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Commentary

The Significance of rDNA Technology in the Management of Hepatitis B Virus

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DESCRIPTION

Hepatitis B is still a serious worldwide health issue more than 40 years after the Human Hepatitis B Virus (HBV) was identified as the causal culprit. The discovery of a prophylactic vaccine made of the HBV surface (envelope) protein (HBsAg) to minimize the risk of new infections was a key turning point in the virus's struggle. The isolation of HBsAg Sub-Viral Particles (SVPs) from the blood of asymptomatic HBV carriers as antigens for first-generation vaccines, followed by the development of recombinant HBsAg SVPs produced in yeast as antigenic components of second-generation vaccines, are ground-breaking advances in biotechnology and medicine.

A recombinant particulate delivery platform was made possible by the HBsAg SVPs' capacity to accept and present foreign antigenic sequences. This capability led to the creation of the malaria vaccine RTS,S/AS01, Mosquirix™, as well as a number of other preclinical vaccine candidates to treat infectious diseases for which there are no suitable vaccines. The study highlights the use of the particles in important and highly effective vaccines while providing an overview of the creation and assembly of the HBsAg SVPs. One of the most prevalent viral diseases affecting people on a global scale, hepatitis B has a high morbidity and fatality rate.

Hepatitis B Virus (HBV) has infected around 2 billion individuals globally, and approximately 257 million people have chronic HBV infections. In 2015, an estimated 887,000 people died as a result of acute or chronic hepatitis B complications. The ability of HBV structural proteins, including hepatitis B surface (envelope) proteins (HBsAg), to assemble into non-infectious Sub Viral Particles (SVPs), enables the production of highly organized particles containing neutralizing epitopes that promote protective immune responses against the parent virus. The first vaccination created utilizing recombinant DNA technology was the recombinant hepatitis B vaccine Recombivax HB in 1986, which was based on HBsAg SVPs and manufactured in the yeast Saccharomyces cerevisiae.

The recombinant vaccination, along with other recombinant goods like human insulin, human growth hormone and alpha interferon, showed how biotechnological methods may produce ground-breaking pharmaceuticals. Like in the instance of the RTS,S/AS01 (Mosquirix™) vaccine against malaria, the ability to incorporate foreign antigenic sequences into the SVP structure can serve as the basis for the development of delivery platforms for targeted therapeutically relevant sequences.

The antigenic elements of Mosquirix™ are chimeric SVPs with HBsAg proteins fused to a Circum Sporozoite (CS) polypeptide unique to Plasmodium falciparum. There is a lot of potential for treating infectious diseases for which there are no effective vaccines through the design and production of chimeric SVPs. HBV belongs to the Hepadnaviridae family of hepatitis DNA viruses and is a hepatocyte-tropic virus.

HBV is classified into ten major genotypes, each of which differs by more than 8% at the nucleotide level. The HBV genome is roughly 3.2kb in size and is represented by a relaxed circular, partly double-stranded DNA molecule that is transferred to the host cell nucleus and transformed into a Covalently Closed Circular DNA (cccDNA) molecule. The cccDNA is a stable non-integrated episome that serves as the template for all viral RNA transcripts. In the absence of a replication origin necessary for DNA-dependent DNA amplification, one of the viral transcripts, pre-genomic RNA (pgRNA), serves as a replication template to make rcDNA *via* reverse transcription. HBV encodes seven proteins and has four open reading frames (C, P, S and X).

CONCLUSION

The reverse transcriptase, RNaseH and priming functions of the polymerase are crucial for numerous phases in the replication pathway. *In vivo* infection and replication are well supported by the X protein. For virions to develop, the core protein (HBcAg), which makes up the viral capsid subunit, must be present.

The e-antigen (HBeAg), which is not a component of the viral capsid, is created by proteolytic processing from the pre-core protein. It is a significant serological marker and is involved in regulating the host immunological response to HBV. Three closely related surface (envelope) proteins (HBsAg) with a shared S-domain are encoded by the virus.

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