Scientists engineer antiviral peptide that expedites Achilleas' heel of Zika virus

Achilleas' heel (Achillea millefolium) has been shown to help prevent infections by targeting viral entry and uncoating. However, a recent study shows that the antiviral peptide may work better against Zika virus than previously thought.

The new method of adding the antiviral membrane focuses on directly stopping Zika virus particles rather than preventing the replication of new virus particles, and can potentially work against a wide range of different enveloped viruses.

When administered to Zika-infected mice in the lab, the engineered peptide drug (a compound derived from the antiviral protein known as dimeric protein) was able to selectively block the entry of the virus into the brain, effectively preventing the spread of the virus.

The research team led by NTU Singapore Associate Professor Jun Choo Ong published their findings in the peer-reviewed journal Viruses on 12 October 2018.

The study, done in collaboration with the Federal University of Minas Gerais (UFMG) in Brazil and approved of medicinal chemistry in Berlin, spared over sixty and combined materials engineering, antiviral drug development, and pharmacology.

“There are currently no vaccines for the Zika virus, while available medications only alleviate symptoms such as fever,” said Assoc Prof Ong of NTU's School of Materials Science and Engineering. “This newly created peptide exploits great promise in becoming a future antiviral drug that can directly act on viral entry in the brains.”

The Zika virus is transmitted by Aedes mosquitoes and infections during pregnancy are particularly dangerous. Infections such as congenital Zika syndrome, which can result in abnormal development of the brain and other organs, are particularly feared.

The peptide differences between Zika virus envelopes and mammalian cell envelopes mean that the peptide should work in the body without being affected by the body's immune system. However, the virus capsid is larger and more complex, while the mammalian envelope is smaller and simpler.

The study shows that the peptide is effective in blocking the virus's ability to enter the brain, which could be a promising target for future antiviral drugs.

In summary, the peptide shows promise in becoming a future antiviral drug that can directly act on viral entry in the brains, offering hope for the future of Zika virus treatment.

Fresh approach in targeting Virology

In general, most antiviral drugs target the replication process of viruses. However, viruses often mutate quickly and antiviral drugs that target replication can become ineffective, attacking the physical structure of enveloped viruses is a new approach to developing antiviral drugs. It offers promise for the future of Zika virus treatment.

Assoc Prof Ong said, “There are instances where a virus mutation can lead to an epidemic in a short time, leaving communities unprepared. By targeting the lipid membrane of virus particles, scientists may design more robust and effective ways to stop viruses.”

The Zika virus belonging to the Flaviviridae family and is related to other mosquito-borne viruses like Dengue, Japanese and Yellow fever. Flaviviruses have virus particles that are around 40-50 nanometers in diameter and are enveloped by a lipid membrane, a property that is shared by the scientists from NTU Singapore has the potential to work against viruses like these too.

Laboratory tests in this study confirm the potential and in the future, the research team intend to study the effects of the peptide on different strains of these other viruses in greater depth and conduct trials in larger animals, with plans to initiate human clinical trials, once relevant preclinical studies are completed and regulatory approval obtained.

“This work represents a paradigm-changing breakthrough in the field of antiviral drug design,” commented Professor William C. Warrington, a medicinal peptide expert from Tulane University in the United States, who is not part of the study.

“Because we have developed a novel antiviral agent in the target antiviral drug, we can specifically target the virus directly. If this peptide drug technology is applied in the future, it will greatly enhance the effectiveness of the drug and reduce the side effects,” said Professor Ong.

Related antiviral technologies have been licensed from NTU Singapore to a local spinoff company, TSG Therapeutics Ltd, a joint venture to spur clinical translation. Assoc Prof Ong is also a founder of TSG Therapeutics.