

## Discussion facilitator

For the second lecture period each week, we will discuss the current literature of host associated microbiomes. For the discussions during the initial phase of the course, a different student each week will be responsible for being a discussion facilitator. The facilitator will choose core papers and background reading on a subject. These readings will provide examples of concepts/patterns we cover in lecture and demonstrate how microbiome research is practiced. The facilitator will engage the students in a discussion during class time using feedback from the thought pieces.

**Goal:** To engage the community of students in an in-depth discussion and analysis of recently published scientific research on host associated microbiomes.

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### Assignment

**Select Core papers:** Choose 1 - 2 core papers from the peer-reviewed literature taking into consideration whether or not they are short format (e.g., *Science*, *Nature*) or full-length papers. Review papers cannot be used as the sole core-paper for a discussion. Core papers should be uploaded to the course Blackboard website by 5 PM on the Friday the week before you lead discussion. Using the Blackboard messaging system, please send a note to "All Participants" and include the links to the core papers.

**Select additional resources:** Select up to five additional papers for supplementary reading. You must add the citations of your core and supplementary papers to the course Mendeley group prior to leading your discussion.

**Review thought pieces:** Before the discussion of the papers, read through all of the thought pieces. It may be helpful to compile the list of student questions.

**Discussion:** When facilitating a discussion, you are encouraged to use handouts (notes or figures) or the whiteboard, but not Powerpoint-like presentations. Your objective should be to engage insightful conversation among a peers with diverse background based on "core" readings, but also through the integration of "supplementary" literature.

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Mendeley is one of the leading reference-manager software packages. It is relatively easy to use, can be installed on multiple operating systems, and most importantly is free. See the following website for downloading a copy of the software and instructions on use: <http://www.mendeley.com/>.

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### Due dates:

**5 PM on the Friday the week before you lead discussion.**

## Thought piece

For the second lecture period each week, we will discuss the current literature of host associated microbiomes. You will be asked to read assigned journal articles from the primary literature. You will also have a written assignment on the article(s) due before the discussion. These readings will provide examples of concepts/patterns we cover in lecture and demonstrate how microbiome research is practiced.

**Goal:** This thought piece will serve three purposes: 1) encourage careful reading of the literature; 2) allow the students to pose questions to the discussion facilitator; and 3) apply ideas from the core papers to other areas of research.

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### Assignment

You will be required to generate a “thought piece”, consisting of:

1. A brief summary of the assigned paper(s).
2. Two to three questions that the discussion facilitator might consider addressing when guiding discussion.
3. Two ideas of how future studies described in core papers could branch into other dimensions of microbiome research (ecology, evolution, genetics, microbiology, immunology, behavior, etc.).

Your thought piece should be shared on the course Blackboard website with the instructor and the discussion facilitator. Although the thought piece should be carefully written, it is sufficient to send this assignment as text; please do not attach as a separate file (e.g., Word document).

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### Due dates:

**5 PM on the Wednesday before discussion**

## Science Outreach assignment

There is a need to communicate beyond the ivory towers of our institutions. It is a worthy goal and a necessary component of doing science especially on a publically funded project. The greater use of science blogs is also a vital part of this communication. Making the science we do as public as we can is an important part of public outreach. We need to make sure that our science and how we do it is freely available to the public and our peers. What better way to help educate people about what we do then do show them the process too. There is a fantastic article by Batts et al (2008) about blogging and other web based resources worth a looking up. Remember, science education consists not only of building a solid research program but also developing connections within and beyond the scientific community.

**Goal:** To think and writing critically about recently published scientific research on host associated microbiomes and present that research to a broader audience.

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### Assignment

**Choose a topic:** For this assignment, you will select a paper from the primary literature (for example, look up the most recent articles in *PLoS ONE* or have a look at <http://www.microbiomedigest.com/> ) After carefully reading the paper, delve in the broader context of the specific research question being addressed. Check out the authors' website. You want to integrate the specific topic of the paper into a larger question of biology.

**Draft a post:** Once you have selected a paper and done some background reading, start drafting a blog post. You should target a post that is around 1000-1500 words. You'll submit an electronic draft (via Google Doc) to the instructor for an initial round of feedback. You can include figures/pictures, but do not concern yourself with placement within the post, that will be handled at the final stage.

**Revise draft:** You'll receive feedback on your post from the instructor within one week. After revising your post, you'll send it around to your peers in the class for another round of feedback.

**Peer review:** Review two of your classmate's posts. You are not required to read the relevant article. You want to provide constructive feedback to your peers. Think about the kind of reviews you'd like to receive yourself.

**Prepare final:** Following this second round, you'll prepare the final version of the text of your post. You will work in lab to publish the final version on our class blog (a UAF hosted Wordpress site). You are also free to crosspost your post on your own personal blog website.

**You should include the following sections in your post** (labeled as you wish):

Background: Develop the broader context of the topic and research paper you've selected. A good picture (properly credited) can help catch the reader's eye. Here, you'll want to hook the reader's attention.

Central question: State clearly the primary question or hypothesis of the research paper.

Evidence: Briefly, and using a little jargon as possible, sketch out the evidence that the authors found to support their conclusions. It is appropriate to use some figures from the paper, but often it helps to provide simplified versions.

Your questions: This is an opportunity to look beyond the evidence in the paper. What experiments do you think would constitute the next step?

Further reading: A section where you provide links where someone might find more information about the chosen topic. You can include additional papers published by the primary authors or links to other resources (e.g. YouTube video of a talk).

References: A complete list of citations included in your blog post. DOIs and hyperlinks will help your post be more connected and attract more visitors in the future.

**As an example**, you can look at something I've written year over at *Nothing in Biology Makes Sense*. This is just an example and there are many other online you can read to get ideas. Ed Yong and Carl Zimmer are also very popular and successful science writers worth checking out.

- <http://nothinginbiology.org/2014/03/11/living-at-the-edge-range-expansion-is-a-losing-battle-with-mutations/>
- <http://phenomena.nationalgeographic.com/blog/not-exactly-rocket-science/>
- <http://phenomena.nationalgeographic.com/blog/the-loom/>

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## Timeline of due dates:

Topic and paper selected and sent to instructor	Week 7
First draft submitted to instructor	Week 10
Comments received from instructor	Week 11
Revised draft submitted for peer review	Week 12
Peer review of at least two other posts	Week 13 (Tues)
Final blog post published by	Week 13 (Lab)

## Microbiome research project overview

Across many labs in this course, you will be collecting microbiome data from yourself and your classmates. These lab modules provide a hands on introduction to the methods in common use for data collection and analysis of host-associated microbiomes. To finish the class, we'll host a mini-symposium, the Microbiome Under the Midnight Sun (MUMS). During this research symposium, each class member will present their own research findings based on their lab work on skin microbiome sampling.

**Goal:** This research project will serve three purposes: 1) collect new data on the skin microbiome; 2) perform novel analysis; and 3) address a specific research question comparing your data to previously published data online. Students should be able to demonstrate an ability to:

- Find and explore and critically review the relevant literature
  - Carry out the investigations, including collecting and analyzing data
  - Draw valid conclusions from the analysis of the data
  - Discuss the relevance of the conclusions in the context of previous findings
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## Assignment

### 1. Data collection labs

#### 1.1. Skin microbiome community analysis

The first module focuses on microbiome analyses, and will teach the skills and techniques necessary to go from environmental sampling (e.g. skin flora) to obtaining hundreds of thousands of DNA sequences for characterizing that bacterial community. This module will include microbial community sampling, DNA extraction, PCR for amplicon sequencing (16S rRNA genes), and library preparation for sequencing analysis leveraging the tools and expertise in the core labs.

#### 1.2. Genome collection module

The second data collection module will involve sequencing the genome of a single bacterial isolate. We will first generate pure cultures of a bacterium (e.g. from the human skin microbiome), then extract DNA and learn the process of library preparation and DNA sequencing using methods geared toward whole genome sequencing as above.

### 2. Data analysis labs

#### 2.1. Class data analysis

This module will teach the computational skills and techniques for students to process next generation sequencing data and describe the microbial community as well as to analyze bacterial genome sequence data.

## 2.2. Data mining

The NIH funded Human Microbiome Project created a Data Analysis and Coordination Center (DACC), which will be leveraged in the creation of both the lab modules as well as course material. The HMP DACC has a large database of existing data that can be used for comparative analyses.

## 3. Research project

The goal of this module is to address a problem using the scientific method. This will include formulating a hypothesis, collecting new observations, and drawing a logical conclusion consistent with the data. In the process you should

- Come up with a question (Hypothesis or research question)
- Perform additional Analysis
  - Written presentation (figures or graphs) of major results
  - Description (including location) of all raw data collected
- Prepare your research report of analyses and results
  - Include novel methods not covered in previous lab

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### Timeline of due dates:

<b>Data collection: community module</b>	<b>Week 5-6 (Lab)</b>
<b>Data collection: genome module</b>	<b>Week 7-8 (Lab)</b>
<b>Data analysis module</b>	<b>Week 10-11 (Lab)</b>
<b>Research question sent to instructor</b>	<b>Week 11 (Friday 5PM)</b>
<b>Data mining module</b>	<b>Week 12 (Lab)</b>
<b>Research project results</b>	<b>Week 14 (Friday 5 PM)</b>

## Symposium presentation

To finish the class, we'll host a mini-symposium, the Microbiome Under the Midnight Sun (MUMS). During this research symposium, each class member will present their own research findings based on their lab work on skin microbiome sampling.

**Goal:** Communicate your research findings via an oral presentation similar to a scientific research conference.

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### Assignment

Prepare an oral presentation of your skin microbiome research project. Each presentation will last for 20 minutes including questions. You should target a talk that lasts a maximum of 15 minutes and allow 5 minutes for questions from the audience.

You are encouraged to use visual aids such as a video slide presentation (e.g. Google Slides). Typical scientific presentations will have approximately one slide per minute of time. Keep your slides simple and with minimal distractions. This means you should limit your text (think bullet points, max 3) and avoid animation and extra images or backgrounds. You can find many guides online and you are encouraged to ask your instructor for help.

#### **You presentation should have the following sections:**

Introduction: Here you'll present the background and context for your research project. This section should **end with the question** you will address with your analysis and results.

Methods: In this context, we are all familiar with the general methods so **keep this section very brief**. If you did analysis or data collection beyond what the class did, now would be the time to describe that.

Analysis/Results: Show us the data, but only the relevant information with respect to your research question. Now is not the time to prove that this was a lot of work by showing us every kind of analysis you completed.. You want to **present the key graphs/figures/tables that helps you understand your research question**.

Interpretation: Address how your results address the exact question you posed at the start of your presentation. End this section with a **take home message**.

Future directions: Briefly, **propose the next steps**. How would you expand this study? What other data is needed to answer your proposed questions.

In order to keep the symposium on schedule, we will enforce strict time keeping. Below is a rundown of timing marks:

- 12 minutes: moderator will signal 3 minutes remaining
- 14 minutes: moderator will stand up
- 15 minutes: moderator will ask audience for questions.

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**Due dates:**

**Upload presentation to course Google Drive**

**Monday (week 15)**

**Presentation group 1**

**Tuesday (week 15)**

**Presentation group 2**

**Thursday (week 15)**



## Symposium Peer Evaluation

Presenter Name:

Your Name: \_\_\_\_\_

\_\_\_\_\_

**I. List one thing you learned, or found particularly intriguing about, this presentation.**

**II. Suggest one way the presentation might be improved**

**III. On a scale from 1 to 10 (with 10 being the best), rate the presentation in each of the following categories. You may add brief comments to justify your choice.**

1. Interesting/exciting topic ( ): \_\_\_\_\_

2. Informative ( ): \_\_\_\_\_

3. Organization ( ): \_\_\_\_\_

4. Clear explanations ( ): \_\_\_\_\_

5. Delivery ( ): \_\_\_\_\_

6. Visual or other aids ( ): \_\_\_\_\_