

Key Virulence Factors for Neurotropic Orthoflaviviruses

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Biotech & Life Science

Abstract

This technology uncovers more about the key virulence factors of Japanese encephalitis virus (JEV), a neuroinvasive and neurovirulent orthoflavivirus, laying the groundwork for molecular markers for improving the JEV vaccine.

What It Is

Japanese encephalitis virus (JEV) is a neuroinvasive and neurovirulent, vaccine-preventable orthoflavivirus common in Southeast Asia, the most populated region of the world. The properties of the virus and vaccine are not well understood. By comparing SA14 and SA14-14-2 genomically, researchers identified key virulence factors that were responsible for the differences in pathogenicity.

Value Proposition

This technology provides an in-depth knowledge of the exact factors of the live-attenuated JEV virus that induce

neurovirulence. This knowledge can improve the JEV vaccine and apply to other similar pathogens.

Applicable Markets

This can be applied in the JEV vaccine market as a tool to improve the JEV vaccine. The Zika virus, Dengue Vaccine, and Yellow Fever markets could use this technology to potentially improve treatments for these similar orthoflaviviruses.

Benefit

Although Japanese encephalitis virus (JEV) is a vaccine-preventable pathogen, it has remained the primary cause of severe encephalitis in the Asia-Pacific region, the world's most densely populated area, for almost a century since its discovery. One in every two hundred and fifty cases causes severe brain inflammation, high fever, headache, neck stiffness, disorientation, seizures, and coma. The fatality rate for severe cases is 30%, while survivors suffer from permanent neurological or cognitive impairments. There is only one vaccine currently on the market for this pathogen. The SA14-14-2 vaccine is a live-attenuated version derived from the wild-type SA14 strain. Despite the critical role of this vaccine, little is known about the viral factors that render SA14-14-2 fully attenuated and incapable of causing Japanese encephalitis, and conversely, those that make SA14 highly virulent and capable of causing the disease.

To determine the viral factors responsible for differences in pathogenicity, USU researchers conducted the first comprehensive, unbiased, reciprocal, and systematic genetic analysis of SA14-14-2 and SA14. Three factors were identified that play a specific role in the neuroinvasiveness and neurovirulence of JEV.

This technology establishes a robust, extensible framework that elucidates the intricate viral genetics governing JEV pathogenicity. This offers new potential molecular targets, thereby laying the groundwork for the design of effective antiviral strategies against JEV infection. Furthermore, these discoveries may extend to other medically important neurotropic orthoflaviviruses, thereby broadening our understanding of viral pathogenicity and facilitating the development of broad-spectrum antiviral approaches for these related pathogens.

Researchers

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Publications

- Comparison of Three Chimeric Zika Vaccine Prototypes Developed on the Genetic Background of the Clinically Proven Live-Attenuated Japanese Encephalitis Vaccine SA14-14-2 <https://www.mdpi.com/1422-0067/26/1/195>
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Intellectual Property

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