always debate. Some contest that nanotechnology is too powerful and could lead to destructive military weapons, and that research must be furthered before the naïve human race quickly rushes to use this potentially life-changing new technology. However, there remains no debate that nanotechnology is on the rise, and doesn't look to be slowing down anytime soon.Analysis says, global market for manufactured goods using nanomaterials could hits $1.6 trillion by 2013.The benefits and advancements nanotechnology brings with it are just too much to pass up in the world we live in today. Nanotechnology has already shown a remarkable prospective in fighting cancer, and may even hold the key to a cure to this disease that has already afflicted so many of our loved ones. It also seems to be the future for tissue regeneration and the ideal way to deliver drugs efficiently and with pinpoint accuracy. However, in early days for nanotechnology in healthcare and whether it will be of value to resource-poor countries is still hotly debated. Critics argues that when millions of peoples in countries like India and Pakistan those in Sub-Saharan Africa are dying because of a lack of access to even basic healthcare, investing in cutting-edge technologies is a ludicrous waste of money.. Nevertheless, the huge potential nanotechnology has is undeniable. This small technology is going to do big things.

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