BRAC UNIVERSITY School of Pharmacy

PHARMA HIGHLIGHTS

ISSUE 103 | April 2023

Promising New Oral Capsule as a Potential Replacement for Insulin Injections

Scientists from RMIT University, Melbourne, have designed a new type of oral capsule for the painless delivery of insulin and other protein drugs. Oral delivery of protein drugs has always been a challenge since they tend to degrade very quickly in the stomach. Diabetics all over the world need insulin injections up to several times a day, which can be unpleasant for the patient and results in high healthcare costs as well. Researchers from RMIT have hence developed a capsule that protects the drug inside the stomach, not allowing it to degrade or disintegrate until it reaches the small intestine. The capsule is designed with a special pH-sensitive coating that does not break down in the low pH environment of the stomach but the higher pH levels in the small intestine trigger the capsule to dissolve. The insulin drug is packaged inside a fatty nanomaterial within the capsule allowing the drug to be absorbed through the intestinal walls. This uses a similar idea as to how the Pfizer and the Moderna COVID vaccines work where the mRNA is packaged within fats, helping to keep the drugs active and safe during delivery in the body.

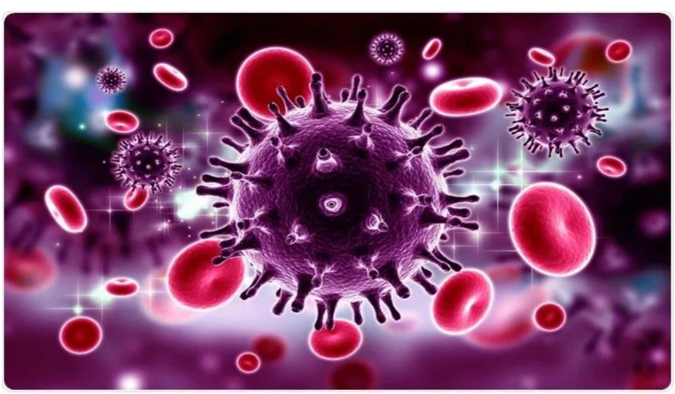
The team has tested the new oral capsule with insulin in a pre-clinical study and the results have been published in the international journal Biomaterials Advances. The paper shows a performance assessment of both fast-acting and slow-acting oral insulin capsules. The study has shown excellent absorption results for the slow-acting form, approximately 50% better than injections with the same quantity of insulin. The fast-acting insulin capsule has also shown good absorption, but the significant lag in the insulin onset of action compared with injections would likely make it less practical. For future work, the researchers are now aiming to design the capsule to allow dosing over specific time periods, similar to injection delivery.

Reference:

1. Strachan, J. B., Dyett, B., Chan, S., McDonald, B., Vlahos, R., Valery, C., & Conn, C. E. (2023). A promising new oral delivery mode for insulin using lipid-filled enteric-coated capsules. Biomaterials Advances, 148, 213368. https://doi.org/10.1016/J.BIOADV.2023.213368

Written by: Syeda Maliha Ahmed (Lecturer)

The Mystery Behind HIV Drug Resistance



The Human Immunodeficiency Virus (HIV) attacks the immune system, leaving the body vulnerable to infections and illnesses. While antiretroviral drugs have been developed to effectively suppress the virus and allow people living with HIV to live long, healthy lives, drug resistance is becoming an increasing concern. HIV drug resistance refers to the ability of the HIV virus to adapt and become resistant to antiretroviral drugs that are used to treat HIV infection. Antiretroviral medications delay or stop the virus from growing in the body of an HIV-positive person. But occasionally the virus mutates, or evolves, and develops resistance to the medications that once worked well to treat it.

HIV medication is administered on a daily basis to ensure that your body has enough of the drugs to suppress the virus to undetectable levels. They don't destroy the virus but stop it from multiplying. However, there are several factors that contribute to resistance to this therapy:

Mutation: HIV can produce mutations as a result of coding errors during replication. These drug-resistant mutations can evade the effects of HIV treatment, giving them a better chance of survival and even becoming the dominant strain.

Non-adherence to medication: Not taking antiretroviral drugs as prescribed can lead to drug resistance.

Transmission of drug-resistant strains: HIV can be transmitted from one person to another, and if the virus in the new host is already resistant to certain drugs, those drugs may not be effective in suppressing the virus.

These factors lead to certain consequences like:

Treatment failure: Drug resistance can lead to treatment failure, where antiretroviral drugs are no longer effective in suppressing the virus. This can lead to the progression of HIV disease, increased risk of opportunistic infections, and poorer health outcomes.

Limited treatment options: As drug resistance develops, treatment options become more limited. This can lead to the need for more complex and expensive drug regimens, with potentially more side effects.

Increased transmission: Drug-resistant strains of HIV can be transmitted from person to person, potentially leading to an increased prevalence of drug-resistant HIV in the population.

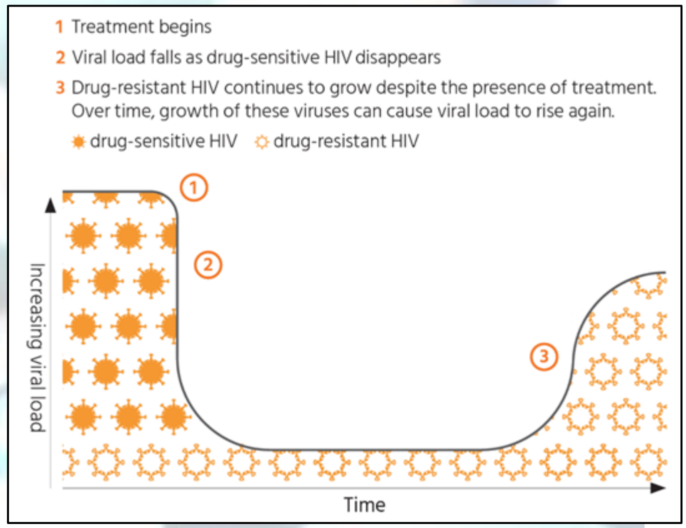
HIV drug resistance is a major challenge in the management of HIV infection. However, certain strategies may be adopted for its prevention and management:

Adherence to treatment: One of the most important strategies for preventing drug resistance is ensuring adherence to antiretroviral therapy. Taking medications as prescribed and on schedule can help prevent the development of drug-resistant strains of HIV.

Resistance testing: Resistance testing can help identify which drugs will be effective against the specific strain of IV in an individual, and can guide treatment decisions when drug resistance is suspected or confirmed.

Switching drug regimens: When drug resistance is confirmed, switching to a different antiretroviral regimen that targets the specific strain of HIV can help maintain viral suppression.

By empathizing with the importance of prevention and management strategies, we can help ensure the long-term effectiveness of HIV treatment and improve health outcomes for people living with HIV. It is important that we continue to invest in research and development of new and more effective antiretroviral drugs, as well as prevention strategies, to address the challenge of HIV drug resistance.



References:

1. "Drug resistance." UNAIDS. Retrieved from https://www.unaids.org/en/resources/fact-sheet-drug-resistance
2. "HIV Drug Resistance." AIDSinfo. Retrieved from https://aidsinfo.nih.gov/understanding-hiv-aids/fact-sheets/21/57/hiv-drug-resistance
3. "HIV Drug Resistance." Centers for Disease Control and Prevention. Retrieved from https://www.cdc.gov/hiv/basics/hiv-drug-resistance/index.html
4. "HIV Drug Resistance." HIV.gov. Retrieved from https://www.hiv.gov/hiv-basics/overview/about-hiv-and-aids/hiv-drug-resistance.

Written by: Tahsin Uddin Jisan (ID: 22346056)

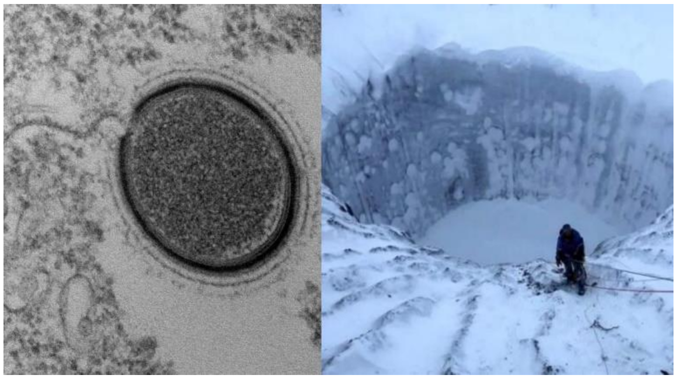
Virus Buried in Ice

In recent years, scientists have been warning of the potential dangers of ancient viruses that are stored beneath the ice in remote regions of the world. These viruses have been frozen for thousands of years and could pose a serious threat if they were to be released into the modern world.

BRAC UNIVERSITY School of Pharmacy

PHARMA HIGHLIGHTS

ISSUE 103 | April 2023



The idea of ancient viruses being stored beneath the ice may seem like something out of a science fiction movie, but it is a very real possibility. In fact, scientists have already discovered several viruses that were previously unknown to science in the ice cores taken from the Arctic and Antarctic regions.

One of the most concerning aspects of these ancient viruses is that they have been frozen in time for thousands of years, and as a result, they have not been exposed to modern human immune systems. This means that if they were to be released, they could potentially cause a global pandemic with devastating consequences.

Scientists have already identified several viruses that could be particularly dangerous if they were to be released. One such virus is the Pithovirus sibericum, which was discovered in the permafrost in Siberia in 2014. This virus is estimated to be around 30,000 years old and is the largest virus ever discovered. It is also able to infect amoebas, which has led scientists to worry about its potential to infect humans.

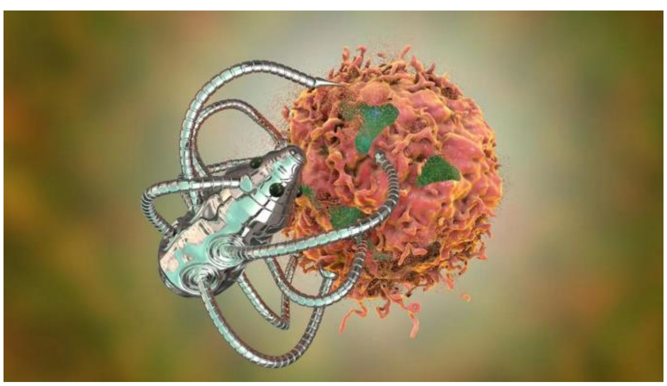
Another virus that has caused concern is the Spanish Flu virus, which caused a global pandemic in 1918 and 1919. Scientists have found samples of this virus in the permafrost in Alaska, and there is a worry that if it were to be released, it could cause another global pandemic with devastating consequences.

So, how likely is it that these ancient viruses will be released? The answer is that it is difficult to say. Climate change is causing the permafrost to melt at an alarming rate, which means that there is a higher risk of these viruses being released. However, it is also important to note that the viruses are likely to remain frozen and pose no threat as long as they remain beneath the ice.

In conclusion, the discovery of ancient viruses stored beneath the ice is a concerning development, and scientists are right to be worried about the potential consequences of these viruses being released. While it is difficult to predict the likelihood of this happening, we need to take steps to address climate change and prevent the permafrost from melting, as this could have devastating consequences for human health.

Written by: Md. Ayman Siddique (Teaching Assistant)

Can Implantable Oxygen-Eating Bacteria Kill Cancer?



Over the past few years, interest in implantable oxygen-eating batteries as a cancer treatment method has grown. These oxygen-consuming and electricity-producing bioelectronic devices have been investigated to localize oxygen depletion in tumors and make them more responsive to radiation therapy. While in its early phases of development, this technology has demonstrated encouraging outcomes in preclinical trials and may present a fresh method for the treatment of cancer.

Because tumor cells frequently have lower oxygen concentrations than normal tissue, treating cancer can be extremely difficult. This is since tumors might outgrow the capacity of the blood arteries around them to deliver oxygen due to their fast growth. Hypoxia, or low oxygen levels, can make cancers more resistant to chemotherapy and radiation treatment. Implantable oxygen-eating batteries may assist overcome this resistance and enhance the efficacy of various treatments by causing localized oxygen depletion within the tumor.

The promise of implantable oxygen-consuming batteries for the treatment of cancer has been shown in numerous research. For instance, when paired with radiation therapy, these devices have been utilized by researchers to produce a hypoxic environment in mouse tumors, which accelerated tumor cell mortality. According to other research, implantable oxygen-eating batteries can

improve the environment for drug delivery, which increases the effectiveness of chemotherapy treatments.
Even though these results are encouraging, there are still lots of unanswered problems regarding the security and effectiveness of implants oxygen-eating batteries for the treatment of cancer. One worry is that the gadgets might use up too much oxygen, which could result in death or tissue damage. Furthermore, it is unknown what the long-term ramifications of implanting these devices in the body will be.

In conclusion, implantable oxygen-eating batteries constitute an innovative new cancer therapy strategy that may enhance patient outcomes. Even while much more study needs to be done, preliminary findings indicate that this technology may significantly alter how we treat cancer in the future. It will take more research to properly comprehend the possible advantages and risks of implantable oxygen-eating batteries and to decide how to employ them in the clinic.

Written by: Iffat Islam Mayesha (Teaching Assistant)