NUS National University of Singapore | Department of Biological Sciences, Faculty of Science

BIOLOGY COLLOQUIUM

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Hosted by Professor Wong Sek Man

The dynamics and mechanisms of SGIV single virus entry into host cells

Professor Qin Qiwei is the Dean of College of Marine Sciences at South China Agricultural University. Prof. Qin has mainly engaged in studies on aquaculture, conservation and utilization of marine bioresources in Japan National Research Institute of Aquaculture, Tokyo University of Marine Science and Technology, National University of Singapore, Sun Yat-sen University, and Chinese Academy of Sciences in recent years, and made a series of creative academic achievements in the field of marine fish virology, fish immunology, and disease control. He has successively finished over more than ten national research projects in China and published more than 100 papers in international peer viewed important academic journals, 3 books, and obtained 8 national patents in China.

By **Qiwei Qin**

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Iridoviruses are large DNA viruses which cause great economic losses in the aquaculture industry and significant threat to global biodiversity. Singapore grouper iridovirus (SGIV) is a novel marine fish DNA virus, belonging to genus Ranavirus, family Iridoviridae, and is one of the most important viral pathogens in aquaculture.

Using single-particle tracking technology, we found that the SGIV entered grouper host cells via the pH-, dynamin-, clathrin-dependent endocytic pathway but not via caveola-dependent endocytosis, and proposed for the first time that macropinocytosis was involved in iridovirus entry. By tracking individual SGIV particles in real time, we observed that SGIV could travel along protrusions and entered into the cells; when microtubules or actin filaments was disrupted by nocodazole or Cyto D respectively, the motility of SGIV was remarkably impaired, implying that the motility of SGIV closely related with cytoskeleton. Based on an atomic force microscopy (AFM), a novel Force Tracing technique was developed, and was firstly applied in study of virus infection: Conjugated with SGIV particles, the AFM tip was slowly directed toward the surface of host cell to contact the cell. Recording the deflection of AFM could directly reflect the virus internalization. Using the Force Tracing technique in constant force mode, two peaks in the distribution of the viral displacement were identified at 180.2 ± 21.6 and 81.0 ± 6.2 nm respectively. Accordingly, the peaks of time distributions were observed at 1.42 ± 0.68 s and 0.82 ± 0.06 s respectively. Further, the maximum velocity of single virus internalization in live cell membranes is about 200 nm/s. In addition, using the Force Tracing technique in constant position mode, the endocytosis force between virus particles and the cell membrane was measured about 60.8 ± 18.5 pN. The increase in the binding energy density with the increase in the engulfment depth.

These results not only contribute greatly to understanding iridovirus pathogenesis and developing antiviral strategies, but also provide a convenient tactic for exploring the life cycle of large DNA viruses.