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NANOTECHNOLOGY IN MEDICINE: TECHNOLOGY TRENDS (НАНОТЕХНОЛОГІЇ В МЕДИЦИНІ: ТЕХНОЛОГІЧНІ ТЕНДЕНЦІЇ)

У статті зроблено огляд нанотехнологій в медицині. Розглянуті деякі технологічні тенденції розвитку даної галузі. Проаналізовано основні занепокоєння з приводу використання нанотехнологій в медицині та зроблено висновок щодо перспектив впровадження технології.

Ключові слова: *нанотехнології, медицина, ДНК, наноробот, лабораторія, перспективи.*

The article reviews nanotechnology in medicine. Some technological tendencies of development of this branch are considered. The main concerns about the use of nanotechnology in medicine are analyzed and a conclusion is made about the prospects of technology introduction.

Keywords: *nanotechnology, medicine, DNA, nanobot, laboratory, perspectives.*

Nanomedicine refers to the area of science that combines nanotechnology with drugs or diagnostic molecules to improve the ability to target specific cells or tissues. These materials are produced on a nanoscale level and are safe to introduce into the body. Applications for nanotechnology in medicine include imaging, diagnosis, or the delivery of drugs that will help medical professionals treat various diseases [1].

This area of research involves attaching nanoparticles onto drugs or liposomes to increase specific localization. Since different cell types have unique properties, nanotechnology can be used to “recognize” cells of interest. This allows associated drugs and therapeutics to reach diseased tissue while avoiding healthy cells. While this is a promising area of research, very few nanomedicines exist that successfully utilize nanotechnology in this manner. This is due to ill-defined parameters associated with pairing the correct ratio or combination of nanoparticles with the drug of interest [1].

Chemists at New York University have created a nanoscale robot from DNA fragments that walks on two legs just 10 nm long.

One of the researchers, Ned Seeman, said he envisages it will be possible to create a molecule-scale production line, where you move a molecule along till the right location is reached, and a nanobot does a bit chemisty on it, rather like “spot-welding” on a car assembly line [2].

The work that Seeman and colleagues are doing is a good example of “biomimetics”, where with nanotechnology they can imitate some of the biological processes in nature, such as the behavior of DNA, to engineer new methods and perhaps even improve them.

DNA – based nanobots are also being created to target cancer cells. For instance, researchers at Harvard Medical School in the US reported recently in Science how they made an “origami nanorobot” out of DNA to transport a molecular payload. The barrel-shaped nanobot can carry molecules containing instructions that make cells behave in a particular way. In their study, the team successfully demonstrates how it delivered molecules that trigger cell suicide in leukemia and lymphoma cells.

Nanobots made from other materials are also in development. For instance, gold is the material scientists at Northwestern University use to make “nanostars”, simple, specialized, star-shaped nanoparticles that can drugs directly to the nuclei of cancer cells. In a recent paper in the journal ACS Nano, they describe how drug-loaded nanostars, that after being attracted to an over-expressed protein on the surface of human cervical and ovarian cancer cells, deposit their payload right into the nuclei of those cells.

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 [2].

Activity with nanofibers. The scientific community is mostly concerned about the toxicity/carcinogenicity of manufactured nanofibers (nanomaterials with length-diameter aspect ratio larger than 3) because of their morphological resemblance to asbestos. Inhalation of asbestos fibers is known to induce asbestosis (a progressive fibrotic disease of the lung), lung and pleura cancer. The health hazards of nanofibers are mostly limited to carbon nanotubes and are the subject of an intensive research. Results of already established toxicity studies show a clear morphology-toxicity relationship for carbon nanotubes, as previously observed for asbestos fibers. However, synthesis of nanofibers is being continuously under progress and, as a result, nanofibers can be made out of nearly any material nowadays. Some of them will very likely resemble more closely to asbestos than carbon nanotubes by their size, chemical composition or surface properties. They open the possibility of making nanofibers with undesired harmfulness [3], which could be putatively equal or even higher than the one of asbestos. Hence, all activities, either with dry nanofibers or nanofibers in suspension will situate the laboratory in the *Nano 3* category except for those where nanofibers are strongly interacting with the matrix (composites), preventing the materials to be released in the environment [4].

Present knowledge on nanomaterial toxicity is insufficient for completing precise risk assessment. Threshold Limit Values for nanomaterials do not exist nor is there standard equipment for sufficiently detailed routine exposure measurements. However, since preliminary scientific evaluations show that there are reasonable grounds for concern that activity with nanomaterials might have damaging effects on human health; the precautionary principle must be applied [5]. New hazard knowledge will be used as it is developed and made available. The lab responsible is in charge of applying measures adapted to specific activities [4].

Conclusion. Recent years have seen an explosion in the number of studies showing the variety of medical applications of nanotechnology and nanomaterials. In this article I have glimpsed just a small cross-section of this vast field. However, across the range, there exist considerable challenges, the greatest of which appear to be how to scale up production of materials and tools, and how to bring down costs and timescales.

But another challenge is how to quickly secure public confidence that this rapidly expanding technology is safe. And so far, it is not clear whether that is being done.

There are those who suggest concerns about nanotechnology may be over-exaggerated [6].

Of attempts to investigate the safety of nanomaterials, the National Cancer Institute in the US says there are so many nanoparticles naturally present in the environment that they are “often at order-of-magnitude higher levels than the engineered particles being evaluated”. In many respects, they point out, “most engineered nanoparticles are far less toxic than household cleaning products, insecticides used on family pets, and that for instance, in their use as carriers of chemotherapeutics in cancer treatment, they are much less toxic than the drugs they carry [7].

Nanomaterials are already used to lower levels of fat and sugar without altering taste, or to improve packaging to keep food fresher for longer, or to tell consumers if the food is spoiled. They are also being used to increase the bioavailability of nutrients.

But, there are also concerned parties, who highlight that while the pace of research quickens, and the market for nanomaterials expands, it appears not enough is being done to discover their toxicological consequences.

But when a technology advances rapidly, knowledge and communication about its safety needs to keep pace in order for it to benefit, especially if it is also to secure public confidence. We only have to look at what happened, and to some extent is still happening, with genetically modified food to see how that can go badly wrong [7].

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SAFFRON (CROCUS SATIVUS) CULTIVATION TECHNOLOGY

У статті представлена сучасна технологія вирощування шафрану, вказані особливості його вирощування. Також представлені проблеми які виникають при вирощуванні шафрану. Надані рекомендації по його вирощуванню та збору.

Ключові слова: *шафран, вирощування, обробіток грунту, збирання, хвороби.*

The article presents the modern technology of saffron cultivation, the features of its cultivation are indicated. The problems that arise when growing saffron are also presented. Recommendations for its cultivation and collection are provided.

Keywords: *saffron, cultivation, tillage, harvesting, diseases.*

Saffron (Crocus Sativus, crocus, red gold) is grown on an industrial scale mainly in South Asia, Iran is the largest exporter [2].

In Ukraine, you can find this plant in the Crimea, as well as in the Kherson