The C-MORE SUMMER COURSE: TRAINING THE NEXT GENERATION OF MICROBIAL OCEANOGRAPHERS

THE C-MORE SUMMER COURSE COLLECTIVE
Center for Microbial Oceanography: Research and Education (C-MORE), University of Hawai‘i at Manoa, Honolulu, Hawaii, USA
http://cmore.soest.hawaii.edu/summercourse/index.htm

With support from the Agouron Institute, the National Science Foundation, and the Gordon and Betty Moore Foundation we have organized 8 annual summer training programs for graduate students and post-doctoral researchers to study the role of marine microbes and how their activities and diversity shape global biogeochemical cycles and ocean ecology. More than 120 students and post-docs from around the world have participated in the program. The course includes lectures and laboratory exercises delivered by leaders in the field. One of the key modules of the program is based at sea, with a 7-10 day oceanographic expedition in the subtropical North Pacific Ocean. In addition, the course provides training in genomic and meta-omic analyses, and students analyze microbial genomes and metagenomic sequences specifically for the course. This poster summarizes the program and its continued development over the past 8 years and highlights some of the major accomplishments.

Graduate students and post-docs from 16 different countries have participated in the program with a ‘US:non-US’ student ratio of 1:1.

Table showing the career development of the course participants

<table>
<thead>
<tr>
<th>Position during summer course</th>
<th>Current position</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Early Career Scientists</td>
<td>1 Lecturer/Dept. Head 1 Assistant Professor</td>
</tr>
<tr>
<td>10 Post-docs</td>
<td>2 Assistant Professor 1 Researcher 6 Post-docs 1 Industry</td>
</tr>
<tr>
<td>111 Graduate Students</td>
<td>54 Graduate Students 30 Post-docs 5 Assistant Professor 2 Researcher 10 Jobs other than Academia 8 Seeking position 2 Out of Science</td>
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</tbody>
</table>

123 Students with 40 Male, 83 Female
275 Days of Class with 288 lectures
96 Days in the Lab
19 Symposia
72 days at sea

Students exploring the BIOME:

Biomass:
- Phytoplankton pigments
- Particulate C/N/P
- ATP
- Cell abundances by microscopy & flow cytometry

Microbial Metabolism:
- Carbon fixation (¹¹C-bicarbonate assimilation)
- Bacterial production (³H-leucine incorporation)
- Photosynthesis-irradiance responses

Sampling, Hydrography, and Biogeochemistry:
- Nutrient analyses
- CTD operations
- Drifting array deployments
- Particulate matter analyses

Microbial diversity:
- DNA extraction
- PCR, Cloning, TRFLP
- Amplicon Sequencing, FISH, Cell sorting
- Whole genome sequencing & annotation (see below)

Students exploring the GENOME:

<table>
<thead>
<tr>
<th></th>
<th>2010 SAR 116 (HIMB 100)</th>
<th>2011 Roseobacter (HIMB 53)</th>
<th>2013 Trichodesmium colonies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxonomic classification</td>
<td>Alphaproteobacteria, Rhodospirillaceae</td>
<td>Alphaproteobacteria, Rhodobacteraceae</td>
<td>Mixed assemblage of cyanobacteria and bacteria</td>
</tr>
<tr>
<td>Genome size (Mbp)</td>
<td>2.46</td>
<td>3.11</td>
<td>NA</td>
</tr>
<tr>
<td>Protein coding genes</td>
<td>2,334</td>
<td>3,239</td>
<td>36,875</td>
</tr>
<tr>
<td>(Meta) Genome-enabled insights</td>
<td>Proteorhodopsin, carbon monoxide dehydrogenase, DMSP-degrading, DMSO reductase</td>
<td>Motile, DMSP-degrading, aerobic anoxygenic phototroph (full puf operon)</td>
<td>Large proportion of surface attached bacteria (Bacterioidetes, a-Proteobacteria); high conservation among Trichodesmium genomes</td>
</tr>
<tr>
<td>Grote et al. 2011</td>
<td>Durham et al. in prep</td>
<td>In progress</td>
<td>Trichodesmium</td>
</tr>
</tbody>
</table>

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