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Principles of nanotechnology (Article review)

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Abstract
Nanotechnology is the technology that deals with ultrafine particles dealing with measurements ranging between one and hundred nanometers. It is the science that is concerned with the study of materials processing on the molecular scale, as well as the importance of nanotechnology in innovations and various applications as a new method used in dealing with nano-scale measurements that are (a thousandth of a micrometer, and a millionth of a millimeter). Nano-scale dimensions are much less than the dimensions of bacteria and living cells, as they are concerned with the properties of living and non-living materials, and their fields vary widely, making them related to all scientific disciplines at the molecular level.

Keywords: Nanotechnology, importance of nanotechnology, scientific disciplines

Introduction

Nanotechnology is a technology that has a very small unit of measurement, which cannot be seen with the naked eye or some simple macroscopic amplifiers. Nanotechnology uses atomic measurements to determine the sizes of material particles. Accordingly, nanotechnology can be defined as the modern science that studies the possibility of changing matter at the nano-scale level, in order to produce new and advanced materials or devices that serve human interests in various fields. Nanotechnology works on the study of materials whose dimensions range between 1 and 100 nanometers, and their understanding and control [1], which can be used in all different scientific and applied fields, such as physics, medicine, chemistry, biology, engineering, and materials science [2]. It is worth noting that what is meant by the term nanotechnology is the study of what is related to the basic understanding of each of the physical, chemical, as well as biological properties on the atomic and molecular scale, and the possibility of controlling these properties in order to be subject to control when creating some materials and functional systems with unique capabilities and capabilities. [3]. It must be pointed out that the term nano is an old scientific term first addressed by the scientist Richer Feynman in (1959 A.D.) in a lecture he delivered at the American Physical Society, in which he said: (*There is a large space inside the atom*), but this topic was not taken seriously in that time [4]. The term nanotechnology has been used a lot in modern times, but it was used for the first time by scientist Norio Taniguchi in 1974, while this term was not widely known. Scientist Kay Eric Drexler used the term known as nanotechnology in his book named; (Generation Engines, The Next Age of Nanotechnology), and in this book he proposed the idea of (assembly) on the nano-scale, to be able to build copies of itself and from other elements that are complex through Control and control at the atomic and molecular level. In 1986, the scientist Drexler contributed to the establishment of the Foresight Institute, to help spread public awareness and knowledge of the concepts of nanotechnology applications and their effects [5], since this technology appeared in the eighties of the twentieth century in the research aspect through theoretical work, he worked to develop this concept leading this to experimental progress in all fields on a large scale of technology and atomic and molecular control and studying the possibilities available for that. Most governments have moved to promote and support the funding of academic and applied scientific research that is concerned with the study of nanotechnology. The United States has launched the National Nano Initiative, by formulating a volume of nanotechnology and providing appropriate funding for research in nanotechnology. In Europe, interest in this field has increased through the Scientific Programs Authority for Applied Research and Nanotechnological Development. With the beginning of this century, great interest in new scientific development began, and it began to flourish and progress, and new projects appeared in the production of types of future plans for nanotechnology [6].

The benefits of nanotechnology

There are many benefits of nanotechnology, as it is involved in all areas of daily life and the various needs of the individual and society. It has contributed to helping to improve many technological sectors involved in medicine and industry to a large extent, as in its entry into information technology, Various types of energy, branches of medicine, and environmental sciences, as well as its entry into food and drug safety, and many other fields. Nanotechnology has entered the control of material structures within very small scales in order to achieve certain specific properties for it through which it can improve and strengthen the effectiveness of materials, although it will be light in weight, but it is more durable and efficient, and has a superior ability to interact and interlock. Many of the commercial products used and consumed daily that are found in the market depend on the basis of their work on nanotechnology. For example, the manufacture of films and transparent nano-thin films can help to benefit from computer screens, cameras, optical devices, home windows, and other surfaces. It may make it waterproof, anti-radiation, and it can be resistant to ultraviolet or infrared radiation, as well as making it scratch-resistant and non-conductive [7]. Nanotechnology has entered most consumer products for humans and the rest of the animal and plant organisms, as billions of microscopic nanowires, each of

about 10 nanometers in length, have been linked with natural and synthetic fibers at the molecular level in order to add stain resistance and cleaning clothes and fabrics. Zinc oxide nanocrystals have also been used to make invisible sunscreen and UV protection. Silver nanocrystals have also been included and prepared and used in the medical and biological fields as vital dressings that can be used to kill and prevent the growth of bacteria and other microbes, as well as to prevent the spread of infection (3).

The most important difficulties in nanotechnology

Difficulty controlling or realizing it due to the small size of the substance particles. Figure (1) represents nano-scale sizes, with an example of living and nonliving materials for each size category or metric unit. The basic specifications of all materials change whenever their sizes change, and their behavior and interactions change according to their different sizes as well.

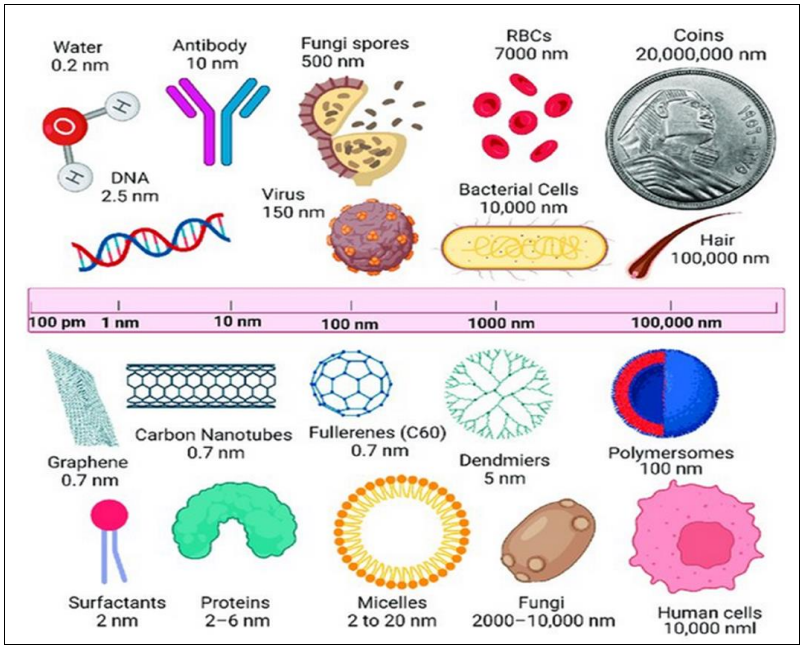

Fig 1: Showing different size categories and metric units.

Difficulty directing particles of materials after removing them from their places to new places. For example, the difficulty is sometimes represented in accurately controlling the direction and transport of nanoparticles from one place to another inside the body for the sake of treatment. If the nanoparticles themselves are used as a treatment or used as carriers for different treatments at the molecular and physiological level, here the subject requires that there be some characteristics physiotherapy that is appropriate for the desired purpose [8], as shown in Figure (2) below:

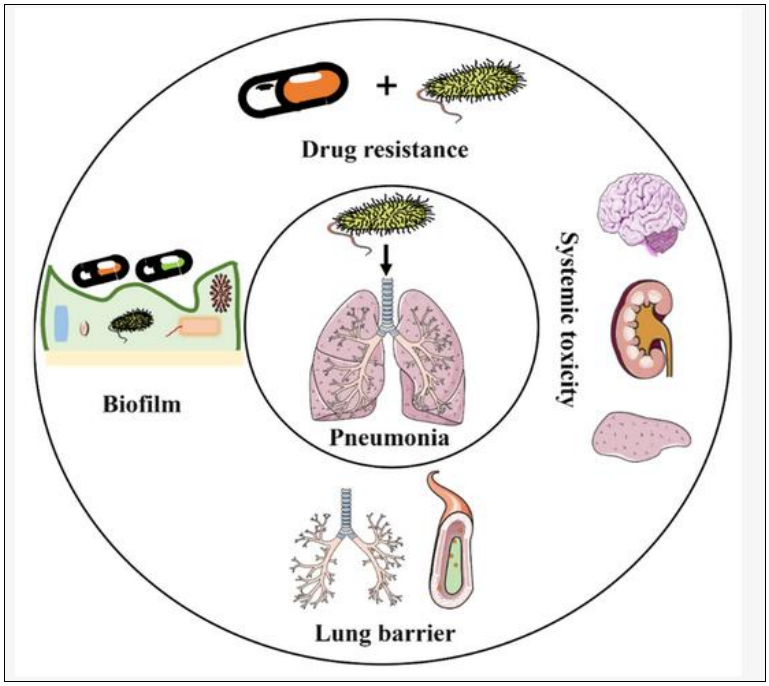

Fig 2: Showing the control of nano-materials transporting and with an antibiotics delivery in human body through treatment processing.

The consequences of changing the properties of molecules cannot be predicted, as it may lead to undesirable results. Among the most important expected difficulties in the use of nanotechnology is its impact on the genetic level, which leads to genetic changes known as genotoxicity, or may be a cause of genetic mutations [9], as shown in Figure (3) below:

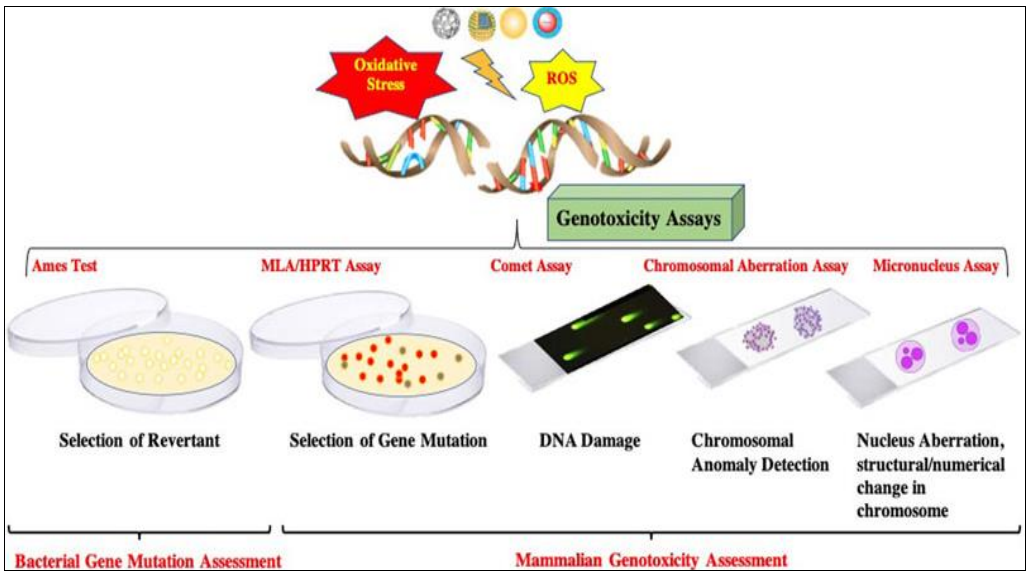

Fig 3: Showing the changing of the molecules properties, which leads to undesired results, effected on DNA in general.

There are many caveats in dealing with nanoparticles for fear of health and public safety of the environment and humans. The introduction of nanotechnology in the field of medicine, biology, and the media industry, cultivating, preserving, and transporting microbes from one place to another made there a lot of caveats in this aspect, because it is possible to develop microbial strains that are harmful to human health and lead to environmental pollution without the knowledge of many people. and even national authorities [10], as shown in Figure (4) below:

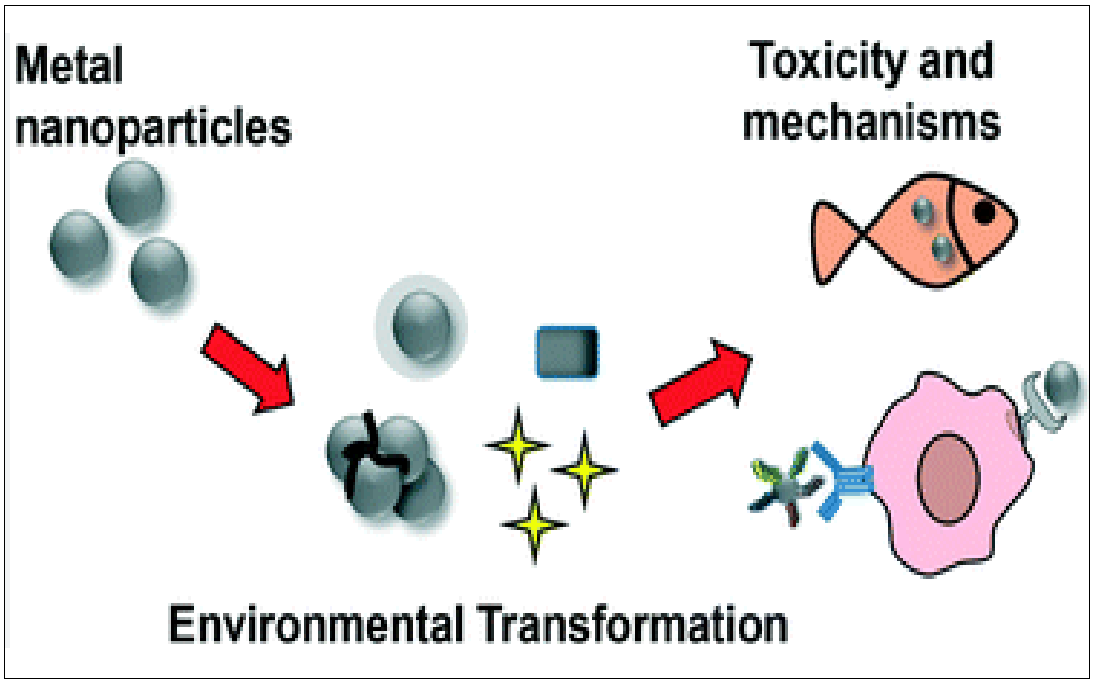

Fig 4: Showing the effect of nanoparticles on the health and environment.

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