CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

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Project Number

31853

Project Title

Using Cryo-electron Tomography to Elucidate Structure and Budding Mechanisms of the Influenza A Virus

Abstract

Objectives/Goals

Because of the health risk the influenza A virus poses to society, affecting millions of people annually, discovering an antiviral medication to combat the virus is crucial to aid people worldwide. This project aims to elucidate the structure and budding mechanism of this virus using cryo-electron tomography. This project compares budding in mutant strains with that in wild-type viruses in order to highlight budding defects that may serve as potential targets for future antiviral therapy that inhibit viral proliferation.

Methods/Materials

The influenza virus samples were prepared using the WT Influenza A virus strain A/WSN/33 (H1N1) and the WSN H1N1 budding mutants (M1 [R101A] and NA [NA3A2] mutants). The Titan Krios microscope was used to take images of these strains as well as the Udorn strain, which were flash frozen onto a grid. Etomo and Inspect-3D, computer software packages that reconstruct the images, were then used to create 3D reconstructions of the sample displaying the surface glycoproteins and components within the virus particle, such as RNA.

Results

The tomographic reconstructions of the Udorn strain of the influenza A virus studied in this project reveal aberrations in the budding process. The various structures of the particles suggest different flaws in the budding mechanism of the influenza virus. The reconstructions show three different forms of the influenza virus: an elongated, filamentous particle; a chain of viral particles that have budding abnormalities; and the typical spherical particle. Currently, RNA appears to play a role in the budding process.

Conclusions/Discussion

Ultimately, from the tomographic reconstructions, RNA appears to play a role in the budding mechanism of the influenza A virus. Its distribution throughout the virus particle appears to cause aberrations in bud closing, resulting in the various particle shapes observed. If RNA does affect virus budding, this knowledge could result in antiviral drugs targeting RNA specifically to impede the budding process, and consequently viral proliferation. The presence of the long chains suggest there might be particular locations along the membrane that are more favorable to budding, and if this were the case, such information could allow for antiviral medications that target specific components of the virus.

Summary Statement

The purpose of this research is to elucidate the structure and budding mechanisms of the influenza A virus, through the comparison of wild-type and mutant strains, using cryo-electron tomography.

Help Received

lab equipment at CNSI (of UCLA) under the supervision of Dr. Hong Zhou