BRAC UNIVERSITY School of Pharmacy

PHARMA HIGHLIGHTS

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Seminar on 'Immunotherapy: A Prospective Therapeutic Potential Against Cancer, Autoimmune and Infectious Disease'

Immunotherapy is a revolutionary new biological therapy that enables the body's immune system to identify and destroy cancer cells effectively. Immunotherapy has already shown promising results in a number of different cancers and is currently the most researched area in the field of cancer therapeutics.

As part of the 'Toolbox for Success' series designed by the School of Pharmacy, BRAC University, a seminar on 'Immunotherapy: A prospective therapeutic potential against cancer, autoimmune and infectious diseases' was organized on November 22, 2022 to provide the students with an insight on current immunotherapeutic approaches to treat hematologic and non-hematologic cancers.

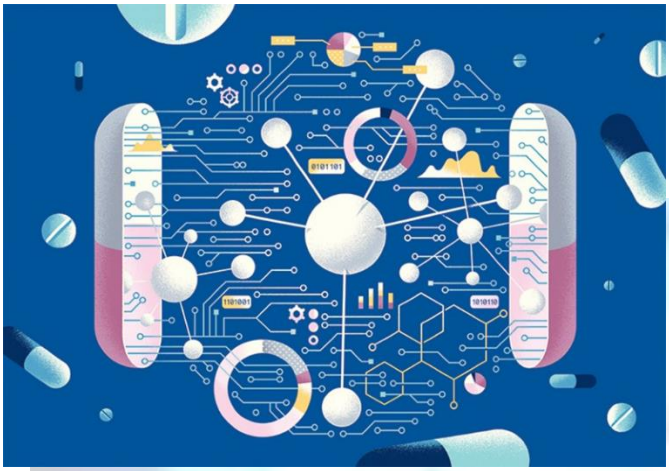
The distinguished speaker of the seminar was Dr. Mohammad Sohrab Hossain, Director of Emory Integrated Biorepository Core and an adjunct Assistant Professor of the Department of Haematology and Medical Oncology of the School of Medicine, Emory University. Dr. Hossain obtained his PhD degree in Immunology from the Medical Institute of Bioregulation, Kyushu University, Japan in 1999 and completed both his Bachelor of Pharmacy and Master of Pharmacy from the Department of Pharmacy, University of Dhaka. He worked at Caprico Biotechnologies Inc. as a senior scientist in 2014 and later became the Head of the Analytical Department of Caprico Biotechnologies Inc., where he served from 2015 to 2021. His research interests include hematology and medical oncology. He is currently supervising research projects on cancer and COVID and also investigating several clinical research projects related to immunotherapy. Dr. Sohrab's research has yielded more than 30 scientific publications in international peer reviewed journals. He is a distinguished fellow with extensive research history, and is recognized for his work in immunology and cancer.

During the seminar, the speaker focused on the most recent FDA-approved immunotherapies, especially the CAR T-cells and the checkpoint molecules used against hematologic and non-hematologic malignancies. Furthermore, the possible causes of cancer development were described along with the standard immunological methods used to investigate the efficacy of immunotherapy in basic preclinical and clinical research settings by drawing examples from the latest immunotherapy research being carried out at the Stem Cell Research Lab at Emory University.

The seminar was moderated by Ms. Farzana Islam, Lecturer, School of Pharmacy, BRAC University. Faculty members, Teaching Assistants and students of the School of Pharmacy attended the seminar.

Written by: School of Pharmacy

A Machine Intelligence Approach to Drug Delivery



Drug design and development is an important area of research for pharmaceutical companies and chemists which can give them leverage among their competitors. However, low efficiency, off-target delivery, and high cost pose challenges that affect drug design and discovery. Furthermore, complex and massive data from genomics, proteins, microarray data and clinical trials also pose a barrier in the drug discovery process. With the recent advances in technology, computer-aided drug design incorporating artificial intelligence algorithms can remove the challenges and obstacles of traditional drug design and development. Artificial neural networks and deep learning algorithms have modernized the field. Machine learning and deep learning algorithms are being implemented in several drug discovery processes such as peptide synthesis, structure-based virtual screening, ligand-based virtual screening, toxicity prediction and resolution, drug release, pharmacophore modeling, quantitative relationship between structure and activity, drug repositioning, identification of molecular pathways and polypharmacology, prediction of protein folding and protein–protein interactions. It can also be used for identification of drug dosage and drug effectiveness. With these advancements in technology, computer-aided drug design integrating artificial intelligence algorithms can eliminate the challenges and hurdles of traditional drug design and development. Usually more than 90% of the experimental medicines fail during the various stages of chemical engineering, animal and preclinical trials. Using machine learning and natural intelligence, scientists will be able to find previously unidentified molecules, helping to cure diseases more effectively and quickly. It is capable of scanning all databases and finding the molecules best suited to a particular biological target and finding a good compound that will fight the disease without harming the patient. In simpler words, the algorithm gets rid of ineffective drugs before companies invest a lot of money. In 2021, DeepMinds' groundbreaking "Alpha Fold 2" AI system solved what is recognized as the solution to the grand 50-year challenge of protein folding. Alpha Fold predicts protein structure and shape to determine its function in the body. So the ability to predict protein structure allows scientists to synthesize new protein-based drugs to treat sickness. In 2021, German biotech company Evotech's new anti-cancer molecule was discovered within eight months using Extensia's AI design platform. In addition, biotech company Insilico Medicine has announced an important next step: the launch of world's first phase 1 clinical trial of drug with anti-aging properties, designed from the ground-up using AI. Hence, the use of AI has a lot of potential in future of drug development.

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Written by: Safuan Ahmed (ID: 22146035)

The Vaccine Revolution

Traditional vaccines have been a gold standard for centuries but these vaccines can take years to produce. With new and emerging infectious diseases, the need for rapid response has also grown. Over the past two decades interest in developing RNA based vaccines increased, revealing that mRNA vaccines provide safe and long-lasting protection. Coronavirus disease an infectious disease caused by the SARS-CoV-2 virus spread rapidly across the world led to the recent pandemic. To contain

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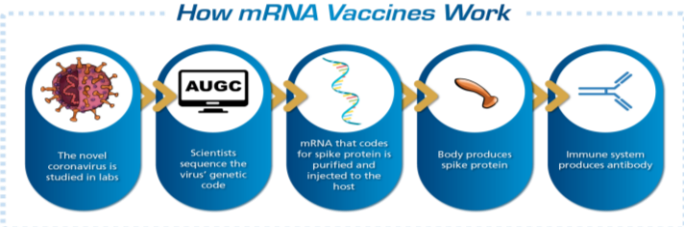
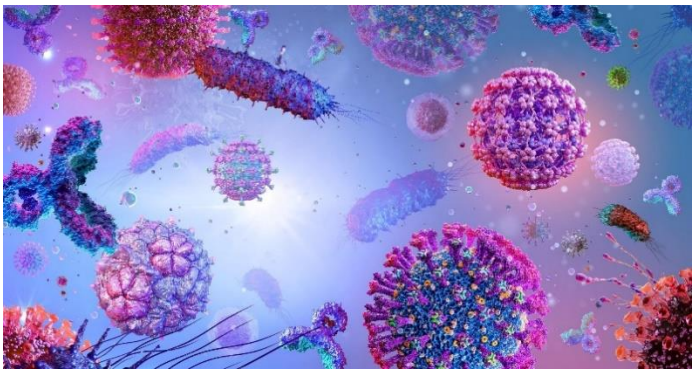
the virus required immediate action. The world needed rapid development of a vaccine that was easy to scale and deploy. The ground-breaking mRNA technology was used by Moderna and Pfizer-BioNTech to develop the COVID-19 vaccines at Penn Medicine. The Pfizer-BioNTech vaccine, BNT162b2, uses mRNA to create the receptor binding domain of the spike protein of SARS-CoV-2 while, Moderna vaccine, mRNA-1273, uses mRNA to create the SARS-CoV-2 spike protein stabilized in its prefusion conformation. They work by introducing mRNA into muscle cells. The spike protein is replicated by the cells, and the mRNA is rapidly destroyed (within a few days). The mRNA is fragmented into little, non-toxic debris by the cell. It is only created briefly during protein synthesis, and then degraded once the process is complete. By imitating viral proteins, mRNA technology deceives the immune system into initiating an attack against the invader.



By this, powerful antibodies are produced that can provide long lasting protection against an actual viral infection. Advancements in the generation, purification and cellular delivery of RNA have enabled the development of mRNA vaccines across a wide range of applications, including cancer and Zika virus infection. This technology has the potential to eliminate some of the most challenging diseases quickly and efficiently. While the technology is not new, COVID-19 has unlocked the power of mRNA vaccines as we enter a new frontier in fighting disease. The future of mRNA vaccines is that it could be used prophylactically to prevent infection and therapeutically to augment immunity post-infection. It is now clear that an mRNA vaccine can be used to express any protein and possibly treat almost any disease.

Written by: Md. Mohiyminul Hassan (ID: 22146084)

Havoc on the Rise



COVID-19 pandemic has led to existential threat, poverty, and economic crisis with many countries still facing the consequences. With the world just recovering from the previous curse, there has been a rise in few infectious diseases which are capable of creating a new catastrophe. This includes:

Ebola virus: It is a rare and fatal infectious disease which can affect both human and nonhuman primates. It occurs mostly in the rural areas of Saharan Africa. It can spread through direct interaction with an infected animal (a bat or nonhuman ape) or a sick person who has the Ebola virus. Its mode of transmission is through blood, secretions, objects or other bodily fluids of the infected host. Unfortunately, the average EVD case fatality rate is around 50%, it alone killed 2299 people in Congo during 2018-20 (World Health Organization, 2022). Although the Ervebo vaccine can be effective in this regard, but it only gives protection against the specific Zaïre Ebola virus strain. Symptoms might take 2-21 days to occur, it includes fever, fatigue, diarrhea, sore throat, rash, reduced appetite and unexpected bleeding or hemorrhage.

Crimean-Congo haemorrhagic fever: It is an infectious disease caused by a tick-borne virus

(Nairovirus). The host for CCHF are cattle, goats, sheep and hares and other livestock animals. CCHF is native in Africa, Balkans, Middle East and Asia. It's mode of transmission is through contact with infectious animal/human blood, body fluids, organs and tick bites, according to World Health Organization, 2022. The mortality rate of CCHF is 30%, with death occurring in the second week of illness. Symptoms might take 5-13 days to occur, it includes fever, muscle pain, photophobia, sore eyes, nausea, vomiting and petechiae (red spots).

Monkeypox: It is an infectious disease caused by monkeypox virus, a member of the Poxviridae family and the genus Orthopoxvirus. It's primarily affecting tropical rainforest regions of Central and West Africa, but has now spread to other locations. It can spread through direct contact with bodily liquids, respiratory droplets of an animal or a person who has the disease or with contaminated objects. It has symptoms similar to smallpox virus which includes fever, swollen lymph nodes, sore throat, muscle ache, intense fatigue, and rash in hand, feet and genitals. Correspondingly, severe symptoms can occur within 6-13 days. It has a fatality rate of 0.04%, with older people and infants being more vulnerable to the disease (ECDC, 2022). With proper safety measures and modified smallpox vaccines, monkeypox can be eradicated.

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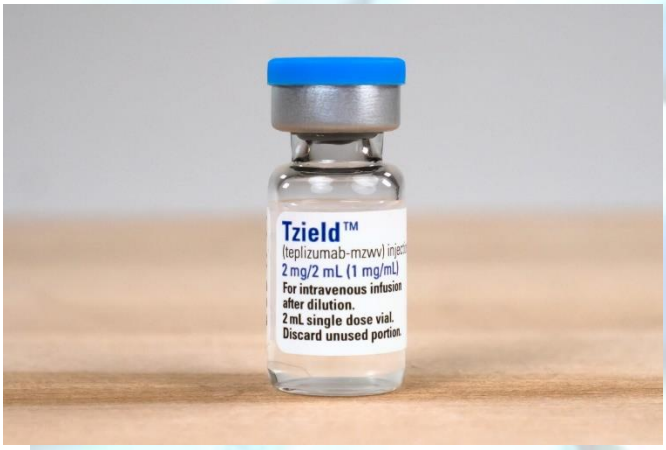
Written by: Adiba Ali (ID: 22146089)

FDA Approves First Immunotherapy That Can Delay Onset of Type 1 Diabetes



The U.S. Food and Drug Administration approved Tzield (teplizumab-mzwv) injection to delay the onset of stage 3 type 1 diabetes in adults and pediatric patients 8 years and older who currently have stage 2 type 1 diabetes.

"Today's approval of a first-in-class therapy adds an important new treatment option for certain at-risk patients," said John Sharretts, M.D., director of the Division of Diabetes, Lipid Disorders, and Obesity in the FDA's Center for Drug Evaluation and Research. "The drug's potential to delay clinical diagnosis of type 1 diabetes may provide patients with months to years without the burdens of disease."

Type 1 diabetes is a disease that occurs when the immune system attacks and destroys the cells that make insulin.

People with a type 1 diabetes diagnosis have increased glucose that requires insulin shots (or wearing an insulin pump) to survive and must check their blood sugar levels regularly throughout the day. Although it can appear at any age, type 1 diabetes is usually diagnosed in children and young adults. A person is at higher risk for type 1 diabetes if they have a parent, brother or sister with type 1 diabetes, although most patients with type 1 diabetes do not have a family history.

Tzield binds to certain immune system cells and delays progression to stage 3 type 1 diabetes. Tzield may deactivate the immune cells that attack insulin-producing cells, while increasing the proportion of cells that help moderate the immune response. Tzield is administered by intravenous infusion once daily for 14 consecutive days.

Tzield's safety and efficacy were evaluated in a randomized, double-blind, event-driven, placebo-controlled trial with 76 patients with stage 2 type 1 diabetes. In the trial, patients randomly received Tzield or a placebo once daily via intravenous infusion for 14 days. The primary measure of efficacy was the time from randomization to development of stage 3 type 1 diabetes

diagnosis. The trial results showed that over a median follow-up of 51 months, 45% of the 44 patients who received Tzield were later diagnosed with stage 3 type 1 diabetes, compared to 72% of the 32 patients who received a placebo. The mid-range time from randomization to stage 3 type 1 diabetes diagnosis was 50 months for the patients who received Tzield and 25 months for those who received a placebo. This represents a statistically significant delay in the development of stage 3 type 1 diabetes.

The most common side effects of Tzield include decreased levels of certain white blood cells, rash and headache. The use of Tzield comes with warnings and precautions, including premedicating and monitoring for symptoms of Cytokine Release Syndrome; risk of serious infections; decreased levels of a type of white blood cell called lymphocytes; risk of hypersensitivity reactions; the need to administer all age-appropriate vaccinations prior to starting Tzield; as well as avoiding concurrent use of live, inactivated and mRNA vaccines with Tzield. Tzield received Priority Review and Breakthrough Therapy designations for this indication.

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Written by: Syeda Maliha Ahmed (Lecturer)