Merging complex "-omic" data and computational ecosystem models

Supported by the Gordon and Betty Moore Foundation's Marine Microbiology Initiative

March 6th – March 7th, 2013

National Hotel
1677 Collins Avenue
Miami Beach, Florida

The workshop will bring together microbial ecologists, theoreticians, and bioinformaticists who are actively wrestling with the challenges associated with the use of metagenomic, metatranscriptomic, and other complex "omic" data in computational ecosystem models. Hands-on interactions will encourage open dialogue, discussions about modeling approaches and datasets that have failed to replicate observations and those that have succeeded, potential collaborations, and building of new synergies among the participants.

Workshop Objectives:

- Identify what types of data are and are not useful for modeling of marine ecosystems
- Compare current approaches being used to model and incorporate data
- Determine critical research needs and bottlenecks for merging "-omic" data and models
- Identify specific outcomes to be followed up upon after the workshop:
    - Tractable techniques and currencies for the field
    - New and strengthened collaborations
    - Special sessions at conferences
    - Follow-up workshops with the larger community
    - Focused perspective article on progress and bottlenecks

GORDON AND BETTY MOORE FOUNDATION

AGENDA

Tuesday, March 5th:

6:00pm	Optional dinner and drinks at Aqua Bar and Grill, National Hotel

Wednesday, March 6th:

8:30am – 9:00am	Breakfast at hotel restaurant
9:00am – 9:30am	Welcome and objectives/GBMF and MMI overview
9:30am – 10:15am	Brief introductions (name, institution)
10:15am – 10:30am	Break
10:30am – 11:30am	"Broad challenges of modeling –omics data" (**Jed Fuhrman and Victoria Coles**)
11:30am – 12:15pm	Lunch
12:15pm – 12:30pm	Introduce breakout groups
12:30pm – 1:45pm	Breakout groups I, II (*see last page for groups*)
1:45pm – 2:00pm	Break
2:00pm – 3:15pm	Breakout groups III, IV (*see last page for groups*)
3:15pm – 4:00pm	Breakout group reports and discussion
4:00pm – 4:15pm	Break
4:15pm – 5:00pm	"Detection of microbial relationships using network inference techniques" (**Karoline Faust**)
5:00pm – 5:30pm	Wrap up and synthesis Review objectives for Thursday
6:30pm	Dinner *Essensia Restaurant at the Palms Hotel* *3025 Collins Avenue* *(305) 908-5458*

Thursday, March 7th:

8:00am – 8:30am Breakfast at hotel restaurant

8:30am – 9:30am "Broad challenges of modeling –omics data" (**Curtis Deutsch and Mick Follows**)

9:30am – 10:15am Revisit outcomes of Wednesday and objectives for the day

10:15am – 11:45am Small group discussions arising from Wednesday

11:45am – 12:30pm Lunch, wrap up, synthesis

12:30pm Time for continued discussions as needed

Breakout Group Session Details

The issue of scale is an overarching, multidimensional challenge for the scientists generating –omics data and for the theoreticians constructing ocean models. Scale can take on many forms, such as temporal and spatial; molecular and cellular to population and community to ecosystem scales. Within the context of scale, breakout groups will focus on defining useful data and defining useful models, using the listed questions to guide the discussions (two questions per breakout group session).

Where possible, please come up with specific examples from your own work to address the questions and focus the discussions.

Moderators (indicated in bold) will facilitate discussion to work through the topic questions. Note-takers are indicated in italics.

Breakout Session I:
12:30pm – 1:05pm

- Which models and datasets have been successful in predicting observations and which have not? Why?
- Are there well studied model organisms (with genomes) that can help guide ways to explore modeling the -omic data – i.e. better understood "needles in the -omic haystack" that can serve as proof of principle and groundtruthing for -omic modeling?

GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
Victoria Coles	**Mick Follows**	**Curtis Deutsch**	**Jed Fuhrman**	**Mary Ann Moran**
John Paul	*Tish Yager*	*Karoline Faust*	*Greg Dick*	*Jack Gilbert*
Chris Klausmeier	Osvaldo Ulloa	Jon Zehr	Andreas Oschlies	Francesco d'Ovidio
Russell Neches	Stuart Daines	Pat Schloss	Katja Fennel	Joshua Weitz
Steve Giovannoni	Katie Pollard	Nitin Baliga	Roman Stocker	John Moisan
Chris Edwards	Adam Martiny	Naomi Levine	Daniel Reed	Chris Algar

Breakout Session II:
1:10pm – 1:45pm

- Are there different considerations for modeling bacteria/archaea vs. microeukaryotes vs. viruses?
- How do models deal with the disconnects between gene expression, protein expression, and actual geochemical rate transformations?

GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
Curtis Deutsch	**Katie Pollard**	**Steve Giovannoni**	**Jed Fuhrman**	**Mick Follows**
Roman Stocker	*Victoria Coles*	*Chris Edwards*	*Mary Ann Moran*	*Russell Neches*
Adam Martiny	Greg Dick	Stuart Daines	Chris Klausmeier	John Paul
Jon Zehr	Pat Schloss	Nitin Baliga	Naomi Levine	Tish Yager
Andreas Oschlies	Katja Fennel	Francesco d'Ovidio	Osvaldo Ulloa	Chris Algar
Jack Gilbert	Daniel Reed	Karoline Faust	John Moisan	Joshua Weitz

Breakout Session III:
2:00pm – 2:35pm

- How can energetics (e.g. nitrogen richness of called proteins) to be used to guide -omic modeling?
- What can we infer about microbial evolution from modeling -omic data?

GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
Tish Yager	**Roman Stocker**	**Curtis Deutsch**	**Mick Follows**	**Jed Fuhrman**
Mary Ann Moran	*Osvaldo Ulloa*	*Chris Klausmeier*	*Naomi Levine*	*Joshua Weitz*
Steve Giovannoni	Nitin Baliga	John Moisan	Chris Edwards	Chris Algar
Pat Schloss	Katie Pollard	Greg Dick	Francesco d'Ovidio	Victoria Coles
Jon Zehr	Russell Neches	Karoline Faust	Katja Fennel	Adam Martiny
Andreas Oschlies	Daniel Reed	John Paul	Jack Gilbert	Stuart Daines

Breakout Session IV:
2:40pm – 3:15pm

- What is different when modeling biogeochemistry vs. microbial interactions from -omic data?
- Beyond keying in on specific genes, what else can be used from the -omic stew to infer the ecology of the microbes? How can genes of unknown function be addressed?

GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
Greg Dick	**Mick Follows**	**Joshua Weitz**	**Jed Fuhrman**	**Pat Schloss**
Russell Neches	*Nitin Baliga*	*Andreas Oschlies*	*Osvaldo Ulloa*	*Roman Stocker*
Katie Pollard	Daniel Reed	John Paul	Chris Klausmeier	John Moisan
Naomi Levine	Mary Ann Moran	Adam Martiny	Chris Edwards	Francesco d'Ovidio
Katja Fennel	Victoria Coles	Tish Yager	Steve Giovannoni	Stuart Daines
Chris Algar	Curtis Deutsch	Jack Gilbert	Jon Zehr	Karoline Faust

Meeting Attendees

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