BRAC UNIVERSITY
Inspiring Excellence
Department of Pharmacy

PHARMA HIGHLIGHTS

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Virtual Reality Game Potentially Provides Pain Relief for Children

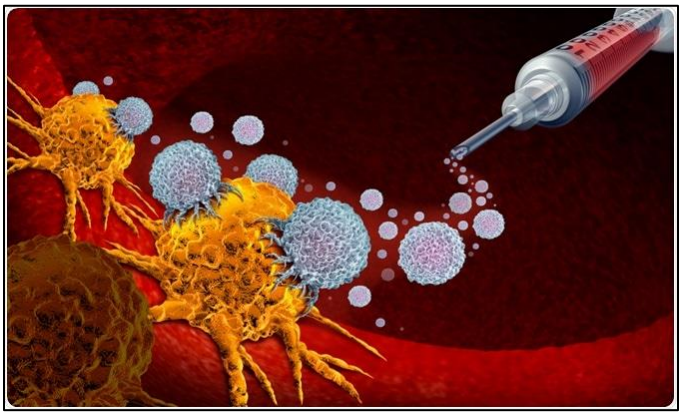
Researchers at Ohio State University have found that smartphone-based virtual reality (VR) games can potentially relieve pain from burn injuries in children and adolescents while having their dressings changed. For the study, the research team studied 90 children and adolescents between 6 and 17 years old and who were receiving outpatient care for second-degree burns. The participants were randomly split into three treatment groups. The first group was asked to play a VR smartphone game. The second group was asked to watch the gameplay of the VR smartphone game. Meanwhile, the third group underwent standard care ie. receiving toys or tablets. Dressing changes lasted for between 5 and 6 minutes. The game, known as 'Virtual River Cruise', was specially designed for the study by Nationwide Children's Research Information Solution and Innovation department. The game designers enhanced two factors for the game's design. The first was that the game should be set in a snowy, cooling environment. The second factor was that it should promote active engagement to ensure increased cognitive functions and processing.

post-intervention surveys were given to patients and caregivers were to report their perceived pain and subjective experience with the game and other treatments. Nurses also evaluated the game's clinical utility. The results indicated that children who played the VR game had the lowest overall pain scores. Most patients and caregivers reported a positive experience with the game, saying it was 'fun, engaging, and realistic.' The nurses also found the game clinically useful.

Dr Henry Xiang, the lead author of the study, says that such VR games could also be used to reduce pain during burn dressing changes at home. In future research, he hopes that studies will investigate whether smartphone-based VR games have an opioid-sparing effect.

Written by: Fairuza Ahmed (TA)

Role of Toll-Like Receptors in Cancer Treatment



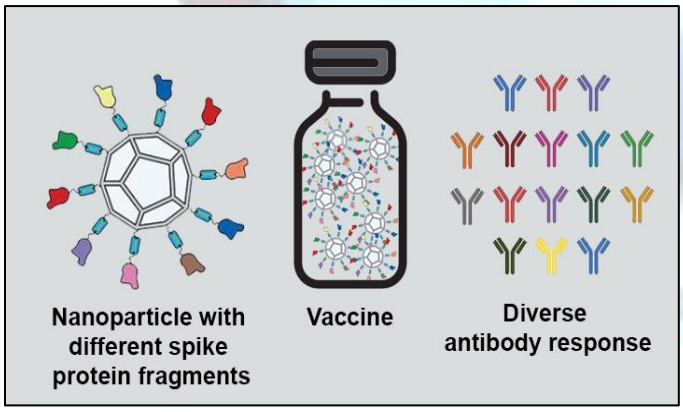
Cancer is recognized as the major concern in today's world. It is a condition or a group of diseases in which cells are abnormally divided. In the past century, the understanding and treatment of cancer has developed a lot and treatment such as chemotherapy, radiation therapy, surgery etc. have emerged. However, these are not enough to meet the desirable expectations and there is still need of new approaches to tame the immune system in the fight against cancer to make it a curable disease in the future. A series of current reports described that Toll-like receptors (TLRs) play a pivotal role in activating immune response against a number of pathogens, several disease conditions including pathogenesis of cancer. Besides, activation of TLRs interplay a crucial role in the initiation, progression and treatment of cancer. Therefore, it can be suggested that Toll-like receptor agonists /antagonists can be targeted as therapeutics against various types of cancer. The activation of various cells such as – DCs, T- cell subsets, and even tumor cells along with their downstream signaling pathways lead to tumor immunity. Successful studies have involved a TLR7 agonist, imiquimod, and a nonspecific agonist of TLR2/TLR4, BCG. There is an emerging area of identifying and developing new immunotherapeutic agents, combinatorial therapies and indications which will facilitate in cancer treatment and some of them are being

studied in clinical trials. An attractive possible tumor therapy can be developed with the association of TLR-specific agonists into cancer vaccination based on DCs. By keeping this in mind, the development of new TLR-agnostic drugs should be done in such a way that it does not exert pro-tumor response instead of anti-tumor immune response by discovering their special characteristics. As a result, TLRs will be able to induce local expression of IFN types I and II that are known to instigate cell death, and activate cell immunity in response to the recognition of pattern receptors (PAMPs and DAMPs) which can be considered as a potential hallmark of cancer treatment. Further in-depth studies will help us to gain better understanding of TLRs role in tumorigenesis, tumor immunity and tumor metastasis which in turn may provide more distinct, structurally more effective and safer drugs to treat the cancer patients.

Written by: Rezia Nowrin Khan (ID: 17146039)

Nanoparticles Designed to Enhance Seasonal Flu Vaccines

According to the U.S. Centers for Disease Control and Prevention, Seasonal flu vaccines only work around 40 to 60 percent of the time. New preclinical data and studies suggest that a novel nanoparticle-based vaccine could help boost the performance and speed up the manufacturing of these seasonal flu vaccines. Classically, flu vaccines contain either deactivated microbes that cause influenza, or they are based on weakened forms of the disease. This vaccine that's being developed is a recombinant protein nanoparticle vaccine which will stimulate a strong immune response.



The new liposome-based flu vaccine may enhance the effectiveness of seasonal flu shots, and can also be produced on a large scale at a much faster rate as nanoparticle vaccines do not need chicken embryos for production. Additionally, because nanoparticles are so potent, only a small quantity would need to be added to evoke a strong response. Thus, smaller doses are required to immunize individuals, which thereby allows a greater supply to be manufactured.

The researchers found that nanoparticle doses as low as 2 nanograms generated a similar level of protection compared to conventional vaccines that require a 1000-fold higher dose. According to the scientists, this dose-sparing effect is critical for scaling up the production of vaccines using fewer materials.

On a molecular level, the viral proteins bind to the surface of liposome nanoparticles and enhance the recipient's immune response to shield against the influenza infection. In animal studies, the trimeric H3 HA (a type of hemagglutinin) viral protein was found to evoke a robust immune response. However, the liposome system is flexible and modular, allowing multiple different types of influenza strains to be incorporated into the nanoparticles.

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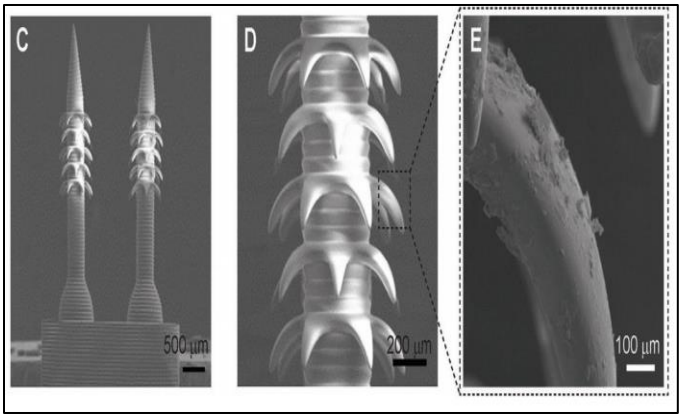
Replacing Hypodermic Needles: Mimicking the Barbs of Insects by 4D Printed Microneedles



The three dimensions are length, width, and height and 3D printers build objects layer by layer along with these dimensions. On the other hand, the fourth dimension is time and 4D printed objects are programmed to change shapes along with time. The materials of 4D printed objects are smart materials, also called responsive materials which can evolve their shape, property, and functionality with time when it is exposed to predetermined stimulus such as heat, water, light, pH. Engineers of Rutgers University created microneedles (MNs) by mimicking the stings of insects that attach to tissues and they proposed this could replace hypodermic needles. Due to the invasive nature, hypodermic needles cause pain to patients during insertion. Therefore, bio-inspired MNs can be an effective alternative. Microneedle technology can be applied to achieve safe anchoring to tissues along with minimum invasion and with great tissue contact. Some living creatures in nature such as mosquitoes, endo-parasitic worms, honeybees, North American porcupine have different types of microscopic shaft, proboscis, or barbs that exhibit very strong adhesion force. Getting inspiration from their unique shapes, functions and strong adhesion force helps to design 4D MNs which already have improved transdermal drug delivery.

Conventional manufacturing techniques such as micromolding, laser cutting, and lithography have some limitations to fabricate micro features on MNs. A recent example of the bioinspired MN is honeybee inspired MN. It has a backward-facing barb. Using the conventional lithography technique to manufacture this MN is very expensive, complex, and also time-consuming. So, scientists proposed 4D printing to create this bioinspired MN. This is based on three approaches such as digital light processing 3D micro-printing technique, projection micro stereo-lithography, and programmed shape deformation of barbs utilizing the printing process-induced cross-linking density gradient. As a result, the potential and sustainability of the MN can be evaluated by controlling the thickness and bending curvature of the barbs, the number of barbs, adhesion, and drug release performance. Through a model of chicken muscle tissue, the researchers exhibited that tissue adhesion with the barbed MN is 18 times stronger than with a barbless MN. Also, the study says that this MN is a good example of a stable and robust drug delivery system. Finally, it can be concluded by saying that, 4D printing needs a substantial amount of effort for future development as it is a very new technology.

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