2020 Top Nanotechnologies for Life

2021-01-12
Given the whole published scientific reports, patents, statistics, news, standards, and regulations as well as commercial products and projects in 2020, StatNano is undertaking a survey in company with the audience to find out the most important event in the nanotechnology field with the greatest impact on people's life quality.

In the other words, according to news and statistics which we put effort to stat them this year, we are going to recognize and publish those aided more improvement in different people's life aspects. Here are the top ten most impressive worldwide nanotechnology topics (according to investigation of StatNano) that may have great effects on the development of science and technology or quality of life. The audience of StatNano is hereby requested to participate in this survey through the link and select a maximum of three items.

Start the StatNano Survey: 2020’s Top Nanotechnologies for Life

1- Detecting COVID-19 Antibodies in 10 Seconds Using Aerosol Jet 3D Printing

Researchers at Carnegie Mellon University report findings on an advanced nanomaterial-based biosensing platform that detects, within seconds, antibodies specific to SARS-CoV-2, the virus responsible for the COVID-19 pandemic. In addition to testing, the platform will help to quantify patient immunological response to the new vaccines with precision. The testing platform identifies the presence of two of the virus' antibodies, spike S1 protein, and receptor-binding domain (RBD), in a very small drop of blood (about 5 microliters). An

additive manufacturing technology called aerosol jet 3D printing is responsible for the efficiency and accuracy of the testing platform. Tiny, inexpensive gold micropillar electrodes are printed at the nanoscale using aerosol droplets that are thermally sintered together.
→ Read more

2- Transforming the Production of Carbon Nanotubes Using Carbon Dioxide

A new manufacturing process developed by SkyNano significantly reduces carbon nanotube production costs, resulting in carbon nanotubes that are competitively priced with other conventional carbon structures. This cost reduction was achieved through a novel process that extracts harmful carbon dioxide from the environment and permanently stores it as solid, stable carbon nanotubes. Given that carbon nanotubes also have the potential to provide significant energy and CO2 savings when replacing conventional carbon structures, this truly remarkable innovation stands to have a lasting impact.
→ Read more

3- Atomic-scale Apertures: a Novel Regime in Physics and Materials Science

Two new studies demonstrate how to fabricate materials with single atom-sized pores that can be used for liquid and gas filtration. The first study shows the ionic transport properties of these pores, with promise for applications in water purification and desalination as well as for creating artificial pores that mimic ion channels in biology. The second study demonstrates how helium gas flows through these pores. Researchers have expertise in making atomically-thin materials and devices that are dotted with nanopores. Using a systematic approach to test and refine their fabrication process, the researchers were able to refine their method and develop a prototype that could be tested in more “real-world” conditions. The opportunities for potential applications are wide-ranging, from water desalination, energy harvesting, and measuring small molecules such as hormones and pharmaceuticals.
→ Read more

4- Novel Nanoparticle that Can Efficiently and Selectively Kill Cancer Cells

Researchers in the Department of Chemistry at LMU reported the development of a class of

novel amorphous nanoparticles made up of calcium and citrate and encapsulated in a lipid layer, which is capable of breaching the barriers to uptake and killing tumor cells in a targeted fashion. Both calcium phosphate and citrate are involved in the regulation of many cellular signaling pathways. Hence, the levels of these substances present in the cytoplasm are tightly controlled, in order to avoid disruption of these pathways. Crucially, the nanoparticles described in the new study are able to bypass these regulatory controls. The particles are selectively lethal – killing cancer cells, but leaving healthy cells (which also take up particles) essentially unscathed.
→ Read more

5- Electron-Transparent Thermoelectric Coolers: The World's Smallest Refrigerator

A team led by UCLA physics professor Chris Regan has succeeded in creating thermoelectric coolers that are only 100 nanometers thick and have developed an innovative new technique for measuring their cooling performance. Made by sandwiching two different semiconductors between metalized plates, these devices work in two ways. When heat is applied, one side becomes hot and the other remains cool; that temperature difference can be used to generate electricity. When an electrical current is applied to the device, one side becomes hot and the other cold, enabling it to serve as a cooler or refrigerator. This technology scaled up might one day replace the vapor-compression system in your fridge and keep your real-life soda frosty.
→ Read more

6- Real-time Detection of COVID-19 Aided by CNT-based Electrochemical Sensors

The winner of the 2019 Mostafa Award in the field of nanotechnology, Dr. Abdolahad from the Nanobioelectronics Devices Laboratory at the University of Tehran has developed and patented a novel approach (Patent pub. No: US 2018 0299401 A1, Pub. Date: Oct. 18, 2018), including an ROS/H2O2 electrochemical system, whose electrode has been modified with multi-walled carbon nanotubes. In this research, they showed how ROS can be used to diagnose lung diseases. Even when the symptoms of the disease are not yet known, the amount of ROS in the cases' sputum changes, and the sensor uses this indicator to diagnose COVID-19. This project is in the commercialization stage and until June 2020, more than 600 patients have been tested in four hospitals in Iran. Seasonal influenza, which is sometimes

mistaken for COVID-19, decreases ROS (H_2O_2) levels. Therefore, regarding this difference in the mechanism of influenza infection and also the small number of conventional acute respiratory pneumonia in warm seasons, this sensor enjoys the potential to detect COVID-19 cases in less than 30 seconds.
→ Read more

7- Nanobodies as a Powerful Weapon Against COVID-19

Nanobodies are antibodies found in camelids, which are much smaller than human antibodies. Their high stability, small structure, and specificity make them ideal for the purification and stabilization of proteins and protein structures, prior to imaging. Nanobodies can stabilize the 'spike' to enable better imaging at the atomic scale, using advanced imaging techniques including cryo-electron microscopy (cryo-EM). The nanobodies also enable the RBD to be stabilized bound to its target, helping researchers better understand how it behaves in the body, and how it might interact with new drugs. Because of its importance, various research groups around the world have focused on this issue.

A new study published in the Journal of Biomolecular Structure and Dynamics discusses the use of nanobodies in diagnosing and treating this deadly disease. The current study deals with the quest to develop nanobodies (Nbs) or VHHs against SARS-CoV-2, which are a novel class of proteins based on antibody fragments with only one domain. They are derived from the heavy chain variable domains of camelids such as camels, llamas, and alpacas, lacking a light chain component. These have the smallest intact antigen-binding domain (about 15 kDa) and are only about 110 residues in length.
→ Read more

The team from Protein Production UK has already made these nanobodies, which bind with high affinity to the 'spike' protein, available to researchers at The University of Oxford. They will be making these important research tools widely available to other research groups around the world.
→ Read more

The National Health Institute (INS) will develop a possible treatment for COVID-19 using innovative technology based on recombinant nano antibodies of a Peruvian llama. The project —financed by the National Fund for Scientific, Technological and Technological

Innovation Development (Fondecyt) — will apply nano antibody technology to develop antibodies derived from camelids capable of neutralizing the coronavirus (SARS-CoV-2) infection in vitro and in an animal model, such as hamsters.
→ Read more

8- Prediction of Nanoparticles' Structure and Dynamics by Machine Learning

Researchers at the Nanoscience Center and at the Faculty of Information Technology at the University of Jyväskylä in Finland have demonstrated that new distance-based machine learning methods are capable of predicting the structures and atomic dynamics of nanoparticles reliably. The new methods are significantly faster than traditional simulation methods used for nanoparticle research and will facilitate more efficient explorations of particle-particle reactions and particles' functionality in their environment. The potential energy of a system is a fundamental quantity in computational nanoscience since it allows for the quantitative evaluations of system's stability, rates of chemical reactions, and strengths of interatomic bonds.
→ Read more

9- Lipid Nanoparticle (LNP) Encapsulated mRNA Vaccine against SARS-CoV-2

mRNA medicines are designed to direct the body's cells to make a protein, which then triggers the immune system into action. mRNA technology commonly employs nanoparticles-based drug release approaches. In this technology, the stretch of RNA which is required for preparing the vaccine is first synthesized and then embedded in lipid nanoparticles (LNP). Moderna's vaccine is an mRNA vaccine against SARS-CoV-2 encoding for perfusion stabilized form of the Spike (S) protein encapsulated in a novel.
→ Read more

Pfizer's' COVID-19 vaccines also use mRNA packaged inside lipid nanoparticle that allows it to get into cells. For the B1 vaccine, the mRNA coded for the part of a protein on the SARS-CoV-2 virus that binds to a receptor on human cells in order to gain entry to them. The B2 vaccine makes the entirety of this protein, known as the spike protein.
→ Read more

10- Power Generation from Ambient Humidity Using Protein Nanowires

Scientists at the University of Massachusetts Amherst have developed a device that uses a natural protein to create electricity from moisture in the air, a new technology they say could have significant implications for the future of renewable energy, climate change, and future of medicine.

They have created a device they call an "Air-gen" or air-powered generator, with electrically conductive protein nanowires produced by the microbe Geobacter. The Air-gen connects electrodes to the protein nanowires in such a way that an electrical current is generated from the water vapor naturally present in the atmosphere. It can generate power even in areas with extremely low humidity such as the Sahara Desert. It has significant advantages over other forms of renewable energy including solar and wind because unlike these other renewable energy sources, the Air-gen does not require sunlight or wind.
→ Read more

Related News:
Most Impressive Worldwide Nanotechnology Contributions to Life Quality in 2020