Genomic Science and Leadership Initiative
Fort Lewis College, Durango, CO
May 21 – 25, 2018

Presented by
Cold Spring Harbor Laboratory, Howard Hughes Medical Institute, J. Craig Venter Institute, University of Wyoming, Fort Lewis College

Instructors
Dr. Agnes Chan (JCVI); Dr. David Jackson and Tara Skopelitis (CSHL); Dr. Joslynn Lee (HHMI); Dr. Jennifer Lowell (FLC); Dr. Arron Shiffer (NAU); Dr. Anne Sylvester (UW)

Supported by
The National Science Foundation, Plant Genome Research Program
# Table of Contents

Detailed Agenda ................................................................. 2  
List of Attendees ............................................................... 5  
Logistics ............................................................................. 6  
Waiver Liability ................................................................. 7  
Workflow of a Microbiome Study ........................................... 9  
Module 1: Pipette Practice .................................................. 10  
Module 2: Isolation of DNA from Water Samples ................. 16  
Module 3: Using the NanoDrop to Evaluate DNA Quality and Quantity ... 22  
Module 4: Amplify DNA by Polymerase Chain Reaction ........ 24  
Module 5: Analyze PCR Products by Gel Electrophoresis .......... 30  
Module 6: How to Read a Journal Article ............................. 35  

Appended  
Lecture 1:  
Lecture 2:  
Lecture 3:  
Lecture 4:
Detailed Agenda

Monday
May 21, 2018
Arrival
4:00 / 5:00 PM Arrive at Fort Lewis College (FLC) campus
5:00 PM Check-in to Bader A Complex
6:00 PM Welcome dinner
8:00 PM Head back to Bader A complex

Tuesday
May 22, 2018
Workshop Day 1 - DNA Isolation from Water Sources
7:00 - 8:00 AM Breakfast
8:00 AM Walk to Chemistry Hall
8:15 – 8:30 AM Welcome, Jennifer Lowell, FLC Department of Public Health
Opening Blessing by Clyde Benally, FLC Elder-in-Residence
8:30 - 9:00 AM Lecture/Discussion
Anne Sylvester, University of Wyoming
- Part 1: Water Quality Testing using Genomics
- Part 2: Lab Safety
9:00 AM - noon Wet-Lab
Tara Skopelitis, CSHL
- Lab 1: Pipette Practice
- Lab 2: Isolation of DNA from Water Samples
12:30 - 1:30 PM Lunch Break
1:30 – 3:30 PM Wet-Lab
Dave Jackson, CSHL
- Lab 3: DNA Quantification Nanodrop
- Lab 4: Amplify DNA by Polymerase Chain Reaction
Lecture/Discussion
Sample Collection, Joslynn Lee, HHMI
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
</table>
| 3:30 - 5:30 PM | **Wet-lab**  
Agnes Chan, JCVI, Dave Jackson  
- Lab 5: Agarose Gel Electrophoresis and Analysis  
- **DEMO:** Nanopore MinION |
| 5:30 - 6:00 PM | Break                                                                   |
| 6:00 - 8:00 PM | Dinner                                                                  |
| 8:00 PM     | Head back to Bader A complex                                            |

**Wednesday**  
**May 23, 2018**  
**Workshop Day 2 - Visit local area**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30 - 8:00 AM</td>
<td>Breakfast</td>
</tr>
</tbody>
</table>
| 8:15 - 9:30 AM | **Lecture/Discussion:** Agnes Chan, JCVI  
- EPI2ME  
- WIMP Nanopore MinION |
| 9:30 - 10:00 AM | Tour FLC Geology and Engineering building                              |
| 10:00 - 12:00 PM | Drive to Silverton                                                    |
| 12:00 - 1:00 PM | Lunch in Silverton, Golden Block Pizza                                |
| 1:00 - 3:00 PM  | Walk around Silverton, drive to Gold King Mine area, Stop at Molas Pass and Baker's Bridge |
| 3:00 - 4:00 PM  | Drive back to FLC campus                                              |
| 4:00 - 4:30 PM  | Break before dinner                                                   |
| 5:30 – 7:00 PM | Dinner                                                                 |
| 7:00 – 8:00 PM | **Talk:** Microbiome Research: Altering the human gut microbiome via Fecal Microbiome transplant and by using modified exercise and nutrition conditions, Arron Shiffer, Northern Arizona University |
| 8:00 PM       | Head back to Bader A complex                                          |
Thursday
May 24, 2018

Workshop Day 3 - Decoding and Identification of DNA Sequences

8:00 - 8:15 AM  Breakfast

8:15 - 8:45 AM  Lecture/Discussion, Agnes Chan, JCVI
    ● DNA Sequencing

8:45 - Noon  Computer Lab, Joslynn Lee, HHMI
    ● Lab 1: How to read a journal article
    ● Lab 2: Basics of Unix/Linux and Cloud Computing

Noon - 1:00 PM  Lunch/Break – FLC Campus Dining

1:00 - 2:00 PM  Talk: Microbiome Research, Jennifer Lowell, FLC Public Health

2:00 - 5:00 PM  Computer Lab, Joslynn Lee, HHMI and Arron Shiffer, NAU
    ● Lab 3: QIIME Analysis of 16S samples
    ● Lab 4: Compare to 2016 results

5:30 - 6:00 PM  Break

6:00 PM  Dinner at Les Sommerville’s Home

Friday
May 25, 2018

Closing of Workshop and Departure

8:00 - 9:00 AM  Breakfast

9:00 -11:00 AM  Lecture/Discussion
    Wrap Up
    ● Part 1: Closing Remarks from Organizers
    ● Part 2: Closing Blessing by Clyde Benally
    ● Part 3: Post-survey

11:00 AM - noon  Return to Bader A - Dorm Check-out
    Depart campus
Logistics

**Workshop Location**
Institute: Fort Lewis College
URL: [https://www.fortlewis.edu](https://www.fortlewis.edu)
Address: 1000 Rim Drive, Durango, CO 81301
Phone: (877) 352-2656

**Accommodation**
Dorm: Bayer A Building
Address: 1000 Rim Drive, Durango, CO 81301
Phone: (877) 352-2656
Check-In Date: Monday 21 May 2017
Check-Out Date: Friday 25 May 2017
Number of Nights: 4
Microbiome Workflow

Research Question(s):
What's in the water and surface sediments that were effected by the 2015 Gold King Mine Spill?
Has the microbial community changed since 2017?

Sample Collection
- Collect metadata (pH, GPS, temp, etc)
- Select sample type and stored on ice
  - Water: Filter-sterilize 1L
  - Sediment: Sterile scoop 1lbs

Isolation DNA from Samples
- Isolate DNA
- check quality and quantity

Operational Taxonomy Units (OTU) picking
- TGGCCGCTTAAAGGTGGTNG
- TGGCCGCTTAAAGGTGGTNG
- TGGCCGCTTAAAGGTGGTNG
- TGGCCGCTTAAAGGTGGTNG
- TGGCCGCTTAAAGGTGGTNG
- TGGCCGCTTAAAGGTGGTNG
- TGGCCGCTTAAAGGTGGTNG
- TGGCCGCTTAAAGGTGGTNG
- OTU1
- TAAACGCTTACGCT
- TAAACGCTTACGCT
- TAAACGCTTACGCT
- TAAACGCTTACGCT
- OTU2
- TGGCCGCTTAAAGGTGGTNG
- TGGCCGCTTAAAGGTGGTNG
- TGGCCGCTTAAAGGTGGTNG
- TGGCCGCTTAAAGGTGGTNG
- OTU3
- TGGCCGCTTAAAGGTGGTNG
- TGGCCGCTTAAAGGTGGTNG
- TGGCCGCTTAAAGGTGGTNG
- TGGCCGCTTAAAGGTGGTNG
- OTU4

Use databases to identify OTU
- Taxonomic assignment (BLAST against known sequences) using Greengenes, RDP, SILVA

Sequence samples

Analyze PCR Products by Gel Electrophoresis

Determine OTU Community Composition
- "Who is there" - taxonomic profiling
- Kingdom
- Phylum
- Class
- Order
- Family
- Genus
- Species

Phylogenetic analysis
- "Incorporate metadata"
- alpha diversity: "How many "species" are there?"
- beta diversity: "How similar are pairs of samples?"