



## Medicine and chemistry uses of nano-alloys

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### Abstract

The uses of nanoparticles have increased nowadays, so that their use has become clear and common in both the medical, and biological fields, as well as other disciplines, which made their importance prominent in science and technology, as it includes the applied aspect by scientists and discoverers in order to benefit from them and invest them to develop the economic aspect, for developing countries that relied on documenting scientific theories, and motivating industrialists to seek to expand perceptions and activate the practical part to implement ideas realistically.

**Keywords:** medicine, chemistry, nano-alloys

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### Introduction

The use of nano-medicine and nano-biology nano-chemistry vary in applied, there are many medical and biological applications of nano-materials, including being used in the manufacture of nano-biological sensors, and molecular nanotechnology, despite the difficulties it faces, but its development is in renewal and remarkable progress, it is associated with Many sciences such as nano-toxicology and ecology have their impact on daily life. Nano-technology classified as a part of science that deals with technology at the nanometer measurements (1). To placed it in perspective, we can say a human hair around (1,00,000) nanometers in wide. This means that the reality of nanotechnology is closely related to all other branches that can be a part of it, and its applicability is possible and available according to the findings of scientists and researchers who made many discoveries that led to the development of scientific and experimental reality. To understand the biological processes on the nano-scale level we must knew strong driving force with evaluation of nanotechnology (2). Nanotechnology is a new research field in biology and other sciences, so that interest in it began to increase rapidly in this century. It is a well-known specialty that covers a wide area of nano-biotechnology, and nano-medicine in general, in addition to all other types of technologies. It helps in all biological and medical investigations at the molecular and cellular level as well. Nanotechnology gives potential evaluations in a biological, and medical imaging and detections, cancer treatment, helping in tissue regeneration, implanting materials, and multi-functional platforms combination different of these modes of action (3, 4). So nanotechnology has become closer to the applied natural and medical sciences, and it is circulating in the industrial field as it is directly linked to the production of many products that contribute to the advancement of science and knowledge. In addition, it is used in the manufacture of electronic chips that may reach (20-nanometers) in size. Molecular biologists have been working for years In the field of molecular and cellular dimensions, sizes ranging from nanometers to micrometers (5). It is believed that the participation and integration of these disciplines will give a new category or a new category through which it is possible to manufacture devices and systems that are multifunctional in the types of biological and chemical analysis characterized by sensitivity and clear specificity (6). The National Nano-technology Initiative (N.N.I) is the research and development at the atomic, molecular or macromolecular levels approximately 100 nanometers to create structures, devices, and sensor systems that have certain functional properties. In this range, scientists were able to manipulate atoms to form stronger, lighter and more efficient materials (7). Whenever researchers document the importance of nanotechnology applications, we cannot stop at one point, as it is a renewable and uncountable science that covers all fields, not limited to a certain limit. Therefore, we document what we have seen from the results that came out of extensive scientific experiments and studies that led to this science reaching the outcome that we are witnessing now. It is known that nanodisciplines are diverse according to the type of research work and its purpose, such as in the field of chemical nanotechnology, physical nanotechnology, biological nanotechnology, engineering nanotechnology and other medical and natural disciplines.

### Applications of Nano-technology in Biological, Medicine, and Chemistry Field

There are many applications of nanotechnology in the field of medicine and biology, some of which are for tissue purposes, some are useful for immunological purposes, and some are diagnostic or therapeutic or both. Medical nanotechnology applications may be separate and independent from the biological applications, and in many cases they may be in common with the biological aspect. The biological sciences, are different approach such as botany, agriculture, zoology, food production, and any part that related with it. We can say the nano-

medicine is of particular interest due to its potential in nanotechnologies and helping for fighting, or even cure diseases. There are several applications of nano-technology in medicine, and biology are more and very wide. It has been integrated in to the world of medicine, and biology nowadays in different beneficial approaches. We documented a few of the interesting applications particularly. A list of some of the applications of nanotechnology to biology, or medicine is given below:

### 1. The Detection Applied

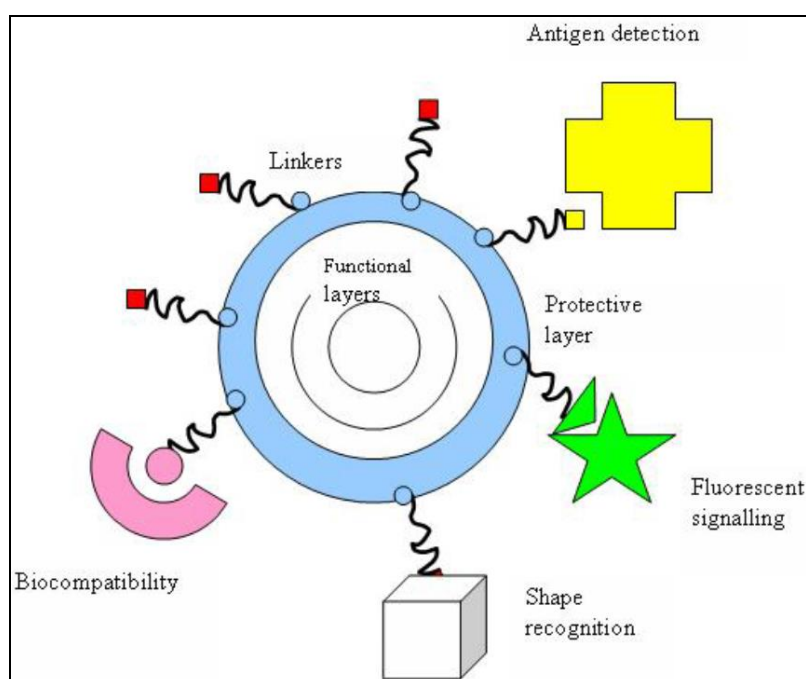
This is classified into two parts, as the nature, mechanism, and methods type of the detection as shown in figure no. 1 and figure no. 2, they are:

#### ▪ *detection of pathogens: (8)*

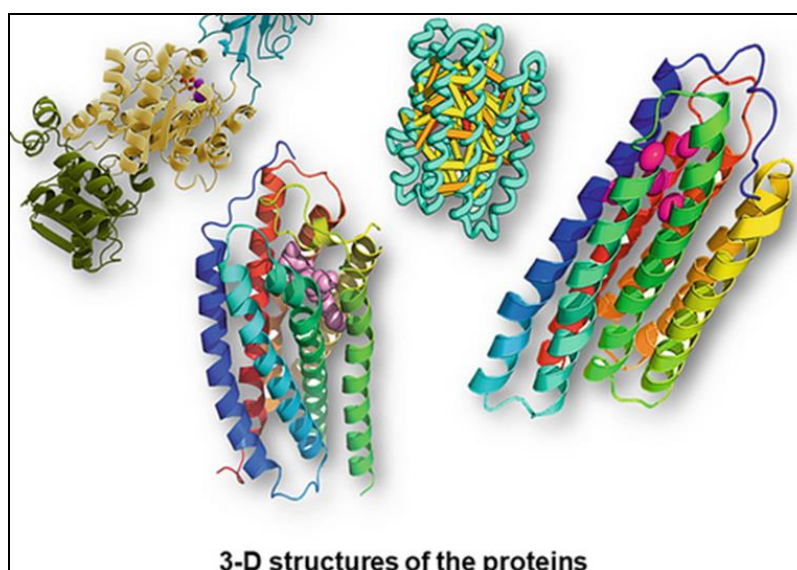
There are multiple ways to detect the pathogens that patients suffer from incurable diseases in particular, including those related to the immune system, and what happens by other reasons, so nanotechnology was considered one of the most important means of detecting it early, easily and very quickly, in addition to accuracy in give the result.

#### ▪ *detection of 3-dimensional proteins: (9)*

The disclosure of the details of information about proteins was done by nanotechnology, where all the minute parts of proteins and their three dimensions were reached in detail through this technology, which showed the functional properties of proteins and their complete components and basic units that consist of them.



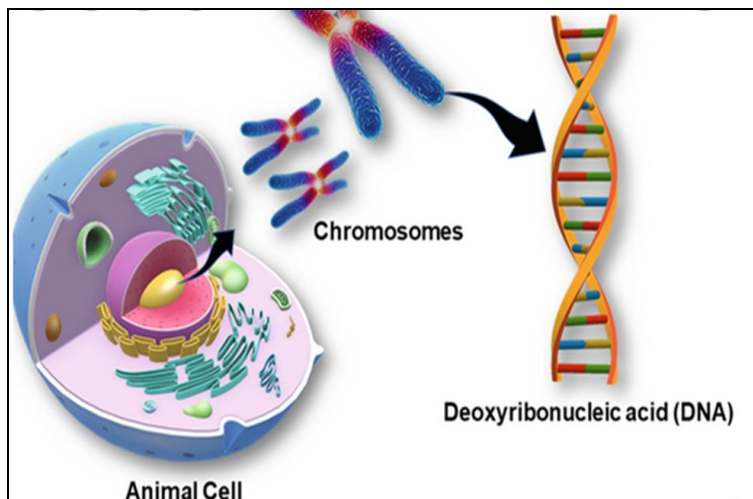
**Fig 1:** To show the nanotechnologies applied for the biological and medical detections.



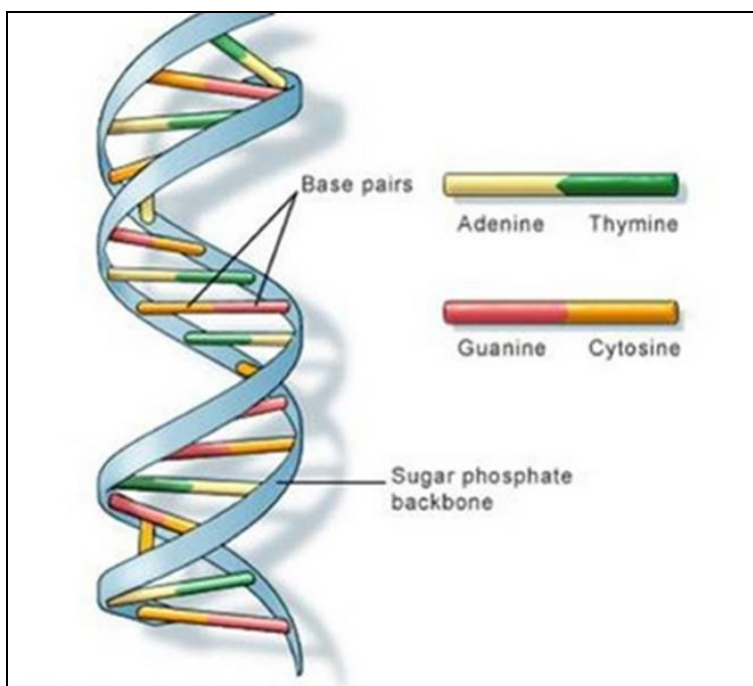
**Fig 2:** Showing application of nanotechnology in three dimensional protein detections.

## 2. Probing of DNA structure: (10)

Examining the structure of DNA by using nanotechnology made there are many facilities in research studies related to deoxyribonucleic acid, and RNA as well. Through this technique, many genetic diseases were identified that were unknown, as was done through This technique is to identify the various pathogens that are of the type of microorganisms by making their genetic map clear through which the type of microorganism to be detected can be identified. Nanotechnology helped in knowing the most important basic components of the animal and plant cell nucleus and chromosomes, as well as knowing the basic structures of nucleic acids and their interrelationship from a structural point of view, such as nitrogen bases and hydrogen bonding as shown in figure no. 3 (A, and B) below:



**Fig 3: A-** Showing application of nanotechnology in probing of DNA structure.

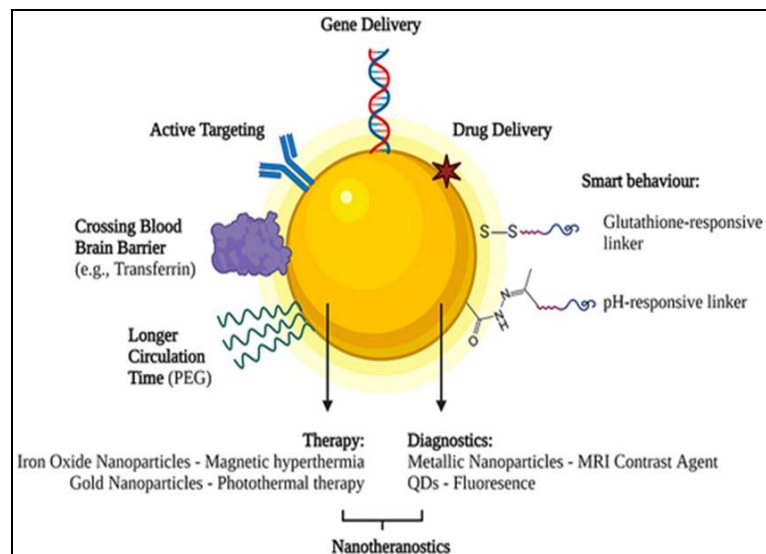


**Fig 4: B -** Showing details of DNA structure (base pairs, sugar phosphate backbone, and other components like adenine, thymine, guanine, and cytosine).

## 3. Drug and gene delivery: (11, 12)

The delivery of drug and gene by using nanoparticles is one of nano-technological methods, this is occur by the attachment between nanoparticles and them. Many scientific research and studies have been published at the experimental and realistic level. Among the materials and nanoparticles that have been extracted and used in this field are various metal particles, including silver nanoparticles, gold nanoparticles, zinc nanoparticles, iron nanoparticles, and nanoparticles. Other minerals, as well as various nano-composites such as nano-oxides such as zinc oxide nano-complex and the rest of the other oxides that are suitable for this purpose. The transfer of the drug using nanotechnology was done using different and varied mechanisms according to the location of the organ or tissue to be treated, or the delivery of the drug to it. The purpose of its treatment, such as the liver,

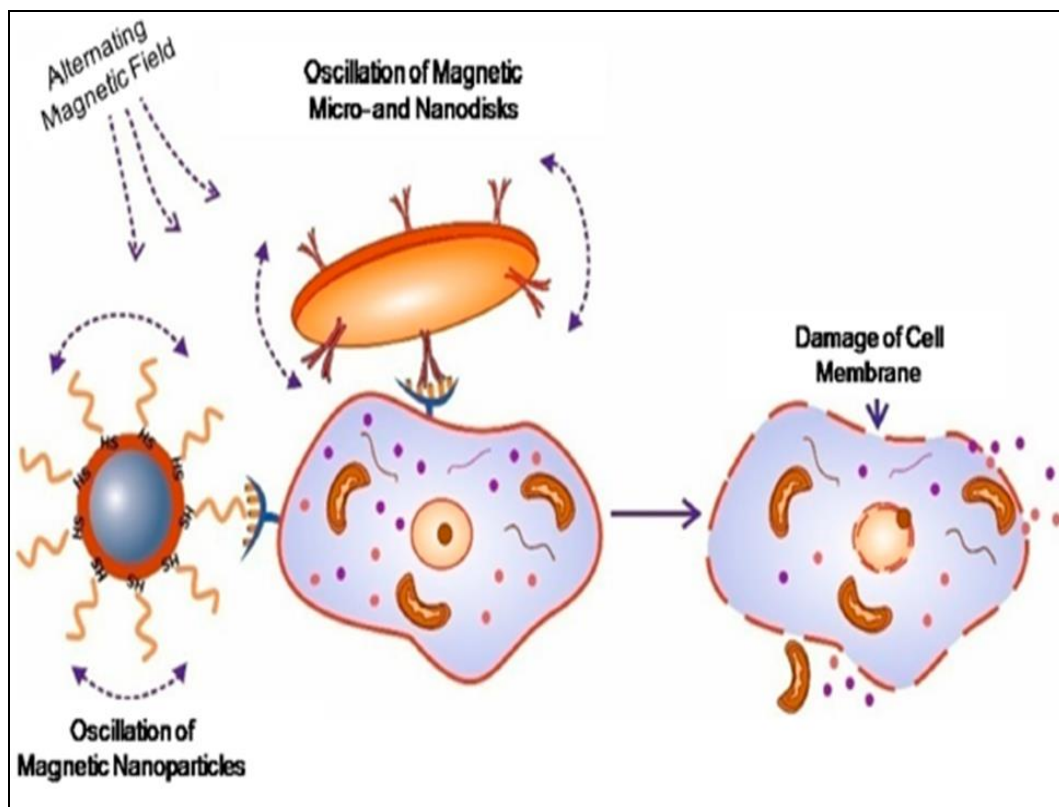
pancreas, or other organs and other organs in the human and animal body. As well as gene transfer and control, and change and improvement of genetic characteristics, as shown in figure no. 4.



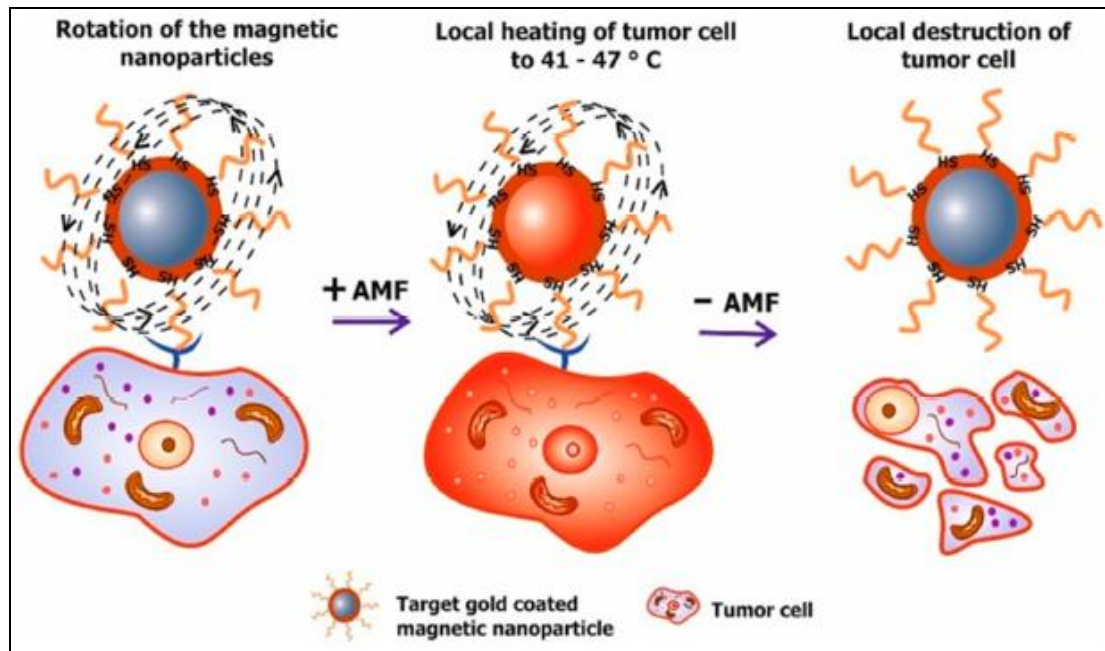
**Fig 5:** To show drug, and gene delivery by nano-technological methods (using nanoparticles).

#### 4. Tumor Destruction by Using of Heat (Hyper-Thermia): (13)

The studies that were conducted in nanotechnology (14) showed that the magnetic nanoparticles that are super-coated and coated with a layer of (50 ng.) aptamer can be used in magneto-dynamic therapy *in vitro* and *in vivo* as shown in figure no. 5. This in turn leads to induction of programmed cell death in which magnetic particles bound to antibodies, aptamers and drugs are used. Tumor cells have a high sensitivity to heating than healthy tissue, in many studies the methods were developed for selective thermal destructions of tumor cells, by controlling the transformation of (Alternation Magnetic Fields) (AMF) energy in to thermal-energy by functionalization of magnetic nano-particles, which is known as heating the tissue in approximately of about (40–46 C, as shown in figure no. 6. (15, 16). Therefore, the relationship of temperature control of nanostructures, whether they are nano-disks, nanoparticles, or any nanoparticle of a material or a metal, has become a science in itself, through which many discoveries can be made and experimental experiences developed.



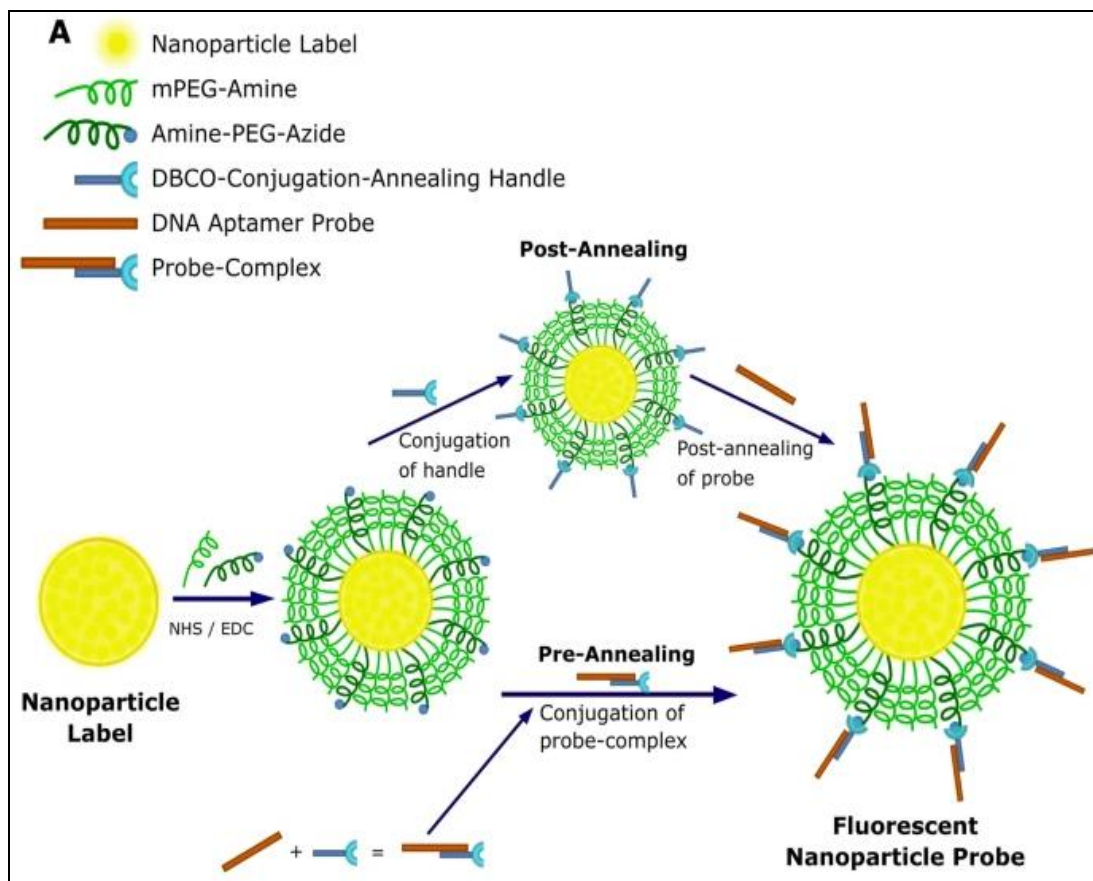
**Fig 6:** The concept of targeted magneto-mechanical cancer-cell destruction using magnetic nanoparticles with different shape.



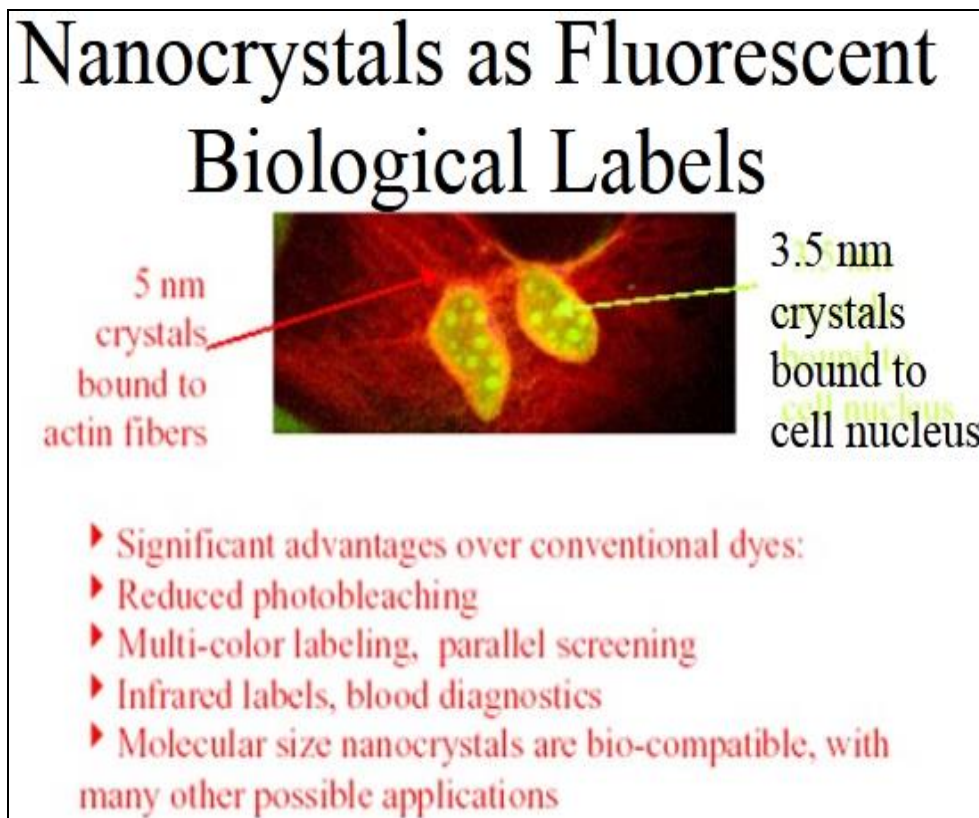
**Fig 7:** showing three steps 1): rotation of the magnetic nanoparticles, 2): local heating of tumor cell 41-47 C , and 3): local destruction of tumor cell.

### 5. Fluorescent Biological Labels: (17, 18)

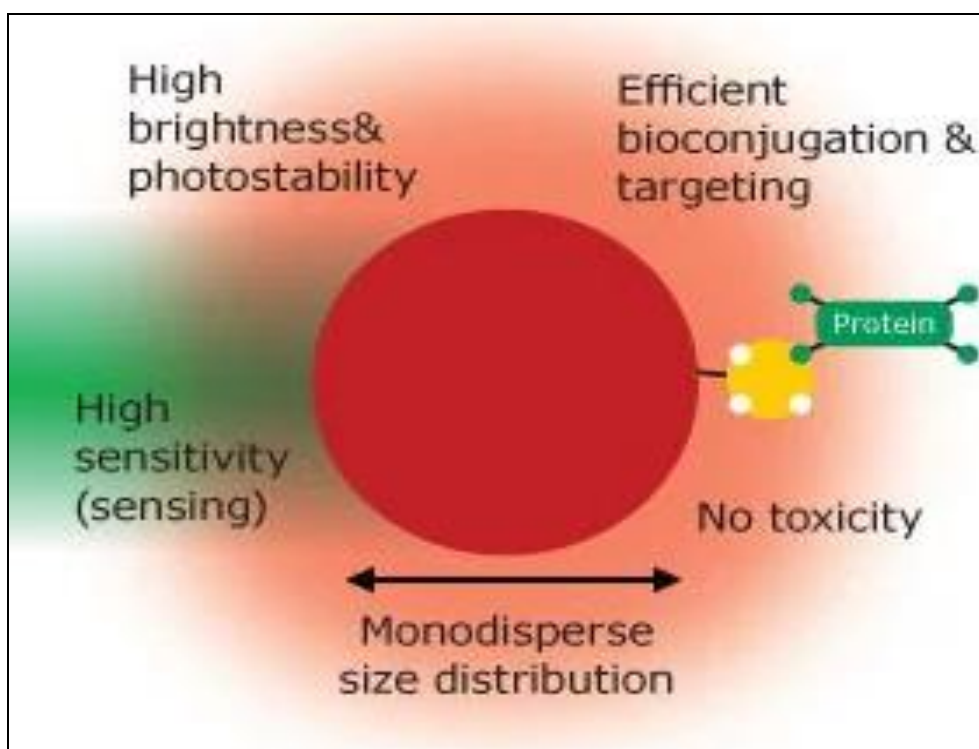
This application include various methods like in molecular biology and in biotechnology, known as a fluorescent labels or fluorescent probes, when the molecules attached by chemical bounds to help in the detection of some biomolecules such as a proteins, antibodies, or amino acids. In general, the labeling can be use a reactive derivative of a fluorescent molecules known as a fluorophores. The fluorophores selectively can be bind to a specific location or main functional groups on the target molecules then attached tightly biologically, as shown in figure no. 7 (A, B, and C) below:



**Fig 8: A):-** To show nanoparticles as labeling for conjugation of probe-complex to perform fluorescent nanoparticle probes.



**Fig 9: B):-** To show nano-crystals as fluorescent biological labels.

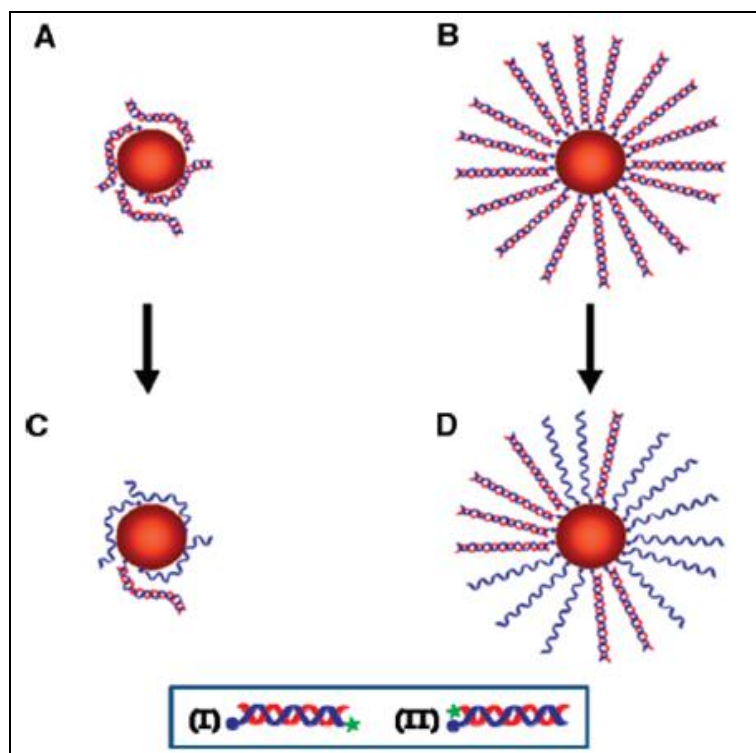


**Fig 10: C):-** To show the use of nanoparticles in the efficient of bio-conjugation and targeting to performed no toxicity.

## 6. Chemically Applied by Using Nanoparticles For DNA Denaturation:

Possible mechanism of (ds-DNA) denaturation adsorption by gold nanoparticles. With low DNA concentration, the (ds-DNA) molecule wrap around the particle (remain hybridization) A. When the interaction with the surface, this is lead to denaturation of the (ds-DNA) as shown in C. As alternative, DNA molecules packing with Gold-NP lead to stretch B. but (ds-DNA) denaturation are vacant high space for addition of thiolated molecule for binding D. In all steps of this mechanism, the thiolated strands still with particle. While, the complement non-thiolated strands most washed away. The two (ds-DNA) species in same sequences, while in the different

strands harboring the radio-label. The gaining of energy is a lot off due to the adsorbed on the surface, so denaturations must be occur, as shown in figure no. 8, (19, 20).



**Fig 11:** The strand modified with a thiol (blue circle) at the 3' end is labeled at the 5' end with a radioactive phosphate (green star ("thiolated")) (II) The nonthiolated complementary strand (red) is labeled at the 5' end with a radioactive phosphate ("complementary").

### Conclusion

The uses of nano-alloys in medicine and chemistry have diversified in many forms. They have entered the medical, biological and chemical fields, for example, what we have touched upon in the treatment of diseases, drug transfer, and the modification of metabolic pathways to benefit the needs of the human body, as well as at the molecular biological level. Genetic. Therefore, this technology is always a renewable technology and we cannot stop at a certain point or at a certain limit, but we constantly look at the theories of researchers and the discoveries they have reached that can be applied to solve many health, biological and chemical problems.

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