ヴァイロファージのトランスクリプトーム解析
Transcriptome analysis of virophages

Chemical Life Science, Bioinformatics Center, Institute for Chemical Research,
Kyoto University　Chen Jingjie

研究成果概要

Virophages are small double-stranded DNA (dsDNA) viruses that parasitize larger dsDNA viruses, so-called giant viruses. Previous studies showed that a virophage, Sputnik, can only replicate inside the host amoebae that is infected with mimiviruses. These studies also demonstrated that virophage infection seriously affects the propagation of mimiviruses, resulting in the reduction of the yield of infective mimivirus particles and increased formation of abnormal mimivirus virions characterized by partial thickening of the particles. However, infection mechanism of virophages in the host amoebae infected with giant viruses remain poorly understood. To address the problem, we performed a time-course transcriptome analysis in Acanthamoeba castellanii cells infected with Acanthamoeba polyphaga mimivirus (APMV) and Sputnik 3 virophage (hereafter called as Sputnik+) and compared their gene expression pattern to those only infected with APMV (Sputnik-). Samples were collected every 3 hours at 0, 3, 6, and 9 hours post infection (hpi). Between Sputnik+ and Sputnik-, amoeba gene expression pattern was similar with less than 10% of the amoeba genes showing significantly different expression. In contrast, APMV gene expression patterns were clearly different with around 400 significantly different expressed genes out of around 900 APMV genes. A principal component analysis of APMV gene expression pattern suggested that Sputnik infection resulted in delay of infection progress of APMV at late stages of infection. We also found that Sputnik infection differently affected the genes with different expression timings. APMV genes were classified into four groups according to their expression timings in the absence of Sputnik infection: ‘immediate early’ (expressed from 0 hpi), ‘early’ (expressed from 3 hpi), ‘intermediate’ (expressed at 3&6 hpi) and ‘late’ (expressed at 6&9 hpi). The early genes showed similar expression pattern between Sputnik+ and Sputnik-, but their expression level was higher in Sputnik+ than in Sputnik- at late stages of infection, indicating a prolonged gene expression. Intermediate and late genes showed lower expression level at earlier stages in Sputnik+ compared with Sputnik- but reaching similar or even higher levels at later stages, indicating a delayed expression. Overall, Sputnik infection little affects amoeba gene expression but substantially affects APMV gene expression at late stages of infection likely by disturbing transition from early to late stages of APMV infection.