

Indian scientists develop artificial enzyme to keep HIV virus in check

New Delhi, April 01: People suffering from Human Immunodeficiency Virus (HIV) infection can now hope to have a better quality of life with researchers at the Bengaluru-based Indian Institute of Science (IISc) developing a nano alternative to a natural enzyme that is used to block reactivation and replication of the virus in the host's immune cells.

Made from vanadium pentoxide nanosheets, the new “nanozymes” work by mimicking the natural enzyme called glutathione peroxidase to help reduce oxidative stress levels in the host's cells, which is required to keep the virus in check.

Presently, there is no method available to completely eliminate HIV from a patient's body. Anti-HIV drugs only succeed in suppressing the virus. They cannot eradicate it from the infected cells. The virus, consequently, hides inside the host's immune cells in a latent state. When the levels of toxic molecules such as hydrogen peroxide increase in the host's cells, leading to a state of increased oxidative stress, the virus gets “reactivated” – it emerges from hiding and begins replicating again.

One way to prevent reactivation is to keep the oxidative stress constantly low. Enzymes such as glutathione peroxidase help in doing this. They convert toxic hydrogen peroxide to water and oxygen. However, inducing the host cells to produce more quantities of these enzymes could disrupt the tightly regulated cellular machinery.

A few years ago, a team of researchers led by Amit Singh, Associate Professor and Wellcome Trust-DBT India Alliance Senior Fellow at the Department of Microbiology & Cell Biology and Centre for Infectious Diseases Research (CIDR), developed a biosensor to measure oxidative stress levels in HIV-infected immune cells in real-time.

Around the same time, another team at the Institute led by Govindasamy Mugesh, Professor at the Department of Inorganic and Physical Chemistry, published a study showing that nanowires made of vanadium pentoxide can efficiently mimic the activity of glutathione peroxidase.

Finding the possibility for synergy in their work, the two teams then got together and decided to collaborate and see whether they could find a viable solution to help keep HIV virus under check on a permanent basis.

The researchers prepared ultrathin nanosheets of vanadium pentoxide in the lab and treated HIV-infected cells with them. The sheets were found to reduce hydrogen peroxide just as effectively as the natural enzyme and prevent the virus from reactivating. They then treated immune cells from HIV-infected patients undergoing antiretroviral therapy (ART) with the nanozymes. They found that the latency was induced faster and subsequent reactivation was

suppressed when therapy was stopped, indicating that combining the nanozymes and ART was more effective.

In a press release from IISc, the researchers said that the combination can have some other advantages too. For instance, some ART drugs can cause oxidative stress as a side effect, which can damage heart or kidney cells. Adding a nanozyme like the one developed could help in reducing the side effects caused by such ART drugs, they said.

The scientists noted that though the nanozymes have been found to be harmless to normal cells in lab tests, more studies were needed to understand if they can have other effects once they are introduced inside the body. They have published a report on their work in journal, 'EMBO Molecular Medicine'.

Keywords: HIV, Indian Institute of Science, IISc, enzyme, reactivation, replication, virus, immune, cell, nanosheets, mimic, oxidative stress, drug, eradicate, latent, toxic, molecule, biosensor, heart, kidney

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