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Nanotechnology Usage in the Operating Room

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Nanotechnology

Nanotechnology, examining the properties of material with dimensions between 1-100 nm, working at atoms level, reducing the substance to nano size, process and reorganize atoms and molecules individually, and using this technology science, which creates different materials, devices and systems

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Nanotechnology

- Conceptual basis of nanotechnology was first introduced in 1959 by Richard Feynman.

- The term nanotechnology was introduced by Norio Taniguchi at the University of Tokyo in 1974, which was defined as the emerging technologies based on further sensitization and reduction of existing Technologies.

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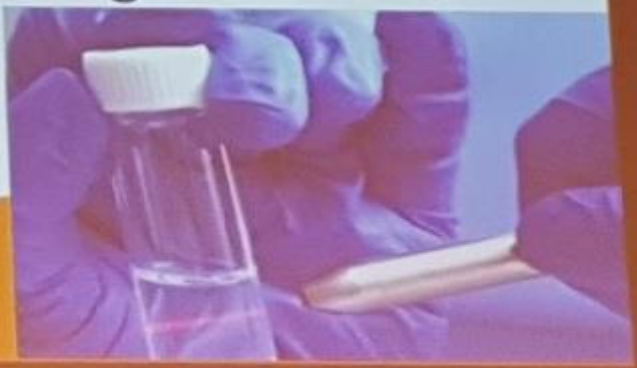
Use of Nanotechnology in Health

- Nanomedicine which used in the treatment of diseases or organs and tissues that can not fulfill the function is the science that corresponds to all nanotechnological studies at the molecular level.

- Nanomedicine, using the properties of quantum-effect nano-level materials, makes researches, produces and uses materials for diagnosis and treatment.



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Use of Nanotechnology in Surgery

- Nanotechnology allows minimal damage to healthy tissue during surgery.

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Use of Nanotechnology in Surgery

Metal nanoparticles and alloys are commonly used:

- Orthopedic practices as joint prosthesis and bone replacement materials
- Jaw surgery
- Dental implant
- Stent applications especially in cardiovascular surgery
- Plastics and reconstructive surgery
- Ophthalmic systems
- In catheters, in insulin pumps, in sutures, in adhesive and in fluids replacing blood.

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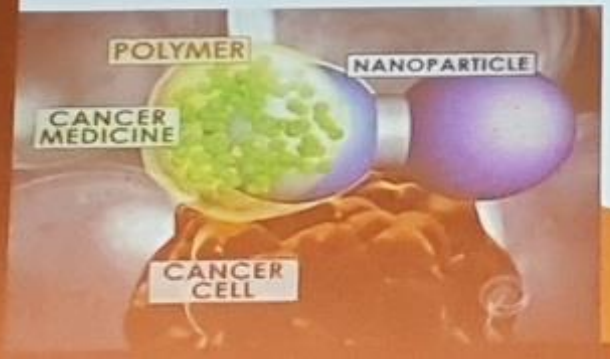
Use of nanotechnology in Oncological Surgery

- Nanoparticles, such as semiconductor quantum dots, superficialized raman sprays, colloidal gold nanoparticles, polymeric liposomes and also tumor targeting ligands can be used to in diagnosis malignancy.
- This allows the nanoparticle to be used to detect cancer cells and to nano-guided surgeries and to allow nanoparticles to be used to assist the removal of the tumor.



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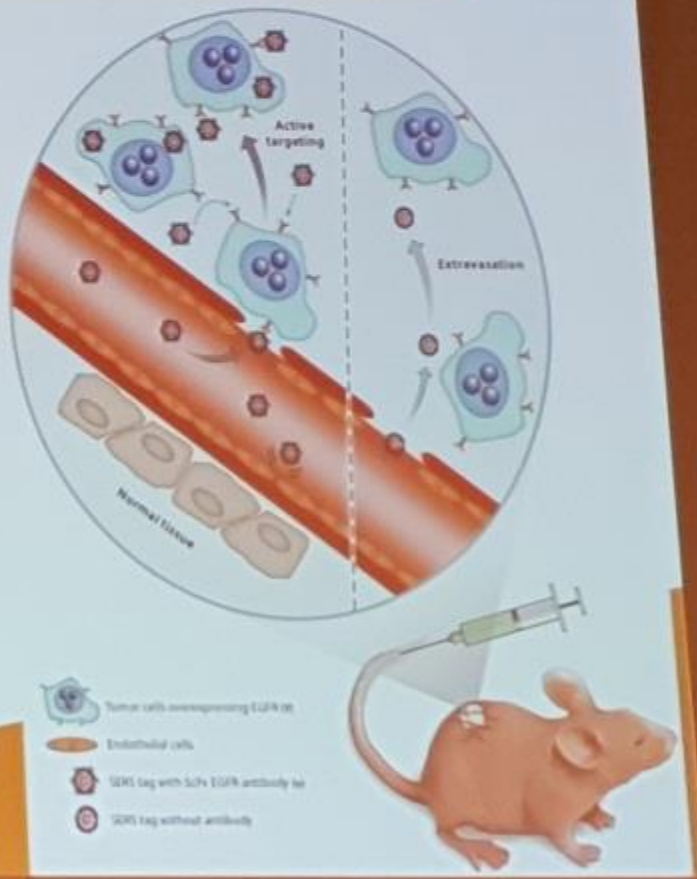
Use of Nanotechnology in Oncological Surgery

In addition, to cell damage nanotechnology is utilized in intraoperative imaging procedures such as light, sound or radiation triggering.



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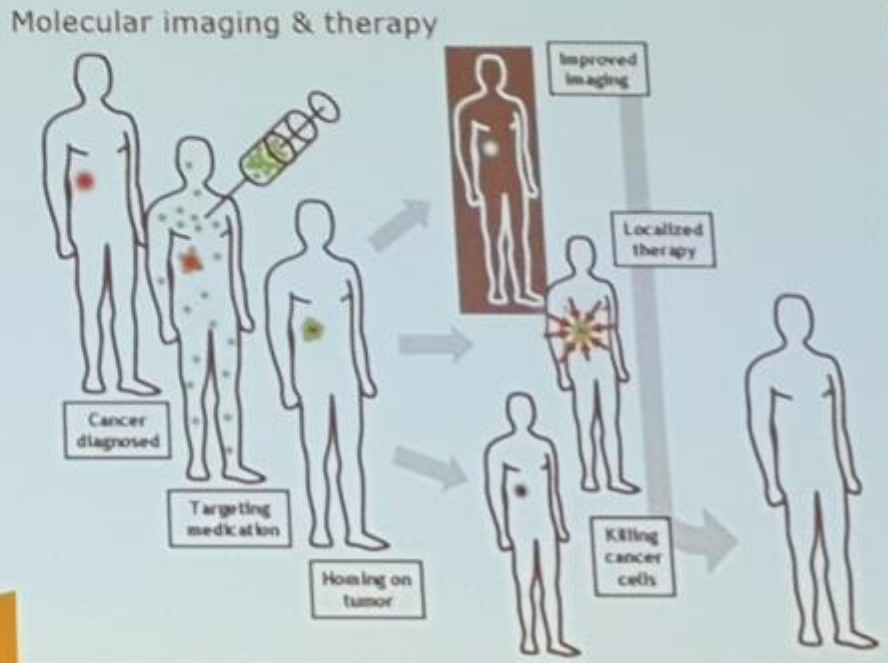
Gold Nanoparticles

- The use of gold nanoparticles for the diagnosis and treatment of squamous cell carcinoma of the head and neck is promising.



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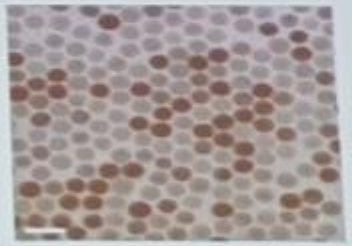
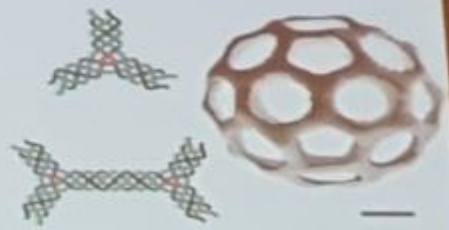
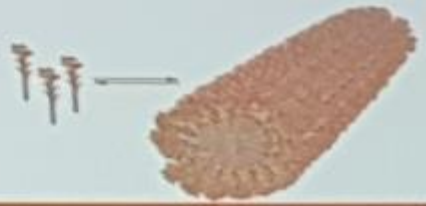
Silver Nanoparticles

- Silver nanoparticles are often preferred in biosensor applications as well as anti-bacterial practices.
- Silver nanoparticles are also used in wound dressing and in surgical instruments covered with antiseptic.







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Titanized Synthetics

- Synthetic materials developed using nanotechnology, orthopedics implants and hernia surgery are used in mesh applications.

- Compared with normal plastic mesh, it reduces scar tissue and postoperative pain due to the compatibility of titanium

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Tissue Growth and Regenerative Medicine

- Researches in the field of tissue regeneration in medicine; structures that can be used in implant development or drug delivery, aims to develop hormones that are essential for growth factors and tissue repair.

- These substances provide continuous circulation of bioactive molecules, proliferation and infiltration of cells to support survival.

- Thanks to this treatment method, complete tissue replacement and functional recovery can be achieved.

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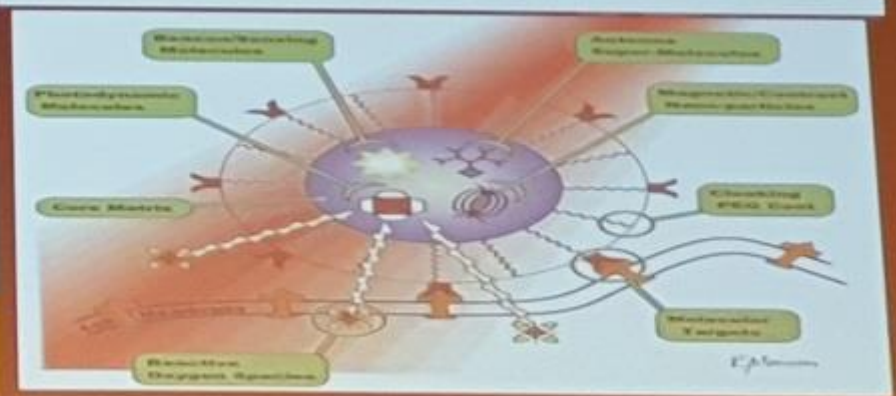
Nanotechnology Use in Drug Development, Targeting and Distribution Systems

Nanotechnology can also be used to develop new forms of treatment, drug targeting and drug delivery systems.

With the use of nanotechnology, diseased tissues can be recognized through nanoparticles and drugs can be given to more sensitive areas in the body. Thus, the optimum adequacy of the anticancer and other therapeutic drugs at the target site is achieved, while the damage of healthy tissues can be minimized.



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Laser Nanosurgery

- The shorter wavelength leads to smaller focusing volumes, so UV light is very suitable for high-precision nano-surgical work.
- This method; reduced phototoxicity due to less absorption and distribution of infrared light by biological samples.
- For this reason, this wavelength range is particularly suitable for nanoparticle applications in deeper tissues or for very light sensitive biological samples.

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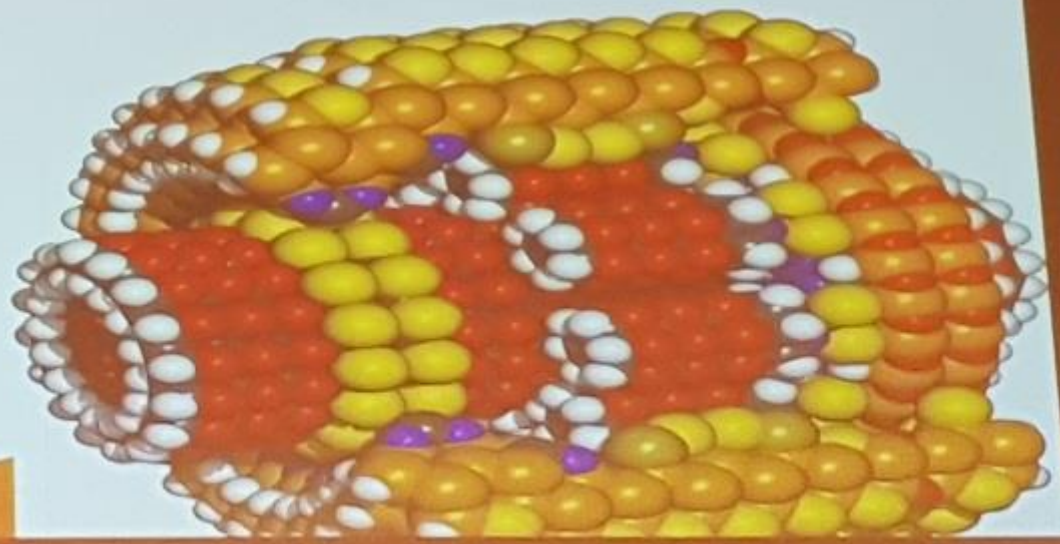
Nanorobotics

- A nanorobot controlled by a physician, chromosome replacement therapy is called by the method of cytosurgery method of the diseased cell can be removed by replacing the current chromosome healthy chromosome can be placed.



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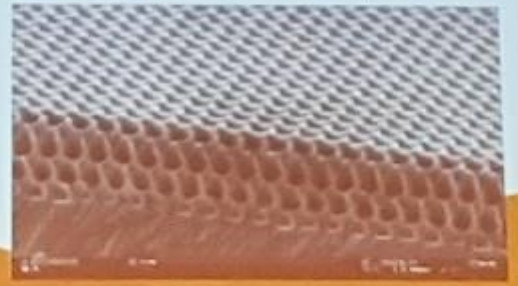
Nanotechnology in Cardiac Therapy

- Nanotechnology is used in diagnostic, imaging and tissue engineering
- Miniaturized nanoscale sensors like nanocrystals, and nanobarcodes can sense and monitor biological signals such as the releas of proteins or antibodies in response to cardiac or inflammatory events.
- Nanotechnology which helps in the design of atomic scale machines that simulating or incorporate biological systems.



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Nanorobotics

- It is envisaged that they can perform functions such as finding and eliminating cancer cells, opening microvascular obstructions and renewing vascular endothelial cells, performing non-invasive tissue and organ transplantation, performing molecular repair on damaged intracellular and extracellular structures

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Nanotechnology Applications in Ophthalmic Systems

- The optic nerve can be damaged by reactive oxygen species (ROS) and this may cause DNA damage to the optic nerve. By using nanomedical techniques, these ROS proteins can be detected and can be prevented or reduced by blocking their production or by applying specific DNA repair.

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Nanotextile Applications in Operating Room

- Textile materials processed by nanotechnological applications; drawing too much water, water-proof, stain-resistant, wrinkle-free, antibacterial, antifungal and heat insulating property can carry.

- Operating room textiles which produced using nanotechnology may help to maintain sterility especially in surgical procedures.

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Nurse's Responsibilities in Nanotechnology Applications

- It is emphasized that nanotechnology may cause toxic, mutagenic and systemic effects in humans. Due to the molecular properties of nanotechnological products in humans; respiratory, nervous, digestive, blood and possible toxic effects on the skin are stated.
- Nurses need to pay attention to the molecular structures and sizes of the nanoparticles in use and to develop special protective applications to prevent the ingestion of these substances through inhalation or skin.

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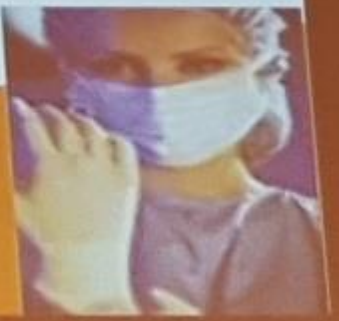
Nurse's Responsibilities in Nanotechnology Applications

- It is important that nurses understand the capacity and limitations of nanometers, take the necessary precautions and plan for the expanding effects of nanotechnology.

- The impact of nanomaterials on evidence-based practice and concepts should be analyzed and discussed.



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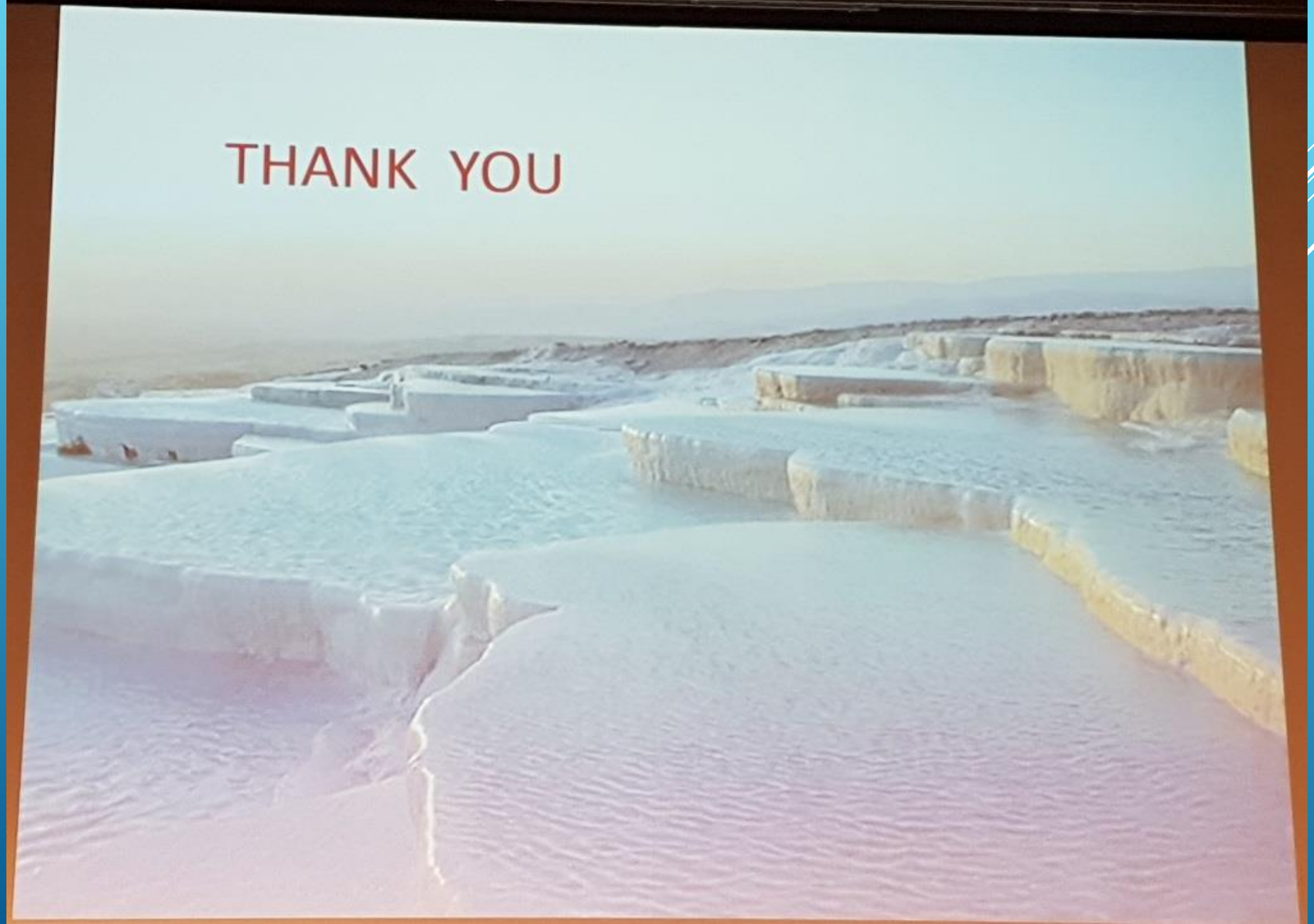
In the Near Future

- Nanorobot application which is considered to provide chromosome replacement therapy, removal of cancerous cells, opening of microvascular obstructions, renewal of vascular endothelial cells, non-invasive tissue and organ transplantation, repair of damaged cell structures at molecular level and creation of structures very similar to biological molecules.


THANK YOU