NANOTECHNOLOGY IN MEDICINE

Xadjayeva Kumushxon

Student of the Health Care Management faculty of the Tashkent Medical Academy
***Scientific adviser**: Sobirjonov Abdusamad, senior lecturer of the Department of "Biomedical Engineering, Informatics and Biophysics" at the Tashkent Medical Academy*

Nanotechnology, the manipulation of matter at the atomic and molecular scale to create materials with remarkably varied and new properties, is a rapidly expanding area of research with huge potential in many sectors, ranging from healthcare to construction and electronics. In medicine, it promises to revolutionize drug delivery, gene therapy, diagnostics, and many areas of research, development and clinical application.

The prefix "nano" stems from the ancient Greek for "dwarf". In science it means one billionth (10 to the minus 9) of something, thus a nanometer (nm) is is one billionth of a meter, or 0.000000001 meters. A nanometer is about three to five atoms wide, or some 40,000 times smaller than the thickness of human hair. A virus is typically 100 nm in size. The ability to manipulate structures and properties at the nanoscale in medicine is like having a sub-microscopic lab bench on which you can handle cell components, viruses or pieces of DNA, using a range of tiny tools, robots and tubes. Imagine, for example, being able to stretch out a section of DNA like a strand of spaghetti, so you can examine or operate on it, or building nanorobots that can "walk" and carry out repairs inside cell components. Nanotechnology is bringing that scientific dream closer to reality.

For instance, scientists at the Australian National University have managed to attach coated latex beads to the ends of modified DNA, and then using an "optical trap" comprising a focused beam of light to hold the beads in place, they have stretched out the DNA strand in order to study the interactions of specific binding proteins.

Meanwhile chemists at New York University (NYU) have created a nanoscale robot from DNA fragments that walks on two legs just 10 nm long. In a 2004 paper published in the journal *Nano Letters*, they describe how their "nanowalker", with the help of psoralen molecules attached to the ends of its feet, takes its first baby steps: two forward and two back.

Nanobots made from other materials are also in development. The researchers found giving their nanobot the shape of a star helped to overcome one of the challenges of using nanoparticles to deliver drugs: how to release the drugs precisely. They say the shape helps to concentrate the light pulses used to release the drugs precisely at the points of the star.

Scientists are discovering that protein-based drugs are very useful because they can be programmed to deliver specific signals to cells. But the problem with conventional delivery of such drugs is that the body breaks most of them down before they reach their destination. Nanofibers are fibers with diameters of less than 1,000 nm. Medical applications include special materials for wound dressings and surgical textiles, materials used in implants, tissue engineering and artificial organ components. Nanofibers made of carbon also hold promise for medical imaging and precise scientific measurement tools. But there are huge challenges to overcome, one of the main ones being how to make them consistently of the correct size.

Nickel nanoparticles are particularly interesting because at high temperatures they help grow carbon nanofibers. The researchers also found there was another benefit in using these nanoparticles, they could define where the nanofibers grew and by correct placement of the nanoparticles they could grow the nanofibers in a desired specific pattern: an important feature for useful nanoscale materials.