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From Kilometer To Nanometer

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ABSTRACT *The purpose of this article is to describe some aspects of the development of nanoscience and nanotechnology. Nanoscience studies the behavior of the substance on the scale of a few atoms or molecules. The analysis shows that the Brazilian research in the area is considered recent, albeit under other names, date of at least 20 years. Innovation is still fairly recent and there are different views on the issue. However, there is already a tendency to promote innovation in nanotechnology in the country. Nanotechnology is considered as the next technological revolution. Proponents of nanotechnology to consider as a solution to the main problems of developing countries. Many arguments are presented regarding this optimistic view, which does not take into account the social context in which science and technology are developed.*

INTRODUCTION

On a cold winter night in 1959, the famous American physicist Richard P. Feynman[5] gave a lecture closing meeting of the American Physical Society. People look forward to the lecture provocative title, and curious, "There is plenty of room down there." One of the points raised was the DNA and the amazing ability of this molecule over a meter in length to fit inside the nucleus of a cell that we can only see with the aid of a microscope. The fact is that there is much more downstairs than our "macroscopic" intuition tells us.

Another point raised by Feynman became the basis of Materials Engineering. In the words of Feynman, "What would the properties of materials if we could arrange the atoms the way we want? I cannot see exactly what would happen, but I do not doubt that when we have some control over the arrangement of things on a small scale we will have an enormously greater range of properties that substances can have, and the different things we can do."

This lecture was considered the trigger of nanotechnology, and the great physicist Richard P. Feynman is considered the father of nanoscience. Feynman[5] spoke of "manipulating and controlling things at the atomic scale", "arrange the atoms the way we want", "arrange the atoms one by one the way we want." The term nanotechnology, nanoscience and nanomaterials were only incorporated into academic texts from 1987, one year before the death of Richard Feynman, who in 1965 received the Nobel Prize in Physics for his work in quantum electrodynamics. Furthermore, Feynman conceived the idea of quantum computing.

However, to paraphrase Richard Feynman, there is also plenty of room up there ... To give a basic idea of the extreme points of the universe, will be given an example of the dimensions of the macrocosm nanocosmo. According to an article published in the journal CENÁRIO[1] XXI, The Milky Way, our galaxy, measures 100 thousand light years in diameter, which means it takes light 100,000 years to cross it from one side to another. Light-year is the distance that light is able to travel for a year in a vacuum. It is a unit of measurement used in astronomy and equals about 9.5 trillion miles. The nearest star to our solar system is Alpha Centauri, a star about the size of our Sun. It is 4.35 light years from us. The diameter of the Sun is approximately 1.4 million kilometers. The diameter of the Earth is 150 million kilometers from the Sun, is about 12,600 kilometers. The Moon, with about 3500 miles in diameter, is at an average distance of 380,000 km from Earth. Our unit and usual legal measure is the meter. The average size of a man is less than two meters. A ruler is about 30 centimeters, while the average thickness of a layer of asphalt used in resurfacing an avenue is the order of five millimeters.

Organisms such as viruses and bacteria corresponds to one thousandth of a millimeter, micrometer call. The human DNA molecule measures approximately 20 hundredths of microns. A nanometer is a billionth of 1 meter, or division of the meter in 1 billion parts. Angstrom (Å) is a tenth of a nanometer. A carbon atom has 1 Å diameter. According CHAVES[2] nanotechnology is the study and manipulation of matter at an extremely small scale, in the range between 1 and 100 nanometers. Although this pathway is already known in chemical processes, the novelty is that now you can directly manipulate atoms and molecules to build products. Nanoscience is "the study of phenomena and manipulation of materials at atomic, molecular and macromolecular scales, where properties differ significantly from those at a larger scale," while nanotechnology is "the design, characterization, production and application of structures, devices and systems by controlling shape and size at the nanometric scale."

NANOSCIENCE, A TRANSDISCIPLINARY TOPIC

FERNANDES and FILGUEIRAS[4] comment that nanotechnology is essentially interdisciplinary, involving chemists, physicists, biologists, engineers, pharmacists, managers and other professionals. Nanotechnology is much more than reduce the size, it is mainly the exploration of phenomena and properties that the substance exhibits at the nanoscale. Not everything in nature is simple. Often, matter organizes itself in more complex structures than

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those produced by the engineering of materials already dominated by man. At the apex of this complexity are living beings. In them, atoms combine into structures with a hierarchical form of complexity: amino acids combine to form proteins of enormous diversity, these and other molecular structures form cells and tissues also very diverse, culminating in a unit that can grow, auto play, make repairs damage in themselves, and finally lose this capacity for self-repair, with consequent disruption of the functions and the decomposition of the body[15].

Nanotechnology is a technological revolution-reaching impact and perhaps unprecedented in history. It is the final step, or nearly, in the pursuit of man's control over matter, control the atom by atom, molecule by molecule. Finally, the engineering on the atomic scale, the last stop of ordinary matter. Its consequences will be huge advances in material from people and their health, and reducing the impact of industrial activity on the planet, so the production of more durable goods as the more efficient use of energy wellness. The use, the domain, the development and exploration of different materials have a profound influence on the social development and are closely related to socioeconomic, cultural, geographic, demographic, environmental aspects, among others[7].

The nanotubes[12] are formed for example by sheets of carbon atoms in a hexagonal arrangement, which is wound to form a spaghetti having a diameter typically between one and two nanometers. Spaghetti can be very long and close carbon atoms in a pentagonal arrangement. This points to a microelectronic nanotube, with which more powerful computers may eventually be built. Nanotubes are now also being used as needles in electronic scanning microprobes. Graphene is the name of the world's finest material that can be obtained by rubbing graphite on a glass plate with a layer of oxide. Of the mop it is obtained some of the remains of graphite being a single atomic layer. These graphene flakes are visible under an optical microscope. The carbon atoms form a hexagonal lattice, almost no defects[3]. The electrons propagate in graphene, almost without resistance, with much higher velocities in most semiconductor; this will allow much faster transistors. The graphene sheet nanoscopic dimensions, consists only of carbon atoms with almost magical properties. Emerges as candidate for the post of silicon in the manufacture of computer chips. But in order to be useful, scientists will have to produce large leaves of nanotissue. Graphene wafers a few inches will be needed. These nanomaterials have high mechanical strength, flexibility and resistance to breakage when bent or twisted. This fantastic set of properties, mainly resulting from the size scale of these materials makes carbon nanotubes have also been used in several applications[1].

Nanostructures have been described in scientific studies since the 1960s. The ratio between the Earth and a pea is approximately equal to the ratio between the pea and a nanoparticle. This means that if a pea would be placed on the floor and the Earth would be reduced to its grain size of the above, the latter would have a nanoparticle size. The study of material properties at the nanometer scale is called nanoscience. When nanotechnology is applied to the life sciences, is known as nanobiotechnology and nanomedicine[8].

FINAL CONSIDERATIONS

Nanotechnologies have found many applications in medicine with regard to tissue engineering, ultra-sensitive diagnostics and more effective and safer drugs. Nanotechnology is finding applications in diverse areas, from energy and electronics industries to the area of health and their utility is based on the fact that may have different properties from those presented at larger scales. POHLMANN and GUTERRES[11] define nanotechnology as the revolutionary discipline in terms of its enormous potential to solve many problems related to health, such as: the creation of artificial organs and implants with greater affinity for the original tissue, nerve cells grown on implants polymeric meshes for repair of spinal cord; Cartilage or bone cells for reconstitution of liver cells and joints for construction of liver transplant. Device implantable in the body can continuously monitor blood levels of certain biological indicators and automatically adjust the drug release in appropriate amounts. For example, diabetes patients can monitor blood sugar levels in real time and manage himself the necessary doses of insulin through smart nanoparticles that, in addition to prevent degradation of the drug promotes a more controlled release or allow their passage through insurmountable biological barriers by free drug.

FERNANDES and FILGUEIRAS[4], mention much faster, smaller and lighter computers can program products according to buyer's requirements, and characteristics of design, size, shape, color, smell, resistance specified. There will, however, difficult to find skilled workers and are increasingly growing number of jobs available to professionals with this training. It is estimated that nanotechnology will go lead to restructuring of the whole school, to break the traditional disciplinary boundaries, in practice, nanotechnology has already surpassed. Adjustments will be required in the curricula of several courses in order to introduce concepts and skills compatible with what is expected of these professionals. As it comes to disciplinary matters is essential that professionals learn to work in partnership, through infrastructure sharing and dissemination of multiuser laboratories.

CONCLUSION

We can say that nanoscience is happening due primarily to three experimental techniques, namely, transmission electron microscopy, high-resolution, the scanning tunneling microscope and the atomic force microscope, and the theoretical point of view, the computational simulations. These techniques allow to observe the atoms and some even more, allow manipulating matter atom by atom. This ability to manipulate matter at the atomic scale, atom by atom, generates a non-existent prior expectation, the possibility of new materials, new electronics, new drugs, the solution of energy problems and new proposals that might not even imagine[9]. Decades ago, if someone said that one day the entire contents of an encyclopedia would fit on the head of a pin space, seem subject of science fiction. But, as we read this article, nanotechnology advances are real.

On the other hand, specifically in relation to the medical field, although nanotechnology is a major breakthrough, many people are still dying on stretchers on the runners of some hospitals served by the Public Healthcare System. The vast majority of users of health systems do not have access to ultrasound imaging, MRI, and in certain cases not involving x-ray examinations, techniques available on the market for many years. So, in a sense, advances in nanotechnology area can be an instrument of exclusion. Remember that good portion of the population of many cities in Brazil and the world does not have good sanitation and availability of compatible electricity.

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