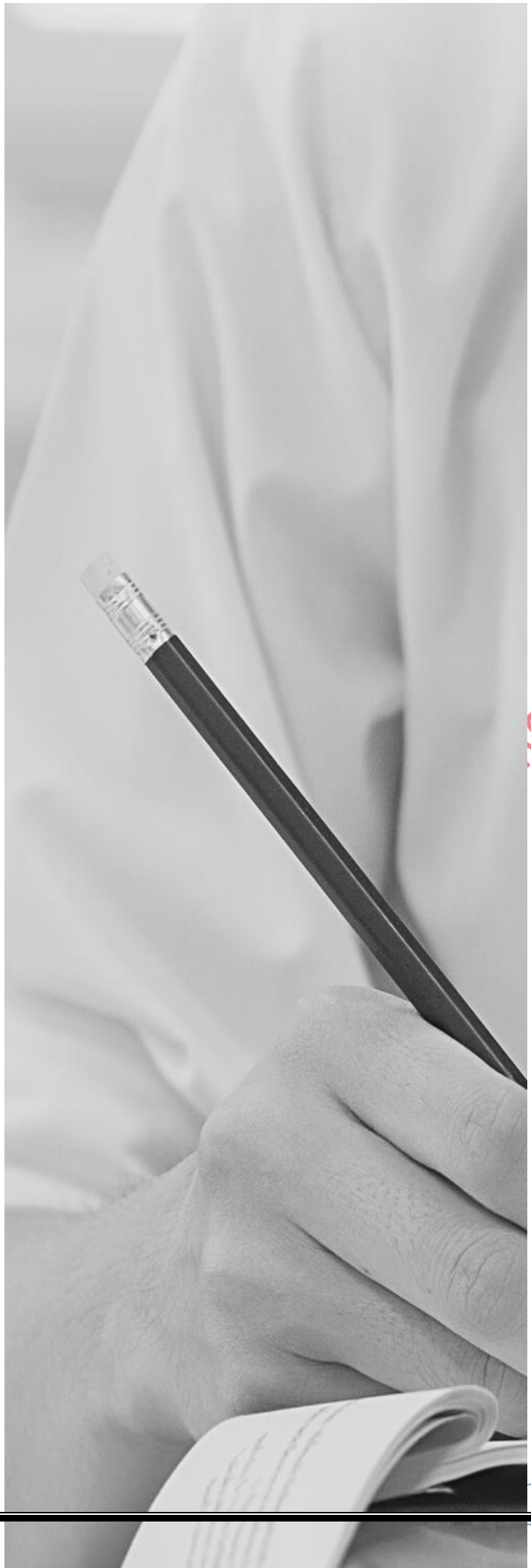

Tikrit University
College of Veterinary Medicine.

Subject name: Special Material(Nano).

Subject year:2025\ 2 \24

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Lect.3.

Methods for preparing nanomaterial's

To prepare nanomaterial's, it is divided into two main parts:

1-One is from top to down

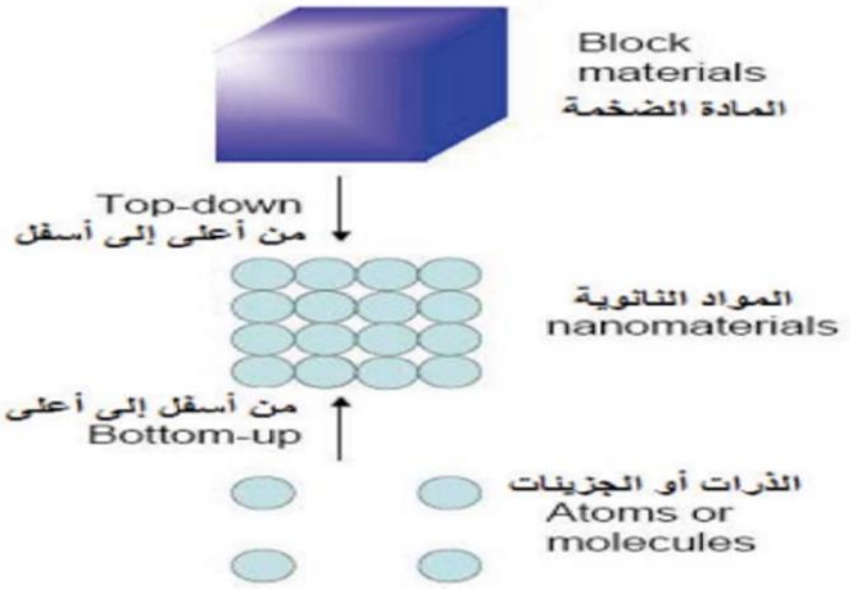
The original (large) material is broken down little by little until it reaches Nano-sized

It uses several methods; To achieve this, they include: photoengraving, cutting, grinding, and fragmentation.

These techniques were used to obtain microscopic electronic components, such as computer chips, and others.

2- The second method starts from the down to the top

Unlike the first method, where the nanomaterial is built, Starting from atoms and molecules arranged; To reach the desired Nano scale shape and size, this method is mostly a chemical method, and is characterized by the small size of the produced materials, the lack of waste, and obtaining strong bonds to the produced nanomaterial.,



Lect.3.

Some mechanical and chemical methods to reach Nano scale size.

1-Grinding method

It is a mechanical method that produces nanomaterial's in the form of a Nano powder with a size of (3-35) nanometers, where the material is placed under very high energy and ground by balls made of steel that move either in a planetary, vibrating, or vertical manner.

a. Head-on impact b. Oblique impact c. Multi-ball impact

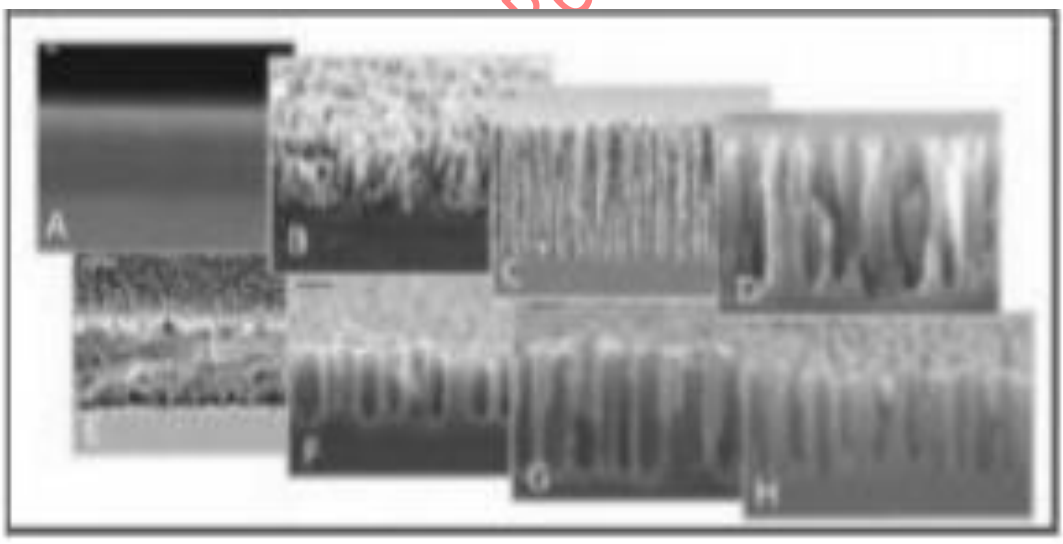
Lect.3.

2-Scratching or drilling(etching) method

This method was used by Professor Munir Nayfeh to produce silicon nanoparticles, and it is either by chemical methods or by electrochemical methods.

The chemical method is to take silicone slices of very thin thickness and place them in chemical materials such as HF (and other materials), which rub the silicone slices and then the silicone particles come out and are on the surface.

These slides are placed in any methanol solution, and they are inserted into the ultrasound device, so particles fall from the surface of the slides and become stuck in the solution.



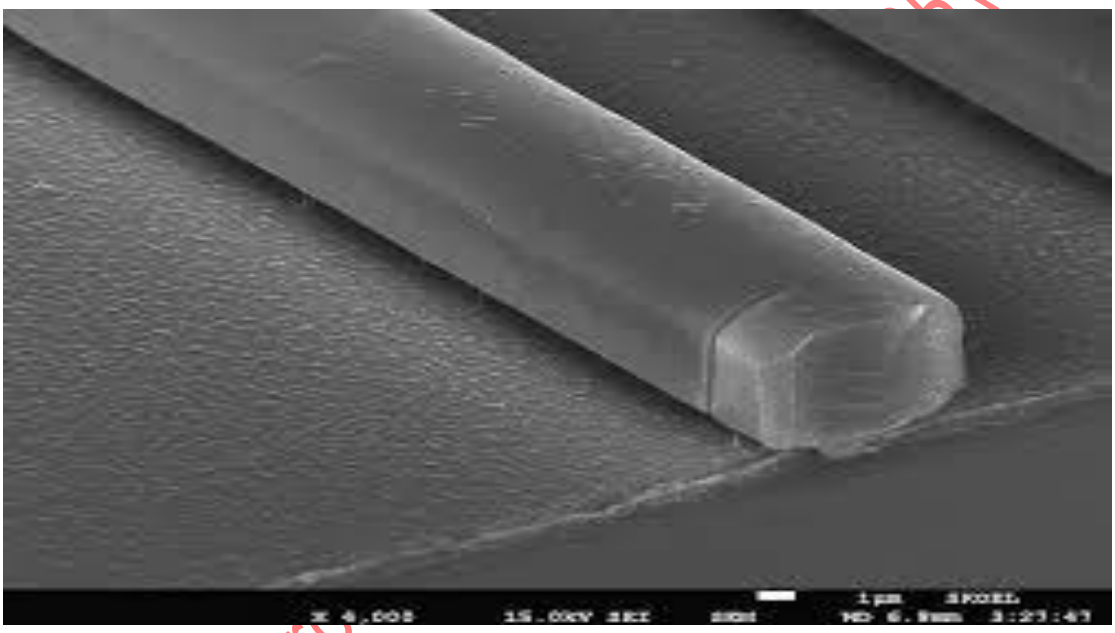
A slice prepared using the drilling method

Lect.3.

3-The electrochemical method:

where the silicon chip is placed in the positive electrode and the polycarbonate chip in the negative electrode and exposed to an electric current.

This is done after placing it in a chemical solution consisting of chemicals that help in rubbing, which in turn brings out the silicon nanoparticles.



Nano silicon

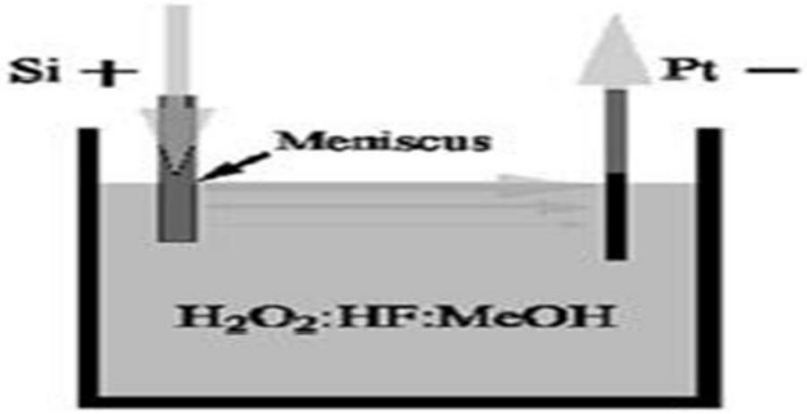


Image of silicon in the presence of platinum

Lect.3.

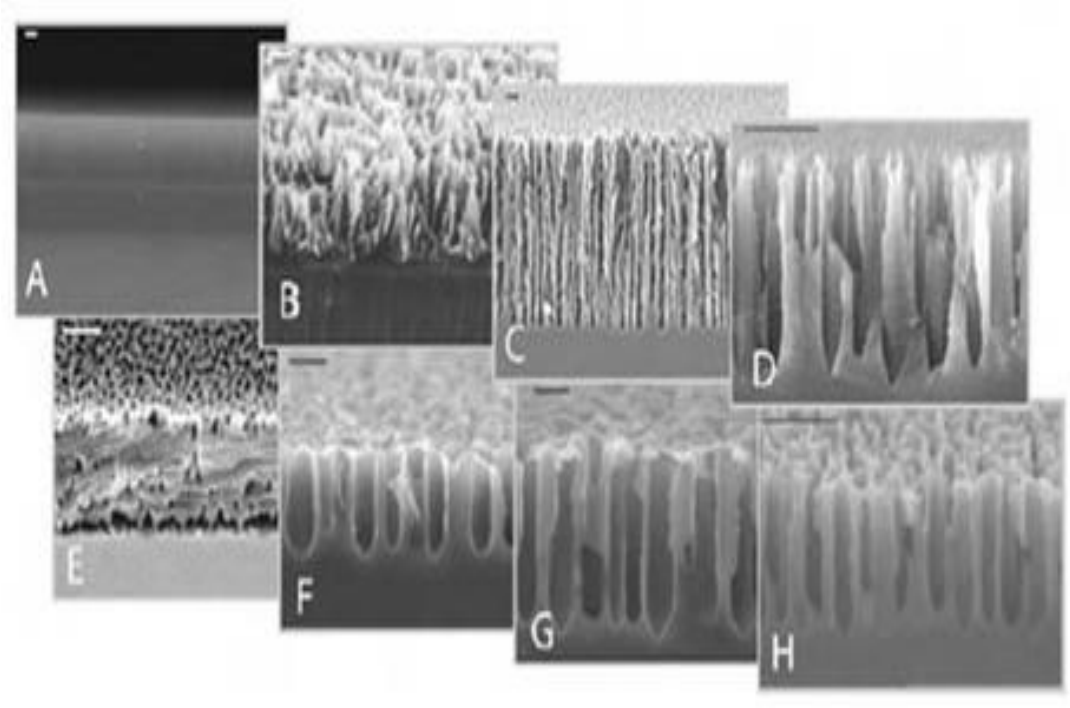
4-Laser ablation method:

A high-energy pulsed laser is used focused on a solid target and placed in a vacuum room. The laser beam interacts with the target, causing the particles to fly out, forming plasma, depositing on the base and forming thin films.

5-Sputtering method

It is used in making thin films, where the material is placed under very low pressure, emptied of air, and on a cold base exposed to a magnetic field.

All of these factors lead to the particles being extracted from the material (or sputtering) to be deposited in the base to form a thin film, and it must be placed Gas to prevent clumps.



Nanomaterial in the Sputtering method

Lec.3.

2- Chemical methods

They include:

1- Chemical vapor deposition method

2-Method of reaction in a liquid medium

3-Solution gel method

Lect.3.

Chemical vapor deposition method

Chemical vapor deposition (CVD) is a vacuum deposition method used to produce high-quality, high-performance solid materials.

This process is often used in the semiconductor industry to produce thin films.

The vapor of the substance to be prepared is entered into a specially manufactured reactor, and the particles of the substance are adsorbed on a basic surface at an appropriate temperature, and adsorbed molecules.

It either disintegrates, or reacts with other gases or steam.

To be a solid foundation on the foundation. This method is used in preparing some very small materials, quantities of semiconductors, ceramics, and very small carbon tubes.

Lect.3.

2- Method of reaction in liquid medium

The most commonly used liquids are water and organic solvents

Ultrafine particles are deposited by changing the conditions of chemical equilibrium.

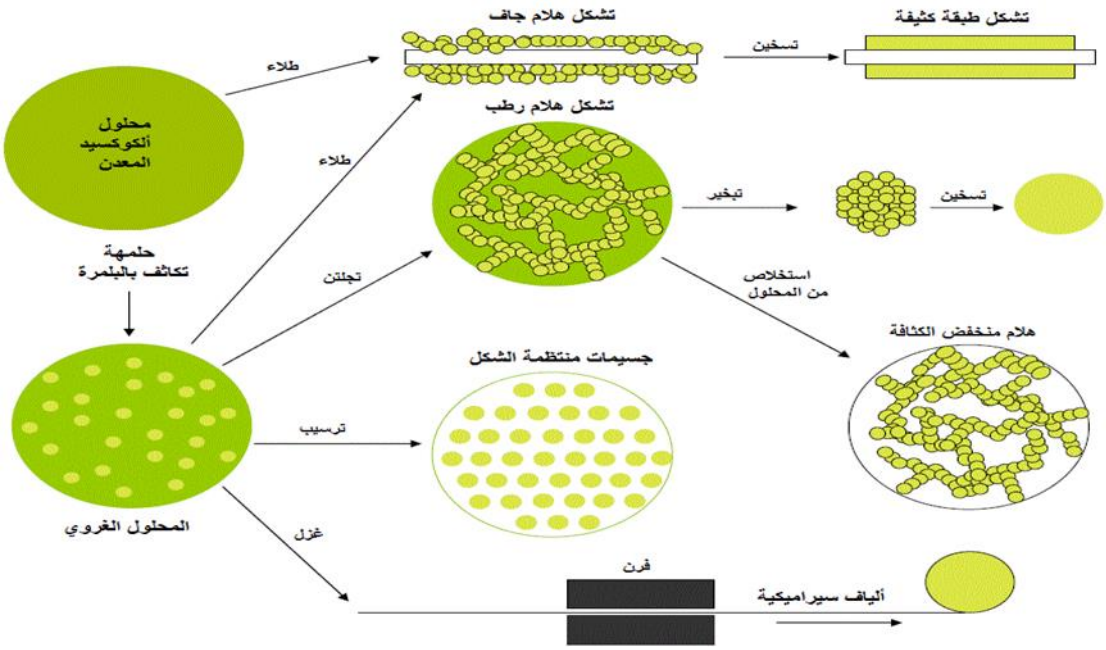
3-Solution gel method

This method goes through two phases: the liquid phase.

Then, after a period of time, the material evaporates and turns into the gel phase

For this reason it is called sol gel.

This method is used to make light rods as a laser medium.



Lect.3.

Medical nanotechnology applications

The modern development in nanotechnology has changed the medical rules used in preventing, diagnosing, and treating diseases, and we have become living in the era of Nano medical technology, where nanotechnology provides new ways for drug carriers inside the human body (called Nano carriers with sizes reaching the nanoscale) that are able to target Different cells in the body).

Many types of nanoparticles are used in medical applications, such that they act as drug carriers or imaging tools inside the body. Currently, different types of manufactured nanoparticles are used as delivery systems for anti-cancer drugs and vaccines.

Gold nanoparticles are also used in home testing devices to detect pregnancy.

Gold-plated Nano sheets are used to destroy cancer cells. The length of these nanosheets is about 120 nanometers, which is 170 times smaller than the size of a cancer cell. When these Nano sheets are injected into the body, they automatically adhere to the cancer cells, and then those cells are exposed to infrared laser rays.

Which works by heating the gold and raising its temperature, which leads to the burning of these cells and their death.

This method is characterized by accuracy and localization due to the small size of the Nano-covers in relation to the cells and their concentration in diseased cells only, which makes healthy cells far from the risks of side effects.

One of the promising medical applications of nanotechnology is the use of polymer nanofibers to perform prosthetic surgeries for blood vessels.

Prosthetic devices made of protein nanofibers have recently been implanted in the human central nervous system.

Polymer nanofibers are also used to treat burns and wounds and are used in the manufacture of cosmetics.

Lect.3.

Medication delivery

Nano technology is an example of prosperity and progress in the medical field with the possibility of delivering medicine to specific cells using nanoparticles.

The overall drug consumption process as well as side effects can be significantly reduced by depositing the active agent only in the diseased area and without any higher doses than required. This selective approach reduces cost and human suffering.

Porous nanomaterial's. An example is the use of block copolymers, which form micelles used in drug packaging.

Lect.3.

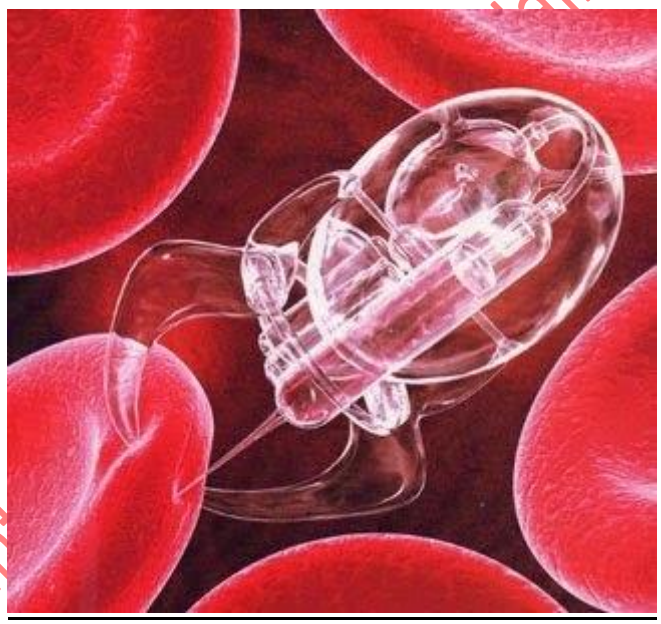
The most important future medical applications of nanotechnology:

1-Nano-cantilever device

Cantilever It is a very precise device on the Nano scale, as its dimensions are close to the dimensions of a white blood cell. It is one of the future Nano devices that can monitor and detect cancer cells through the curvature of its tiny protrusions.

Nanocantilever devices can be specifically engineered to enable them to attach to cells whose changes indicate the incidence of various types of cancer diseases.

These devices are characterized by their superior ability to diagnose cancer cells in their early stages, with accuracy reaching the point of detecting a single cancer cell. It is worth noting that these Devices Nanocantilever devices are still in the early stages of development, and they are one of the very advanced applications of nanotechnology that still require further research and study.



Lect.3.

2-Delivery of medicines

Future Nano applications, which include drug delivery technology using one of the so-called Nano devices DENDRIMER.

It is one of the Nano-devices for drug delivery that is able to easily enter infected cells and provide them with multiple quantities of the drug without any negative results.

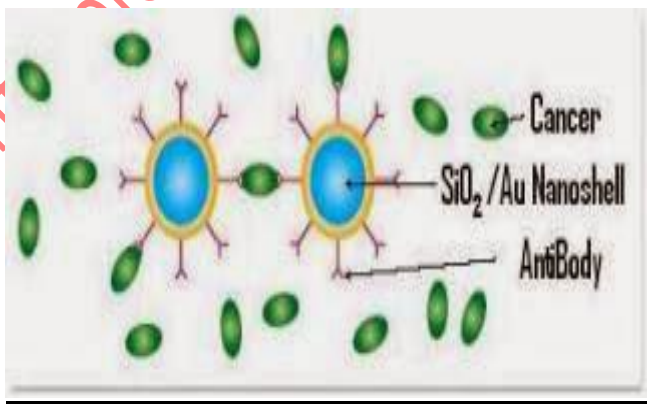
Nano devices (dendrimers) are distinguished by their ability to identify and treat infected cells, as well as provide a report on the effectiveness of the drug.

Pharmacology is one of the sciences that requires high precision because it is directly related to human health.

The arrival of a large amount of medicine to unaffected organs of the body reduces the effectiveness of the medicine and leads to unwanted side effects.

Traditional methods of treating cancer, such as chemotherapy and radiation, lead to significant side effects and are less effective in treating this disease.

It is important that anti-cancer drugs are delivered to the affected parts very precisely in order to obtain the maximum possible benefit from the drug.



Lect.3.

3 In the field of medicines and therapeutic drug

A new term to medical science is nanoionics, which is the new alternative to antibiotics.

At Hang Bang University, researchers were able to introduce nano-silver into antibiotics, and it is known that silver is capable of killing 650 microbial bacteria without harming the human body.

This technology will solve many of the problems of antibiotic-resistant bacteria that have caused mutations that prevent the antibiotic from affecting these bacteria, examples of which are resistant bacteria(: (Staphylococcus aureus Pseudomonas).

Nano bio penetrates the bacterial cell wall or virus-infected cells, allowing water to enter the cells and destroy them.

4 Using nanotechnology as an aid in surgical operations-

The company (Corvis) has manufactured visual transformers (a small robot) the size of nanometers that is used as an assistant to doctors in critical and dangerous surgical operations.

The doctor can control the robot using a special device, which helps in making the operation successful with high efficiency and extreme accuracy. It is better than traditional methods and reduces the risks greatly.

The surgeon uses a joystick to enable him to control the robot arm, which carries precise devices and a miniature camera, in order to transform large movements into small movements, which allows for greater surgical precision.

5-Using technology to treat diabetes

The University of Illinois in the United States of America has succeeded in developing a nanotechnology-engineered device implanted in the body that regulates blood sugar and spares diabetics the need for insulin injections.

The beautiful thing is that it will be on the market soon.

Lect.3

6-Medical imaging

Nano imaging enables researchers and doctors to track any movement that occurs in living tissue inside the human body.

Doctors here are able to accurately identify the movement of the drug within the diseased tissue.

Studying some of the body's cells is difficult, and hence scientists resort to coloring them.

There is another problem, which is that the cells that emit light waves of different lengths do not work in one way or in one way.

Permanence, which makes medical imaging operations face problems in terms of correct diagnosis, and scientists have been able to solve this problem by using some Nano-particles that show different reactions to different wave frequencies arising naturally from the difference in wavelength.

7-Diagnosis

The primary goal is to detect the disease as early as possible so that it can be eliminated before it causes symptoms or complications.

Using nanotechnology, bioassays to measure the presence or activity of tested substances become faster, more accurate and more flexible.

Magnetic nanoparticles can be combined with appropriate antibodies and used as markers for the presence of specific molecules or microbes.

Likewise, gold particles combined with short sections of DNA can be used to identify sequences of genes in a sample.

There is also nanopore technology for analyzing DNA, which directly converts the sequence of its subunits into electrical signals.

Using nanoparticles as contrast agents(As an alternative to dye) we obtain MRI and ultrasound images with better contrast and distribution. Indeed, luminous nanoparticles can help the surgeon during the surgical procedure identify the location of the tumor and thus make the process of eradicating it easier.

Lect.3.

It is one of the tools used in nanotechnology in the medical field:

1-Advanced microscopic devices such as the scanning electron microscope.

2- Equipment used in imaging cells, bacteria, viruses, and molecular units.

3-Carbon particles, as they are formed to produce materials that are 100 times stronger than steel, even though their weight is one-sixth the weight of steel and more than copper in terms of conductivity. It can be used safely in some medical applications such as drug delivery systems and is considered one of the most famous examples.

4-In the use of nanotechnology in medicine, such as(Fullerenes , Nanotubes).

5-Micro-devices that include small electrical systems (MEMS), which contain miniature moving parts for surgical operations and pacemakers.

6- Microfluidics for DNA testing.

7-Microarrays, which are used to detect small amounts of pathogenic bacteria .