

PRINCIPLES AND APPLICATIONS OF NANO-BIOTECHNOLOGY

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ABSTRACT

The article presented by us includes the most important principles and applications of nano-biotechnology to some related fields, since nano-biotechnology is related to the rest of the disciplines that we live in our daily lives at the present time. In what we will mention in our current article, we rely on the results reached by researchers following extensive experimental studies that have already been applied through arriving at new theories, ideas and opinions that we can develop by relying on impact, and reliable scientific sources.

KEYWORDS: *Nano-Biotechnology*

INTRODUCTION

The concept of nanotechnology means the innovative technology that can develop materials that have improved properties that can be used for all purposes, a technology that focuses on studying materials accurately, understanding, controlling and controlling them within the dimensions ranging from 1 to 100 nanometers. So, nanotechnology regarded as the science of the very small material in size, there are many phrases of nano-word such as nanotechnology, nano-biotechnology, nano-chemistry, nano-physics, nano- medicine, nano-engineering, nano-science, and others. The nano-science is deal with all the study of (molecular and atomic) particles. In the nanometer measurements (each one nanometer equal 10⁻⁹ of meter). It's very small measurement the scale, we are talking about an atomic and molecular sizes. For creation of a visual images of a nanometer, the width of nail on the finger is reach to about ten million nanometers across. As for the relationship of nanotechnology with biology, it results in various biological applications, all of which can be used in the interest of society, science, knowledge and many industrial fields that subsequently lead to the advancement of economic reality. The manipulations of the nano-materials go to the binding of several biomolecules, like bacteria, proteins, toxins, and nucleic acids (1). The applications of nano-biotechnology have helped to improve many industrial and technological sectors, which led to Developing information technology, medicine, transportation, energy, as well as science, in addition to benefiting from them in other sectors, including environmental security and food safety scientific studies are continuing in the field of nano-biology, and each period brings us unique theories. among the goals of nano-biotechnology is the designs of new methodology to diagnostic of many diseases at an early stage by cheaper materials (2).Based on a number of scientific and cognitive studies related to nano-biological technology, many seminars were held in order to reach the maximum extent of the possibilities that can be obtained over time, which led to the manufacture of many medical and biological devices such as sensors and other devices that were discovered during the industrial revolution. Today the use of RNA nanoparticles is a common methodutilized in tumor diagnosis (3, 4).

PRINCIPLE OF NANO-BIOTECHNOLOGY

The term nano-biotechnology is often used to describe the real interaction that occurs between multi-system activities that are usually associated with biosensors, especially when different sciences converge such as photonics sciences, chemistry, biology, chemistry and biophysics, nano-engineering, nano-medicine, Other examples are represented in the link between nano-science and the industrial aspect, such as the manufacture of sensors that are used in all the fields mentioned. Nano-biotechnology is the study of how the living world works, at the atomic scale. In order to be able to continue to advance in this field, nanoscopic scales have been manipulated by scientists, researchers and discoverers in order to develop this ever expanding science. Therefore, understanding how to work with it more accurately and in detail is very necessary. The science of nano-biotechnology is one of the departments of nanotechnology that is concerned with studies of biological applications and biochemistry (biochemical) and all its uses. In electron microscopic observation, the collisions of electrons with the nanoparticles produced by (X-rays), and the elements have a unique atomic structures forming a unique of peaks on it's (X-ray) spectrum which is lead to the characterizations of main element (5). The relationship between biological sciences and nanotechnology can be summed up in two aspects. The first aspect is the use of biology science and its use in nanotechnology as the extraction and synthesis of nano-elements (nanoparticles) and nano-composites from living organisms of all kinds and branches, where researchers and discoverers used different methods in this The purpose, including mechanical, biological, chemical, physical, and other methods and other processes that lead to obtaining results through which we can understand that biology has been included in the field of nanotechnology, and in this case, this connection is called nano-biotechnology. Whereas, if the relationship of nanotechnology to biology includes adding nano-elements (nanoparticles) or nano-composites, or adding nanotechnology in any way to the various fields of biology, then it is called bio-nanotechnology, as shown in **figure (1)**. The multiplicity of uses for nanobiological science and the multiplicity of studies led to reaching a huge amount of solutions to many biological problems through this unique application of its kind. Benefit from it on the scientific and cognitive level. On this basis, innovations and new discoveries abounded by delving into the study of nanotechnology, which has become necessary with various other fields.

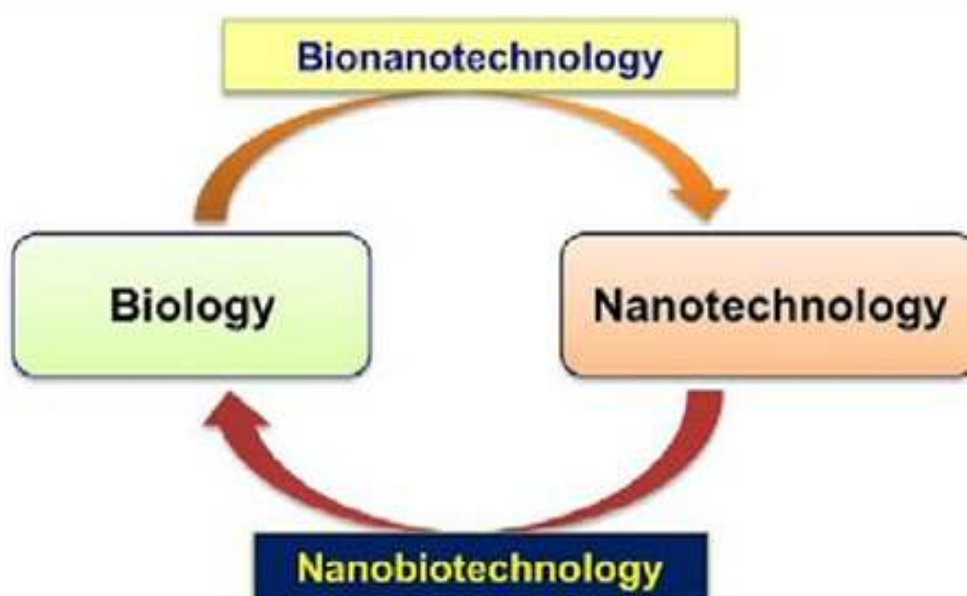


Figure 1: To Show Related Nanotechnology with Biology and Versus.

APPLICATION OF NANO-BIOTECHNOLOGY

Biotechnology deals with physiological and other metabolic processes all subjects of biology included microorganisms. In the combinations with nanotechnology, nano-biotechnology play an important role in development and implemented of many useful an instruments in the life studying. While, nano-biotechnology is the application of nanotechnologies in biological approaches, so biologists, physicists and chemists each view nanotechnology as a field of their subject, and collaborations in which are contributed equally as in common. Nano-biotechnology uses biological materials, in any case in biological or medical applications.

The integrations of nanotechnology with biology have led to the following applications:

Diagnostic Devices

Through it, it is possible to detect the nature of cells and the pathological conditions they are exposed to, whether they are infected with a malignant disease or not, in addition to revealing all the conditions to which they are exposed. The use of nanotechnology has been proven to detect and treat infection with the Corona virus, despite the complications that occur in this purpose, because the Corona virus is a very delicate creature and it is difficult to deal with and it is not easy to reach a cure or get rid of it and avoid its problems in any way of shapes , as shown in **figure no.2** below. Nano-biotechnology can help to more advantages in terms of its applications in emergency viral diseases like corona virus (covid. 19)(6). According to the Food and Drug Administration (FDA), nanoscale systems present different physicochemical and biological properties, compared to macro and micro materials. For example, drug encapsulation into nano-carriers makes it possible to control its release rate in the target sites, improve biocompatibility and decrease toxicity in healthy tissues (7; 8).

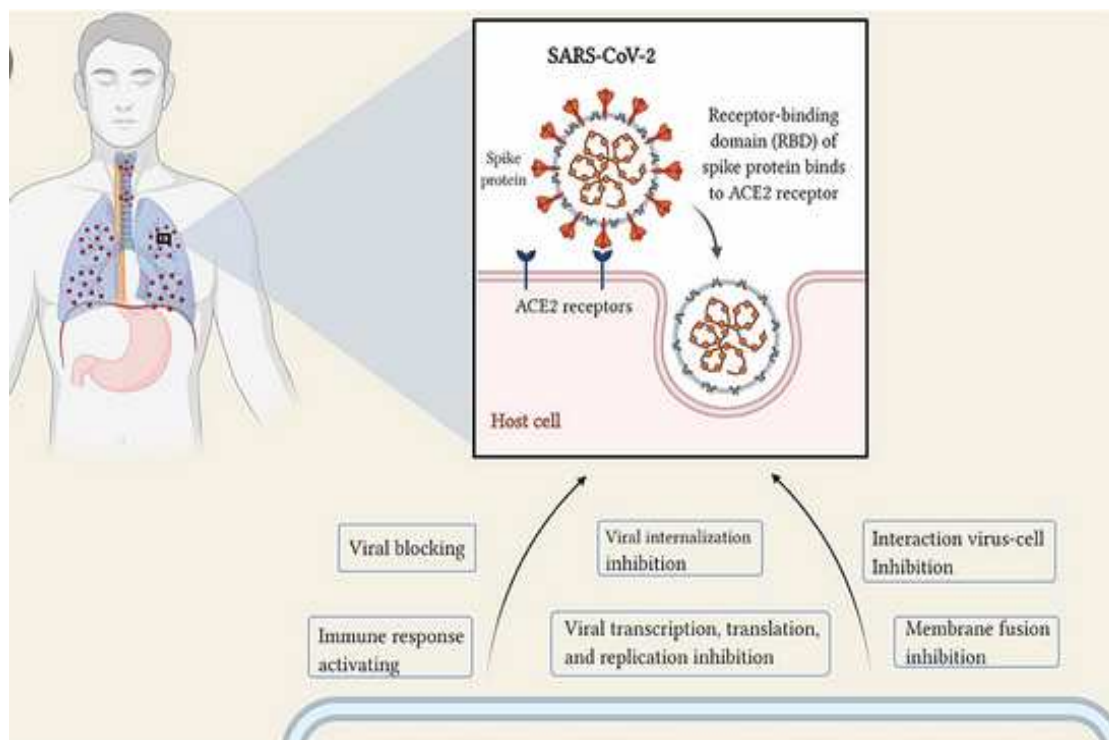


Figure 2: To Show the way of Corona Virus Diagnosis, Treatment, Prevention, by using Nano-Biotechnology and Other Details of the Infection Mechanisms.

Contrast Agents

It is an application that is useful in various applications such as medical imaging, such as X-ray imaging, through which it is possible to detect the type, percentage, and nano-scale of the metallic element, through the wave spectra that are shed on the samples to be detected, whether they are powder or liquid. Many researchers have conducted clinical experiments on some patients with primary or secondary brain malignancies to determination of the limited time of delayed contrast enhancement of some drugs such as ferumoxytol, and then compare between ferumoxytol and others with and without contrast agents (nano-materials) for magnetic or attraction mechanisms. In the results the maximal ferumoxytols enhancement intensity was observed at about (24-28 h.). The studies were assessed with each agents, indicated early vascular leak with gadolinium not with ferumoxytols drug (9). In the processes of drug delivery for transporting it any target location in the body such as cells, and tissues or any organs there are many suitable mechanisms to performed this function, as shown in **figure no. (3)** blow.

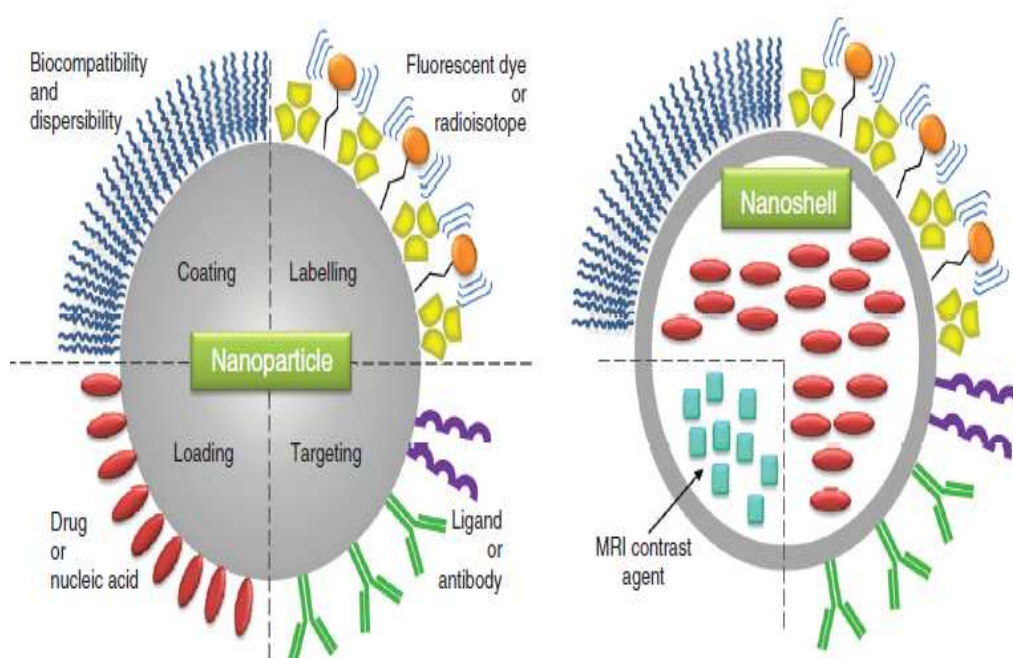


Figure 3: To Show the Drug Delivery to the Target Location in the Body such as Cells, and Tissues or Any Organs with Suitable Mechanisms and Several Processes.

Analytical Tools

This application is used in various fields such as optics, electronics, magnetization, catalysts, and others, and its biological effects at the nano-scale. - therapy, and drug-delivery vehicles, nano-biotechnology research is still in its infancy. Among the tools that are used to diagnose the real path and the realistic mechanism of the correlation between molecules, nano-materials and biological systems is the unit of measurement indicated by the scale as shown in the figure that shows us the real picture to compare the sizes of living things on the one hand and the sizes of compounds, materials and molecules. Nanotechnology, this is the closest explanation by which one can imagine what is the process that includes what will be the effectiveness and application of nano-biotechnology, as shown in **figure no. (4)**.

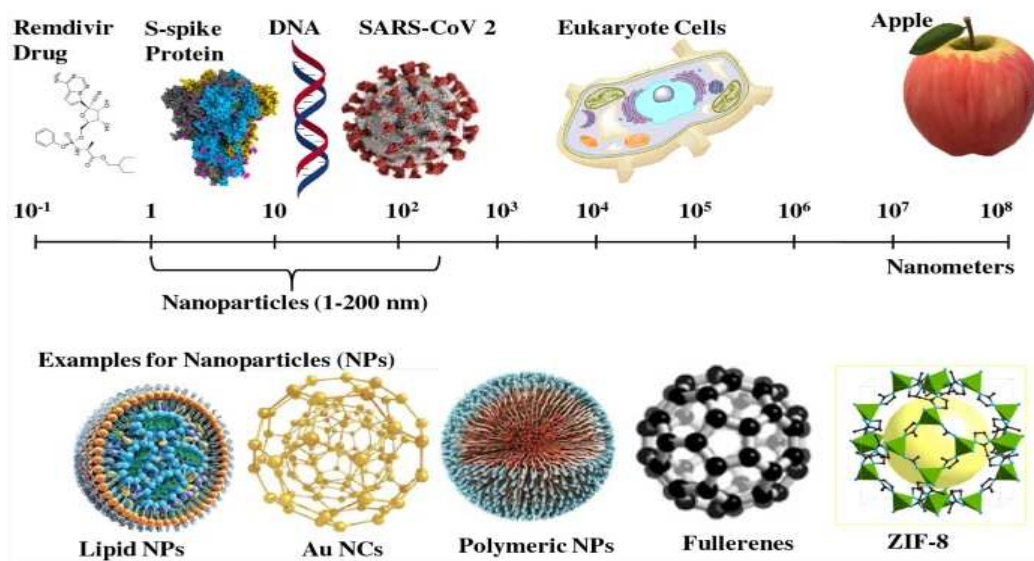


Figure 4: To Show the Scale of Nano-Biotechnology.

Treatment of Environmental Pollution and Agriculture Related

This application is at the environmental level to protect it from pollution, maintain the ecological balance, in addition to treating the toxicity of heavy sewage water by reducing the proportion of methane gas through a set of chemical reactions that lead to a change in the biological properties of water. There are many processes related with agriculture undergoes to the nano-biotechnology, as shown in **figure no. (5)A, and B**, this is imbedded several methods that based on many aspects like chemical, industrial, and other specialized related with nano-biotechnology. Nano-biotechnology improves the efficacy of crop breeding by delivered exogenous bio-chemicals and nucleotides into plant cells (10).

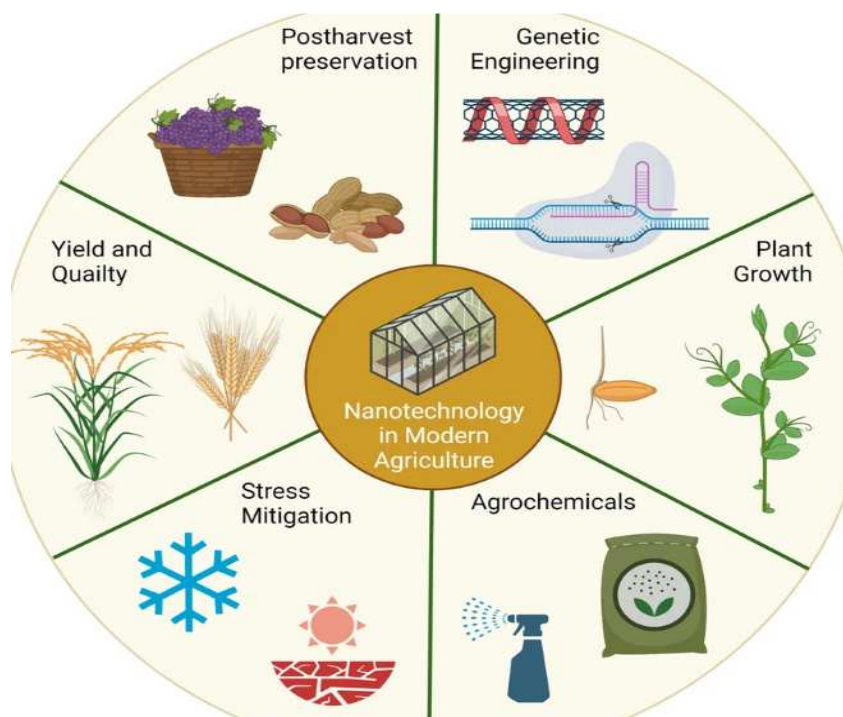


Figure 5 (A): To Show the Role of Nanotechnology with Agriculture.

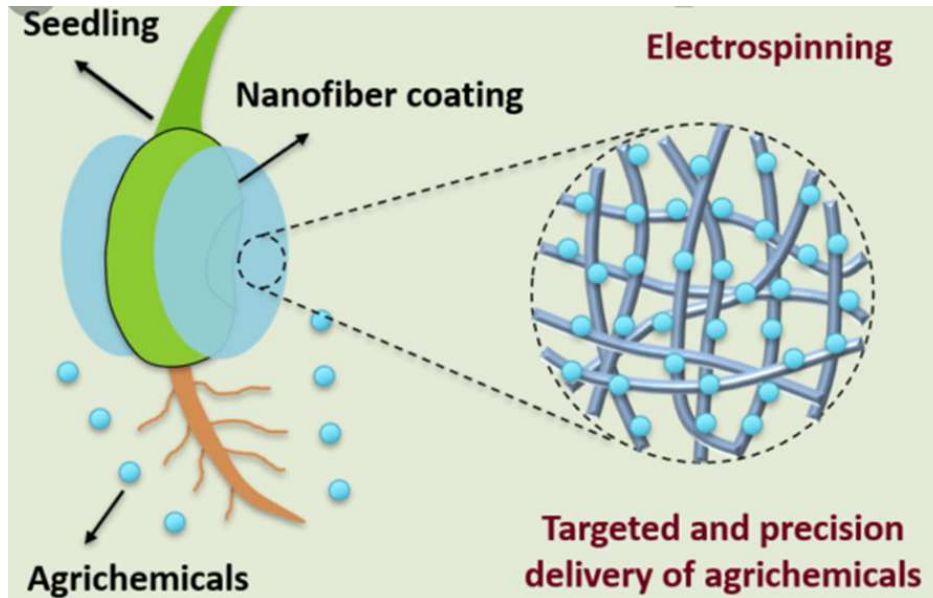


Figure 5 (A): To Show the Role of Nanotechnology with Agriculture and Delivery of Agrichemicals.

Maintaining in the Ionic Balance of the Cells

This is by binding to ions and transporting them through protein carriers that perform their function when there is an imbalance in the ion concentration inside and outside the cell and allowing the cell membranes to undergo the process of maintaining the acceptable ratios of the necessary elements of cells in most of the body's systems and organs, as shown in **figure no. (6)**. In the study of inorganic nano-materials, (11) demonstrated that ultra small magnetic iron-oxide nanoparticles exhibited dose dependent analgesic effected in the treatment of chronic-pain.

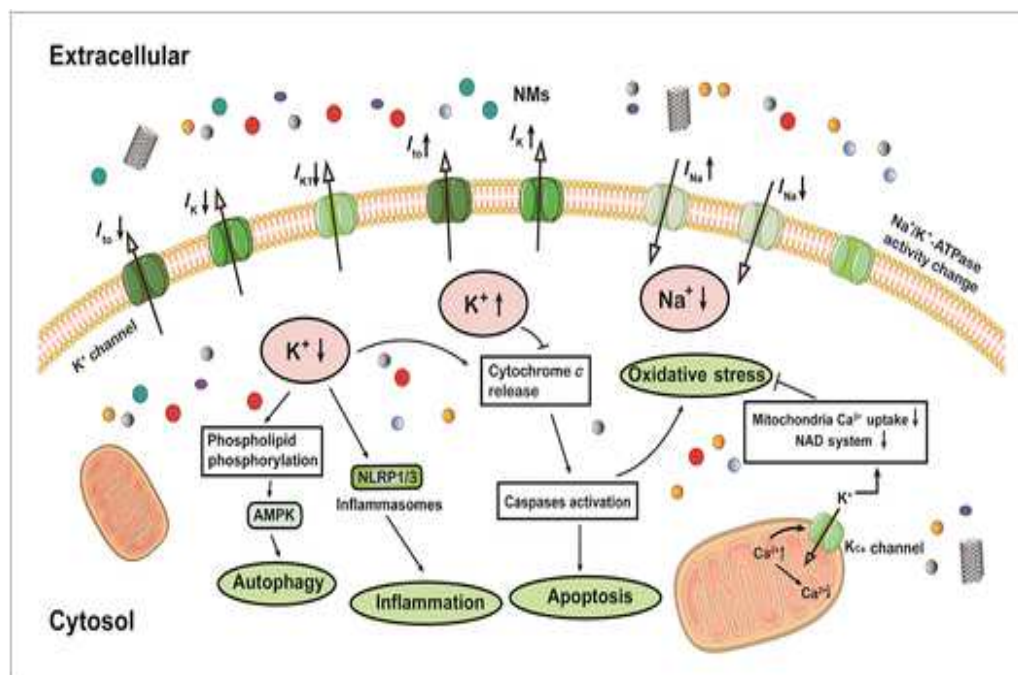


Figure 6: To Show the Role of Nanotechnology in Keeping of the Ionic Balance In and Out of the Cells.

The Process of Drug Transfer

It has emerged recently that the large number of uses of nanotechnology at the biological level in transporting drugs inside the body and delivering them to any part of it by ensuring the absorption process and performing the required function, as shown in **figure no. (7)**. However, the bio-safety of inorganic non-metallic nano materials would be a considerable obstacle to their application in clinic (12).

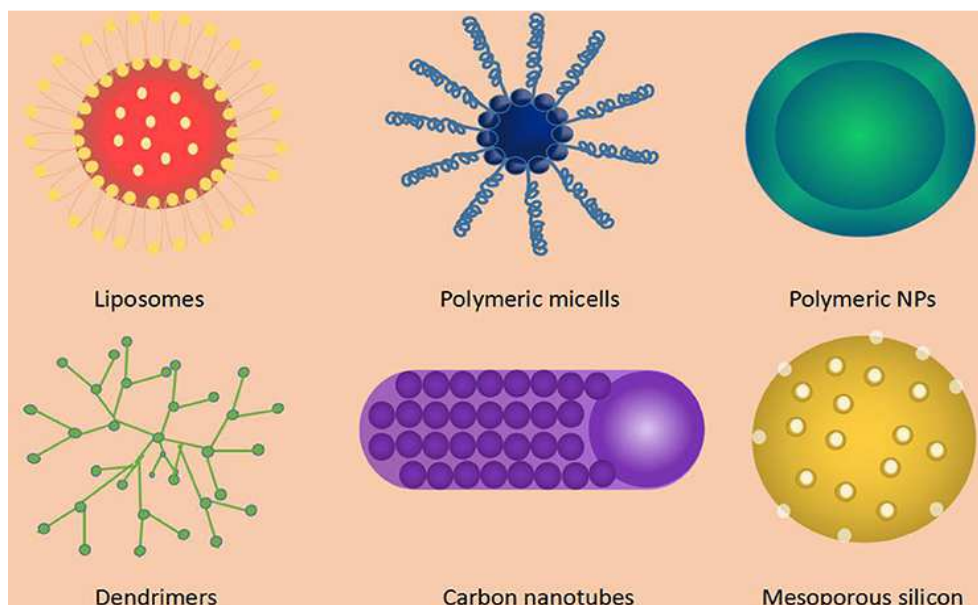


Figure 7: Common Types of Nano-Drug Transporters.

Treatment at the Genetic and Molecular Level

Many applications have been made in this field, such as changing the genetic characteristics of microorganisms by controlling the sequence of nitrogenous bases, or working on DNA damage (13) or mutating for the microbes that cause a specific disease, in addition to controlling the amino acid chain of proteins and peptides, as shown in **figure no. (8)**.

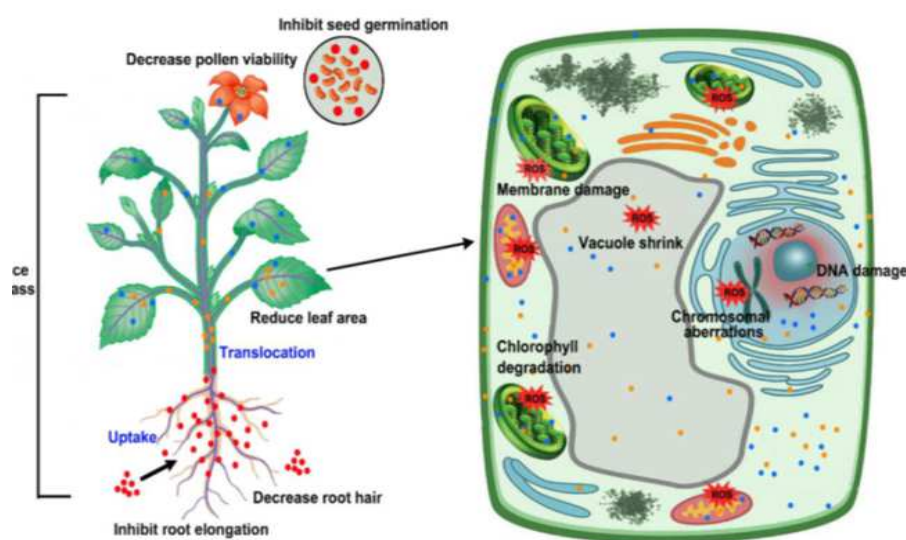
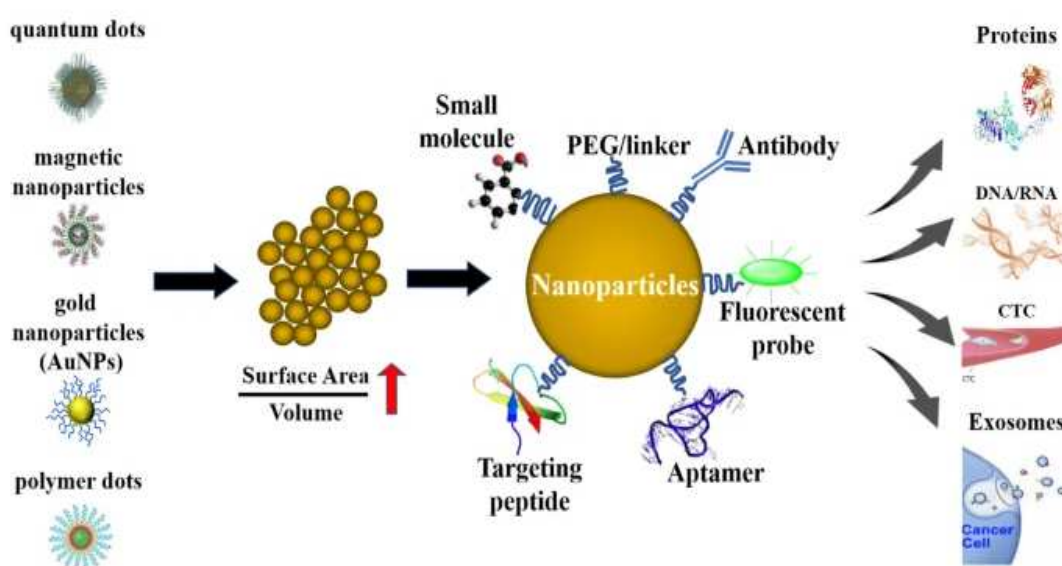


Figure 8: Schematic Representation that Showing the DNA-Damage, and Aberration of Chromosomes.

Biocompatibility with Antibodies at the Immune Level

This is illustrated by observing the special relationship between nanoparticles and the vital and kinetic features of the antibody and the mechanism of binding to the membrane, and its transfer through a magnetic attraction device to tissues and organs, and thus there is control and control in it and moving it to any place that we can consider the goal in treating a specific disease or getting rid of a specific problem on the immune level. Increasing of the uptake ratio of target cells, and reduce enzyme degradation, thereby improve the safety on the drugs activation (14). These details are important in their development in the stage of diagnostic nano-devices. **Figure no. (9).** show different biological aspects that related directed with the nanotechnology on the molecular, immunity, treatment , detection , and synthetic levels.



Nanotechnology improves cancer detection and diagnosis

Figure 9: Schematic Representation to Show Multiple uses of NANO-BIOTECHNOLOGY by the Relationship of Nanoparticles with many Aspect of Biological Sciences.

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