**Phages of Photoautotrophs**

Many viruses that infect Prochlorococcus and Synechococcus have been isolated. Whole genome sequencing and proteomics have been determined for some. This has allowed for an in-depth examination of key aspects affecting their physiology, ecology, and evolution.

**Developing additional systems**

C-MORE researchers have heterotrophic, photoheterotrophic, and autotrophic phylotype in culture and are working to isolate viruses infecting these key marine microorganisms.

**Viral DNA extraction**

PhycoVirus DNA can be a bottleneck in high-throughput sequencing protocols. A streamlined phage extraction protocol was adapted from a Lambda phage protocol, which allows for the preparation of sequencing-quality DNA in under 2 hours.

**Phage of a Heterotroph**

Methylophilales Methylophilaceae are a subsurface peak in cyanophage-like sequences was seen at 70 m at Station ALOHA in a Viruses are a significant source of mortality for marine microorganisms. Viral lysis results in a loss of productivity for higher trophic levels, but stimulates experimentation and can also lead to the generation of new hypotheses that linking genomes to biomes. Modeling can be used to test hypotheses about viral processes is a key step in realizing the C-MORE goal of viruses of key marine microorganisms.

**Depth profiles of the concentrations of prokaryotes**

**Phage infection**

A peak of a phage infection is visible at Station ALOHA (viruses are circled).

**Regional changes in the abundance of genes encoding photosynthesis and nitrogen fixation**

The presence of key genetic elements can be inferred by monitoring changes in gene abundance. This can help identify and track changes in the diversity and abundance of marine viruses.

**Methods Development**

**Viral community fractionation**

Metagenomics data allows for the identification of viral communities in a targeted fashion. This can help to uncover new viral populations and their ecological roles.

**Future Plans and Directions**

**The Virus Initiative**

Viruses influence life in the sea. As a result, there is widespread interest in viral processes among C-MORE investigators. To identify areas of mutual interest across institutions, Jenn Brum, former C-MORE grad student and post-doc, spearheaded a virus initiative to foster new collaborative ventures through teleconferences and in-person meetings to exchange ideas. Several new projects are in the works as a result of this effort, including one focusing on viruses of Richelia, a cyanobacterial symbiont of diatoms.

**Uncultivated Viruses: Making the Host Connection**

One of the challenges for viral ecologists is making ecological sense of the diversity of high-quality DNA sequences that are being uncovered using high-throughput sequencing. Several new projects are in the works as a result of this effort, including one focusing on viruses of Richelia, a cyanobacterial symbiont of diatoms. Viral ecologists are also planning to work with collaborators at MBARI and WHOI to develop protocols for autonomous sampling and sensing of viruses in situ.

**Autonomous Sensing and Collection**

Electronic sensory systems are being developed to collect samples autonomously which can be used to study viral ecology in real-time.

**Nutrients and Viruses**

C-MORE researchers are following up on observations of ecological and metagenomic studies suggesting that there are interesting interactions occurring between phosphorus cycling and viral replication that may be relevant to understanding subsurface productivity in oligotrophic ocean waters.

**Modeling**

Modelers and viral ecologists within C-MORE have begun discussions on how viral processes change throughout the range of environmental conditions. Several new projects are in the works as a result of this effort, including one focusing on viruses of Richelia, a cyanobacterial symbiont of diatoms.