Phage Genomics Workshop

WELCOME

Karen Klyczek

Dan Williams

Steve Caruso

Veronique Delesalle

Debbie Jacobs-Sera

Dan Russell

Steve Cresawn

Graham Hatfull

William Biederman

Danielle Heller

Denise Monti

Pushpa Ramakrishna

Vic Sivanathan

Bethany Wise

Expectations for HHMI Events

HHMI welcomes the participation of persons of **all identities** and **backgrounds**.

If you experience or witness **inappropriate behavior**, please speak to your event organizer.

Attendees are expected to treat others with **courtesy** and **respect.**

HHMI will **investigate promptly** and take any appropriate corrective action.

Visit **hhmi.org/policies** for details. Refer to your **event materials** for event organizer information.

Event Organizers

Billy Biederman or Denise Monti

biederma@hhmi.org montid@hhmi.org

Vic Sivanathan

sivanathanv@hhmi.org

Workshop Logistics

- Keep to workshop schedule (especially for meals)
- Enjoy our campus
- Please wear your name badges

SEA-PHAGES Bioinformatics Workshop Overview

hhmi

Objectives

- **Characterize and investigate phage genomes** including the details of gene calling, functional assignments, and preparing final submission files **that meet QC requirements**.
  - This year's genome is *Arthrobacter* phage QuinnAvery.
  - **Install and use the software** for annotation and analysis of phages. The software includes DNA Master, Phamerator, PECAAN and other web-based tools.
- **Identify basic phage biology concepts** that underlie bioinformatic investigations.
- **Explore classroom implementation strategies.**

Primary Learning Method

- Learn by doing
  - Gather data
  - Do the work: annotate & analyze the genome
  - Do science like scientists do it. [Translation: new technology changes at a moment's notice]

Workshop Logistics

- Workshop page at seaphages.org
- We will be working in groups (assignments are on Workshop page)
- SEA-PHAGES Bioinformatics Guide and the new SEA-PHAGES Genomics Guide
- Lab notebook. Take notes while annotating!
- seaphages.org forums: Check often.

We Will…

- Use *Arthrobacter* phages QuinnAvery genome to
  - Learn to manipulate the tools we use
    - DNA Master
    - GeneMark, Glimmer
    - BLAST
    - Phamerator
    - HHpred
    - Starterator
    - PECAAN
  - Practice calling genes and functions
- Increase our phage biology knowledge
- Produce a **quality** genome annotation
  - Sequence quality control: ✓
  - Annotation quality control: Checklist and files

SEA-PHAGES is an authentic CRE as part of an iREC

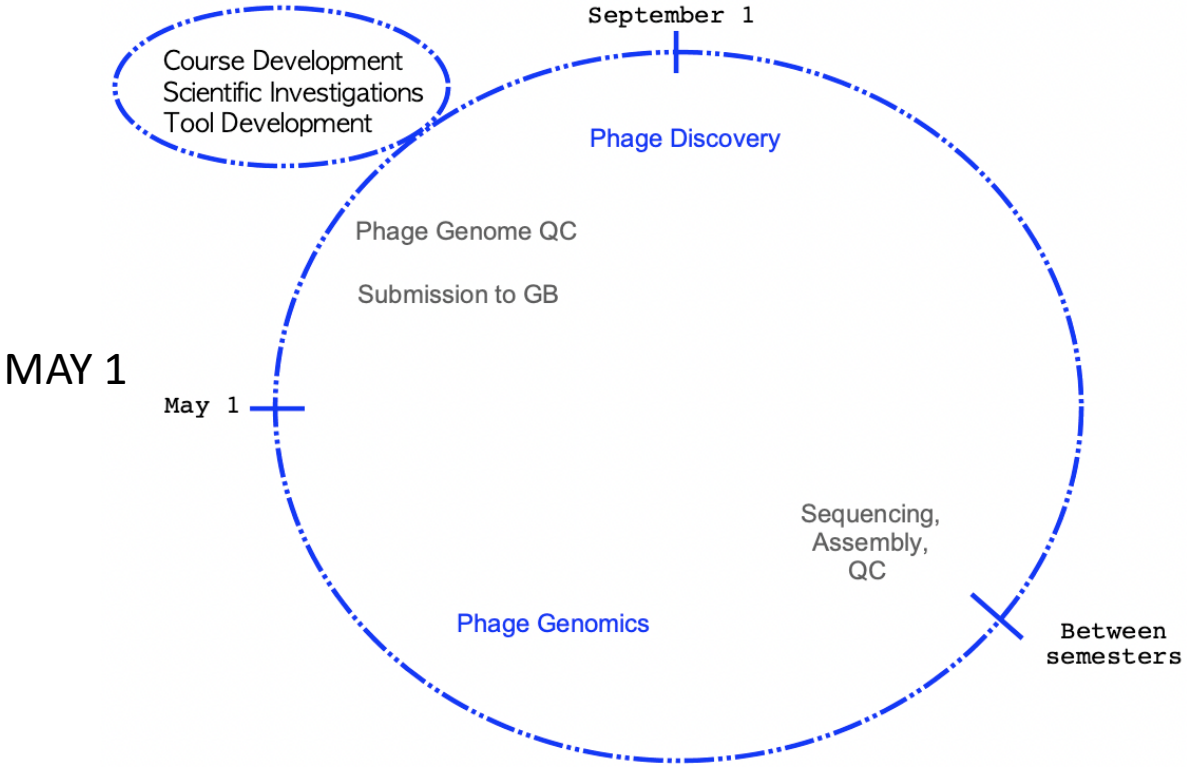
Phage Discovery — September 1

- Phage Isolation, Purification, Amplification
- Phage Characterization, Archving, DNA Extraction

Sequencing, Assembly, QC — Between semesters

Phage Genomics

- Phage Genome Annotation — May 1
- Phage Genome QC
- Submission to GB — September 1


Course Development
Scientific Investigations
Tool Development
September 1
Phage Discovery
Phage Genome QC
Submission to GB
MAY 1
May 1
Sequencing,
Assembly,
QC
Phage Genomics
Between
semesters

Phage Genomics

Phage Genome Annotation — due May 1

What does Phage Genome Annotation include?

Preliminary Genome Investigation

Zoom out: Whole genome, Whole genome comparisons
Zoom in: Synteny, Gene Functions

Manual Genome/Gene Investigation

3 Questions:

- Is it a gene?
- What is its start?
- What is its function?

Big picture: zoom out

- Whole genome
- Cluster, Subcluster evaluation
- Comparison decisions

Details: zoom in

- DeNovo decisions
- Single genes
- Start sites
- Gene functions
- Special features

Tools:

- Auto-Annotation
- Phamerator
- GeneMark Output
- Starterator
- Blast
- HHPred:
  - Database Comparisons
    - PDB
    - UniProt
    - CDD
    - InterPro

Mechanics:

- Add a gene
- Delete a gene
- Change a start
- File Preparation
- Review/Revise
- Document findings

Two aspects that go hand in hand: Biology of phages & Mechanics of phage annotation

- To get started on the Biology of phages, review Central Dogma principles, according to phages. (before dinner)
  - Read Bioinformatics Section in the Phage Discovery Guide
  - Review Central Dogma check-list
  - Questions
- To get started on the Mechanics. (after dinner)
  - Auto-annotate
  - Blast
  - Gather GeneMark graphic outputs
  - Bookmark websites