551-1119-00L Microbial Community Genomics

Introduction to the course:
Time plan, room plan, assessments

Important information: COVID-related guidelines

- Bring and wear your own masks. Wearing masks is mandatory. Lecturers may wear a face shield or remain behind a plexiglass pane as an alternative.
- According to regulations, our sessions are planned to last for less than 2 hours each (1.5 hours) and there will be 30 min breaks in between sessions. Between our sessions, the room will be ventilated and disinfection solutions are provided.
- Whenever possible, distance rules have to be respected.
- The installation and activation of the Swiss Covid app is strongly encouraged.
- Students with any COVID-19 symptoms are not allowed to enter ETH buildings and have to inform Shinichi Sunagawa or any of the instructors.

Supervisors

Shinichi Sunagawa

Hans-Joachim Ruscheweyh

Guillem Salazar

Melanie Lang

Learning objectives

- Understand the basics and be capable of analyzing the composition of microbial communities using Next Generation Sequencing approaches.
- Critically asses current literature in community microbiology.
- Gain skills in planning and developing scientific projects.
- Gain skills in data analysis, statistics and critical interpretation of research results.
- Gain skills in oral presentation of scientific results and scientific writing.

What to expect

- Introduction to the research area of microbial community metagenomics
- We will balance tutorials with REAL scientific research for the next 3.5 weeks
  - Things may not work out as planned
  - Your supervisor will be managing multiple projects as well as yours. Please be patient with them. If you have “spare time”, read papers, practice some of the skills you acquire, etc.
  - You will get out what you put in…
  - You are expected to work professionally and responsibly at all times

Important points for *real* research

- Scientific Integrity
  - You will be working in an environment and with equipment that is shared with the Microbiome Research laboratory
  - Be respectful, do not enter experimental laboratories, etc.
  - Do not remove/modify any data on the systems that are unrelated to your work. If in any doubt ASK (we prefer stupid questions to stupid accidents!)
  - When doing original work, you need to document what you do, so that it is reproducible for anyone else
  - Take time to think and talk through course content so you understand what you are doing

Plan for the next 3 weeks

- Learn basics of describing microbial communities through sequencing technologies

- Apply data analysis to understand the compositions in mice gut microbial communities

16S rRNA gene-based analysis of mice gut microbiota composition. Mice were sacrificed and sampled at 8 or 14 weeks of age and after (or not - control) undergoing behavioral testing. The same experimental design was conducted at different laboratories.

- Identify and work on research questions you would like to address

Methods

- use of bioinformatics software and programming language R
- use data from PCR-amplified 16S rRNA gene fragments to analyze microbial communities
- use command line software to analyze data
- work on specific research questions in groups

Assessment

1) Written report (1/3) in the format of a short scientific paper.

→ Title, Abstract, Introduction, Methods, Results, Discussion (+Figure/Table)

- Each student should prepare at least one figure/table with legends/headers
- Each participant should produce their own report. Plagiarism will not be tolerated.
- Font size 12, 1.5 line spacing. Maximum 10 pages in total including figures, legends and references.

→ Hand in by October 18th 2020

2) Written exam (1/3)

3) Oral presentation (1/3): 20 min (15+5)

Timing – week 1

	Week 1: 15.-18.09.2020			
	Tue	Wed	Thu	Fri
8:30-10:00		3. Lecture Gut 16SrRNA	7. R Introduction to R (ggplot)	11. R analysis (HMP data)
Break				
10:30-12:00		4. Scientific presentation on the data/project (Ivanna - ZOOM)	8. 16S pipeline / Lecture	12. R analysis (own data)
LUNCH				
13:30-15:00	1. Introduction	5. R Introduction to R (base R)	9. 16S pipeline / Lecture	13. R analysis (own data)
Break				
15:30-17:00	2. Setup infrastructure UNIX intro	6. R Introduction to R (tidyverse)	10. Lecture Diversity / R analysis (HMP data)	14. Wrap up / Plan group projects
17:15		Seminar		

Timing – week 2

	Week 2: 22.-25.09.2020			
	Tue	Wed	Thu	Fri
8:30-10:00		3. Flash talks from 3 members of the group	7. Group projects	11. Group projects
Break				
10:30-12:00		4. Group projects	8. Group projects	12. Group projects
LUNCH				
13:30-15:00	1. Lecture: Best practices for data analysis	5. Group projects	9. Group projects	13. Group project presentations
Break				
15:30-17:00	2. Group projects	6. Group projects	10. Group projects	14. Wrap up / plan next week
17:15		Seminar		

Timing – week 3

	Week 3: 29-02.10.2020			
	Tue	Wed	Thu	Fri
8:30-10:00		3. JC	7. Group projects	11. Lecture Report writing
Break				
10:30-12:00		4. Group projects	8. Group projects	12. Group projects (freeze results)
LUNCH				
13:30-15:00	1. Group projects	5. Group projects	9. Group projects	13. Group projects (freeze results)
Break				
15:30-17:00	2. Group projects	6. Group projects	10. Discuss project results	14. Wrap up
17:15		Seminar		

Timing – week 4

	Week 4: 06-07.10.2020	
	Tue	Wed
8:30-10:00		3. Prep presentation
Break		
10:30-12:00		4. Prep presentation
LUNCH		
13:30-15:00	1. Exam	5. Presentation (13:30 - 16:00)
Break		
15:30-17:00	2. Lecture: Presentation and report format/content	6. Wrap up (16:30-17:00)

Important information: locations

HCI (4th finger)

- HCI G443 – Block Course room

- HCI F423 – Shini's office
- HCI F425A/B – Sunagawa lab offices

Important information: learning resources

- Main source of material:

https://sunagawalab.ethz.ch/share/Teaching/551-1119-00L_Fall2020/

- Teams group for online teaching/support:

[LEC BIOL] Sunagawa_lab_block_course_HS2020

Important information: Seminars in Microbiology

https://ethz.zoom.us/j/95255381852

Seminars in Microbiology

Takes place via Zoom usually Wednesdays at 17:15 (ETH VVZ 551-1109-00L)

Program Autumn Semester 2020

16.09.2020

Prof. Sara Mitri Host: Prof. Wolf-Dietrich Hardt
University of Lausanne (CH)

Eco-evolutionary dynamics in a small bacterial community

23.09.2020

Prof. Philipp Engel Host: Prof. Shinichi Sunagawa
University of Lausanne (CH)

Structure and function of microbiomes - lessons from social bees and their gut symbionts

24.09.2020 **at 15:00**

Erik Bakkeren Group of: Prof. Wolf-Dietrich Hardt
ETH Zürich, Institute of Microbiology (CH)

The evolution and adaptation of Enterobacteriaceae in the murine gut

30.09.2020

Prof. Jan Roelof van der Meer Host: Prof. Shinichi Sunagawa
University of Lausanne (CH)

Engineering xenometabolic capacity into the soil microbiome

07.10.2020

Prof. Siegfried Hapfelmeier Host: Prof. Julia Vorholt
University of Berne (CH)

Probing intestinal mucosal responses with auxotrophic Salmonella