Term Information

Effective Term	Spring 2023
Previous Value	*Autumn 2021*

Course Change Information

What change is being proposed? (If more than one, what changes are being proposed?)

Change the course from 2 credits to 3 credits

What is the rationale for the proposed change(s)?

In our end-of-semester survey last time we offered VETPREV/M7719, we received feedback that while the students appreciated the breadth of the course, they felt that the course could benefit from more time spent on each unit. Expanding the course will allow us to discuss in class more of the papers that were previously assigned only as supplemental reading, and will also let us spend more time guiding students through some hands-on data analysis.

What are the programmatic implications of the proposed change(s)?

(e.g. program requirements to be added or removed, changes to be made in available resources, effect on other programs that use the course)?

none.

Is approval of the requrest contingent upon the approval of other course or curricular program request? Yes

Please identify the pending request and explain its relationship to the proposed changes(s) for this course (e.g. cross listed courses, new or revised program)

Course is cross listed with veterinary biosciences (VETPREV 7719) so credit change needs to be approved in both Departments.

Is this a request to withdraw the course? No

General Information

Course Bulletin Listing/Subject Area	Microbiology
Fiscal Unit/Academic Org	Microbiology - D0350
College/Academic Group	Arts and Sciences
Level/Career	Graduate
Course Number/Catalog	7719
Course Title	Microbiome in Health and Disease
Transcript Abbreviation	Micrbm Hlth & Dis
Course Description	This course is designed to introduce students to host-associated microbial communities (specifically human and animal hosts) and their roles in host health and disease.
Semester Credit Hours/Units	Fixed: 3
Previous Value	*Fixed: 2*

Offering Information

Length Of Course	14 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade
Repeatable	No
Course Components	Lecture
Grade Roster Component	Lecture

Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Sometimes
Campus of Offering	Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites	
Exclusions	Not open to students with credit for VetPrev 7719.
Electronically Enforced	No

Cross-Listings

Cross-Listings	Cross-listed in VetPrev.

Subject/CIP Code

Subject/CIP Code	26.0502
Subsidy Level	Doctoral Course
Intended Rank	Masters, Doctoral

Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- Design a microbiome study and identify the strengths and limitations of varying study types
- Describe and identify strengths and weaknesses of in vivo, in vitro, and in silico techniques used for studying the microbiome
- Critically interpret microbiome data and communicate your critique constructively
- Apply, as relevant, key ecological concepts to microbiome study design and interpretation
- Identify and explain the potential and risks of microbiome-associated diagnostics and therapeutics

Content Topic List

- Introduction to the host-associated microbiome
- How do we study the host-associated microbiome?
- Microbial community acquisition
- Factors that shape the gut microbiome: Diet
- Other factors that shape the microbiome
- Microbial community dynamics
- Microbial interactions with the immune system
- The gut microbiome and metabolic disease
- Gastrointestinal pathogens and the gut microbiome
- Cancer and the microbiome
- Antimicrobial resistance in the gut microbiome
- The gut-brain axis
- Microbiota targeted therapies
- Clinical diagnostics / commercial profiling

Sought Concurrence

Yes

Attachments

- VETPREVMICRO7719-Syllabus.3Credit.v14.docx: New Syllabus (3 cr)

  (Syllabus. Owner: Kwiek,Jesse John)

- VETPREVMICRO7719-Syllabus.v6.docx: Current Syllabus (2 cr)

  (Syllabus. Owner: Kwiek,Jesse John)

- Vetprev_concurrence.pdf: VETPREV concurrence

  (Concurrence. Owner: Kwiek,Jesse John)

Comments

- Email from VETPREV stating alignment between VETPREV and Micro with regard to requested course change *(by Kwiek,Jesse John on 08/03/2022 09:31 AM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Kwiek,Jesse John	08/03/2022 09:32 AM	Submitted for Approval
Approved	Kwiek,Jesse John	08/03/2022 09:32 AM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	09/14/2022 11:45 AM	College Approval
Pending Approval	Cody,Emily Kathryn Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Hilty,Michael Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	09/14/2022 11:45 AM	ASCCAO Approval

Microbiome in Health and Disease (VETPREV 7719/M7719)

Format: Seminar, 3 contact hours/week

Instructors Dr. Vanessa L. Hale, Assistant Professor, Veterinary Preventive Medicine
Dr. Patrick Bradley, Assistant Professor, Microbiology

Dr. Vanessa Hale
Email: hale.502@osu.edu
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Phone: 614-247-8377
Office Hours (Zoom or in-person): By appointment

Dr. Patrick Bradley
Email: Bradley.720@osu.edu
Office: 440A Biological Sciences
Phone: 614-292-2120
Office Hours: By appointment

Lecture time and location: TBD

- **In-person attendance is encouraged (unless advised otherwise)** as group discussions are a critical aspect of this course. A Zoom link is also available as we recognize that this may provide flexibility in many circumstances (e.g. quarantines, changes in child care availability, preference for avoiding in-person contacts). Your health and well-being – physical and mental – comes first, and we will strive to support this in every way we can. If you are feeling unwell, please DO NOT attend in-person.
- Zoom link: go.osu.edu/7719 (password: 7719)

Course Description: This course is designed to introduce students to host-associated microbial communities (specifically human and animal hosts) and their roles in host health and disease. We will focus heavily on the gut microbiome and will explore the interactions between host and microbes. We will also examine methodologies used to examine, predict, evaluate, or manipulate microbiota within the context of host health.

Course Objectives

- Design a microbiome study and identify the strengths and limitations of varying study types
- Describe and identify strengths and weaknesses of in vivo, in vitro, in silico, and analysis techniques used for studying the microbiome
- Critically interpret microbiome data and communicate your critique constructively
- Apply, as relevant, key ecological concepts to microbiome study design and interpretation.
- Identify and explain the potential and risks of microbiome-associated diagnostics and therapeutics.

Text: This course will be based on primary literature for which links and PDFs will be provided weekly. No other texts are required for this course.

Grading:

Assignment	Percent
FINAL PROJECT – Study design	25
Take home quiz*	25
Reflection questions with reading 1*	15
Reflection questions with reading 2*	15
Microbial community dynamics group presentation*	20
Total	100

Letter Grade (Percent)	Points (out of 100)
A (90.0-100%)	90+
B (80.0-89.9%)	80-89.9
C (70.0-79.9%)	70-79.9
D (60.0-69.9%)	60-69.9

*You will have the option of dropping one of these assignments (not the final project) if you choose.

FINAL PROJECT - Study Design Project (25 points): Establish a scientific question involving a host-associated microbiome and design a study to answer that question. Explain why you chose this approach and the strengths and weaknesses of your approach. You have unlimited funding and may employ any method you see fit. On exam day, you will present a summary of your intended study. You will be evaluated on (but not limited to) the criteria below and a more detailed rubric will be provided for guidance.

- Does the design answer the question effectively?
- Are appropriate control groups and microbiome controls included?
- Review another person's Study Design Project and provide critical feedback, questions, or suggestions for additional data or experiments that could be performed.
- Final presentation should be engaging (e.g. include interactive questions, quizzes, scenarios, group work, games etc.). The presentation will be assessed on:
    - Background of topic
    - Accurate presentation of strengths and weaknesses, potential pitfalls, or controversies / barriers in relation to this topic
    - Clarity of slides, oral delivery, methods to engage the class, ability to field questions, and appropriate references

Reflection Questions (15 points): Provide a brief written response to several reflection questions on a selected study. Reflections should be submitted on Carmen assignments.

Microbial Community Dynamics Group Presentations (20 points): Groups will meet and prepare 1-3 slides at the beginning of class. Slides will define one type of microbe-microbe interaction and provide an example of this type of interaction based on literature. A more detailed rubric will be provided for guidance.

Take home quiz (25 points)**:** There will be one take-home quiz that will cover material from weeks 1-4. Quizzes must be submitted by the *beginning* of the class in which they are due, listed below. Quizzes should be submitted on Carmen assignments. Late quizzes will only be accepted with an approved excuse. While we highly encourage you to discuss the readings together, the quizzes should be completed by yourself. We suggest budgeting one hour for a quiz.

Week	**Topic**	Assignments (Subject to change)
1	Introduction to the host-associated microbiome • Host ecosystems (niches) • Oral • Gastrointestinal • Skin • Urogenital • Nasal / Respiratory	**Readings** Lloyd-Price et al. 2017, Nature *Strains, functions and dynamics in the expanded Human Microbiome Project* https://www.nature.com/articles/nature23889

2	Methods - How do we study the host-associated microbiome?
	• Sample collection considerations
	• Sample storage / preservation
	• Sample extraction and controls
	• Review (covered in M5155)
	• Composition: 16S, metagenomes
	  ○ Functional potential: metagenomes, putative function predictors
	  ○ Function: Metabolome, proteome, transcriptome
	• Gnotobiotic models
	• Single cell technologies
	• Organoids
	• Culture and co-culture
		Readings
		Knight et al., 2018
		Best practices for analysing microbiomes
		https://www.nature.com/articles/s41579-018-0029-9
		
		Read up to the "Higher-level analyses" section of this paper

	• Gut reactor models • In-silico models	
3	Methods - How do we study the host-associated microbiome? • 16S / Metagenomic analyses • Metabolomic analyses • Correlation vs. causation • Statistical analysis methods • Longitudinal analyses	**Readings:** Knight et al., 2018 *Best practices for analysing microbiomes* https://www.nature.com/articles/s41579-018-0029-9 Read the remainder of the Knight paper OPTIONAL: Afshinnekoo et al. 2015, Cell Systems Geospatial Resolution of Human and Bacterial Diversity with City-Scale Metagenomics https://www.cell.com/pb/assets/raw/journals/research/cell-systems/do-not-delete/CELS1_FINAL.pdf
4	Strain variation and transfer • Vertical transmission • Horizontal transmission • How to track transfer ****Take-home Quiz will be posted online by midnight Sept 16th**	**Readings**: Nayfach et al. 2016, Genome Research An integrated metagenomics pipeline for strain profiling reveals novel patterns of bacterial transmission and biogeography https://genome.cshlp.org/content/early/2016/10/05/gr.201863.115 AND OPTIONAL: Brooks et al. 2017, Nature Communications Strain-resolved analysis of hospital rooms and infants reveals overlap between the human and room microbiome https://www.nature.com/articles/s41467-017-02018-w
5	Microbial community acquisition • Primary and secondary succession • Early colonization • Post disturbance colonization • What is healthy? • Community stability / stable states • Age	**Due: Take-home Quiz** **Readings**: Roswall et al. 2021, Cell Host & Microbe Developmental trajectory of the healthy human gut microbiota during the first 5 years of life https://www.sciencedirect.com/science/article/pii/S1931312821001001?via%3Dihub
6	Factors that shape the gut microbiome: Diet • How does diet alter the microbiome? • Co-evolution of hosts / microbial communities related to diet	**Due**: **Reflection Questions 1** (due at the END of class, but please complete questions 1-6 BEFORE class) **Select ONE paper from the options below** **Readings**: Hryckowian et al. 2018, Nature Microbiology *Microbiota-accessible carbohydrates suppress Clostridium difficile infection in a murine model* *https://www.nature.com/articles/s41564-018-0150-6* Gehrig et al. 2019, Science Effects of microbiota-directed food in gnotobiotic animals and undernourished children https://science.sciencemag.org/content/365/6449/eaau4732 David et al. 2013, Nature Diet rapidly and reproducibly alters the human gut microbiome

		https://www.nature.com/articles/nature12820 Hehemann et al., 2012, PNAS *Bacteria of the human gut microbiome catabolize red seaweed glycans with carbohydrate-active enzyme updates from extrinsic microbes* https://www.pnas.org/content/109/48/19786.short Delsuc et al 2014, Molecular Ecology *Convergence of gut microbiomes in myrmecophagous mammals* https://www.zoology.ubc.ca/~parfrey/parfrey_lab/wp-content/uploads/2017/06/Delsuc_convergence_myrm_microbiome_2013.pdf Chassaing et al. 2016, Gut *Dietary emulsifiers directly alter human microbiota composition and gene expression ex vivo potentiating intestinal inflammation* https://gut.bmj.com/content/66/8/1414 Carmody et al. 2019, Nat. Microbiol *Cooking shapes the structure and function of the gut microbiome* https://pubmed.ncbi.nlm.nih.gov/31570867/ Zeevi et al. 2015, Cell *Personalized Nutrition by Prediction of Glycemic responses* https://www.cell.com/fulltext/S0092-8674(15)01481-6
7	Other factors that shape the microbiome • Xenobiotics • Chemical exposures (e.g pesticides, plastics) • Drugs (toxicity, activation, inactivation, side effects) • Chemotherapies • Exercise	**Readings** Savage, 2020. The complex relationship between drugs and the microbiome https://www.nature.com/articles/d41586-020-00196-0 AND Scheiman et al. 2019, Nature Medicine Meta'omic analysis of elite athletes identifies a performance-enhancing microbe that functions via lactate metabolism https://www.nature.com/articles/s41591-019-0485-4 Optional readings: Koppel et al. 2018, eLife *Discovery and characterization of a prevalent human gut bacterial enzyme sufficient for the inactivation of a family of plant toxins* https://elifesciences.org/articles/33953 Chiu et al. 2020, Toxilogical Sciences The Impact of Environmental Chemicals on the Gut Microbiome https://academic.oup.com/toxsci/article/176/2/253/5835885

		Koppel et al. 2018, Science Chemical transformation of xenobiotics by the human gut microbiota https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5534341/ Wu et al, 2017, Nature Medicine Metformin alters the gut microbiome of individuals with treatment-naive type 2 diabetes, contributing to the therapeutic effects of the drug https://www.nature.com/articles/nm.4345 Bhatt et. al, 2020, PNAS Targeted inhibition of gut bacterial β-glucuronidase activity enhances anticancer drug efficacy https://www.pnas.org/content/117/13/7374
8	Microbial community dynamics • Type of interactions: parasitism, predation, competition, mutualism, commensalism, ammensalism • Keystone species • Predator/prey dynamics • How can community dynamics change in disease?	**Due: Microbial Community Dynamics Group Presentations** **Readings**: Coyte & Rakoff-Nahoum, 2019, Current Biology Understanding Competition and Cooperation within the Mammalian Gut Microbiome https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6935513/ OPTIONAL Kehe et al. 2021, bioRxiv Positive interactions are common among culturable bacteria https://www.biorxiv.org/content/10.1101/2020.06.24.169474v1.full Smillie et al. 2018, Cell Host & Microbe Strain Tracking Reveals the Determinants of Bacterial Engraftment in the Human Gut Following Fecal Microbiota Transplantation https://www.sciencedirect.com/science/article/pii/S1931312818300386
9	Inflammatory Bowel Disease, Cancer and the microbiome • Interactions between microbes and host cells and the immune system	**Due: Reflection Questions 2 –** Due at the beginning of class **Readings:** Lloyd-Price et al. 2019, Nature Multi-omics of the gut microbial ecosystem in inflammatory bowel diseases https://www.nature.com/articles/s41586-019-1237-9 OR Kostic et al. 2013, Cell Host Microbe *Fusobacterium nucleatum* potentiates intestinal tumorigenesis and modulates the tumor-immune microenvironment http://www.ncbi.nlm.nih.gov/pubmed/23954159 OR Roberts et al. 2014, Science Translational Medicine

		Intratumoral injection of *Clostridium novyi*-NT spores induces antitumor responses https://stm.sciencemag.org/content/6/249/249ra111
10	Distal effects of the microbiome: Cardiovascular disease and the gut-brain axis • How do microbes shape host metabolism? • Microbe-host-neuron interactions • Role of microbes in behavior	**Readings**: Sharon et al. 2019, Cell Human Gut Microbiota from Autism Spectrum Disorder Promote Behavioral Symptoms in Mice https://www-sciencedirect-com.proxy.lib.ohio-state.edu/science/article/pii/S0092867419305021 Optional readings: Zhu et al. 2016, Cell *Gut Microbial Metabolite TMAO enhances platelet hyperreactivity and thrombosis risk* https://www.sciencedirect.com/science/article/pii/S0092867416301131#undfig1 Wu et al. 2020, Cell Metabolism The Gut Microbiota in Prediabetes and Diabetes: A Population-Based Cross-Sectional Study https://www-sciencedirect-com.proxy.lib.ohio-state.edu/science/article/pii/S1550413120303120?via%3Dihub
11	Microbial interactions with the immune system • Immune development • Microbe-host signaling • Vaccine responses and the microbiome	**Due: Topic for Final Project** TBD: Guest lecture by Dr. Prosper Boyaka
12	Gastrointestinal pathogens and the gut microbiome • Invasion, recovery • Susceptibility and colonization resistance (microbial and metabolic) • Gut microbial metabolites • Transmission • Asymptomatic carriage • FMT / Cdiff	**Readings**: Litvak et al. 2019, Cell Host & Microbe *Commensal* Enterobacteriaceae *Protect against* Salmonella *Colonization through Oxygen Competition* https://www.sciencedirect.com/science/article/pii/S1931312818306309 OR Buffie et al. 2014, Nature Precision microbiome reconstitution restores bile acid mediated resistance to C. difficile https://www.nature.com/articles/nature13828 Optional: Mullineaux-Sanders et al. 2018, Nature Microbiology *Sieving through gut models of colonization resistance* https://www.weizmann.ac.il/immunology/elinav/sites/immunology.elinav/files/2018_elinav_nature_micro.pdf
Week 13	Microbiota targeted therapies • Prebiotics / probiotics / synbiotics (for gut and skin) • FMTs	**Due: Final Project Presentations**

	• Phage therapy • CRISPR-Cas •	
Week 14	Clinical diagnostics / commercial profiling • What is on the market now – strengths and limitations Potential of microbiome profiling / metagenomics in clinical practice	**Due: Final Project Presentations**

Course and University Policies

Attendance and Participation: Attendance and participation are strongly encouraged.

Late Assignments: Late assignments will only be accepted with an approved excuse. If you are submitting an assignment that is or will be late, please inform us immediately to request approval for your submission.

Academic Misconduct: It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct http://studentlife.osu.edu/csc/.

Mental Health: As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273-TALK or at suicidepreventionlifeline.org.

Diversity: The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

Harrassment and Assault: Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at http://titleix.osu.edu or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu

Accessibility: The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can

privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Microbiome in Health and Disease (VETPREV 7719/M7719)

Format: Seminar, 2 contact hours/week

Instructors Dr. Vanessa L. Hale, Assistant Professor, Veterinary Preventive Medicine
Dr. Patrick Bradley, Assistant Professor, Microbiology

Dr. Vanessa Hale
Email: hale.502@osu.edu
Office: A196 Sisson Hall
Phone: 614-247-8377
Office Hours (Zoom or in-person): By appointment

Dr. Patrick Bradley
Email: Bradley.720@osu.edu
Office: 440A Biological Sciences
Phone: 614-292-2120
Office Hours: By appointment

Lecture time and location: Thursdays 2-4pm, Location TBD

Course Description: This course is designed to introduce students to host-associated microbial communities (specifically human and animal hosts) and their roles in host health and disease. We will focus heavily on the gut microbiome and will explore the interactions between host and microbes. We will also examine methodologies used to examine, predict, evaluate, or manipulate microbiota within the context of host health.

Course Objectives

- Design a microbiome study and identify the strengths and limitations of varying study types
- Describe and identify strengths and weaknesses of in vivo, in vitro, in silico, and analysis techniques used for studying the microbiome
- Critically interpret microbiome data and communicate your critique constructively
- Apply, as relevant, key ecological concepts to microbiome study design and interpretation.
- Identify and explain the potential and risks of microbiome-associated diagnostics and therapeutics.

Text: This course will be based on primary literature for which links and PDFs will be provided weekly. No other texts are required for this course.

Grading:

Assignment	Points	Percent
FINAL PROJECT: Study Design	25	25
Take home quiz 1	25	25
Critical Review of a Manuscript (GROUP, or individual if you opt out)	25	25
Take home quiz 2	25	25
Total	100	100

Letter Grade (Percent)	Points (out of 100)
A (90.0-100%)	90+
B (80.0-89.9%)	80-89.9
C (70.0-79.9%)	70-79.9
D (60.0-69.9%)	60-69.9

FINAL PROJECT - Study Design Project (1-2 pages, 25 points): Establish a scientific question involving a host-associated microbiome and design a study to answer that question. Explain why you chose this approach and the strengths and weaknesses of your approach. You have unlimited funding and may employ any method you see fit.

- Does the design answer the question effectively? (7 points)
- Are appropriate control groups and microbiome controls included? (3 points)
- Review another person's Study Design Project and provide critical feedback, questions, or suggestions for additional data or experiments that could be performed. (2 points)

- Final presentation should be engaging (e.g. include interactive questions, quizzes, scenarios, group work, games etc.). The presentation will be assessed on:
    - Background of topic (5 points)
    - Accurate presentation of strengths and weaknesses or controversies / barriers in relation to this topic (5 points)
    - Clarity of slides, oral delivery, methods to engage the class, ability to field questions, and appropriate references (3 points)
- A more detailed rubric will be provided for guidance.

Critical Review of a Manuscript (GROUP Project) (1-2 pages, 25 points): Provide a well-rounded review of a published manuscript including:

- A summary of the manuscript and its key value to the field and/or critical issues (2 points)
- Assessment of the following:
    - Does this paper provide a background context based on previous literature as well as clear goal / question? (3 points)
    - Is the design sound and does it address the outlined goal / question? (3 points)
    - Are the results clear, logical, displayed effectively? (3 points)
    - Do the conclusions follow appropriately from the results? If not, what further evidence is needed? (3 points)
    - Is the manuscript written clearly? If not, how could it be made more accessible? (3 points)
    - Are there any ethical concerns arising from the use of animals or human subjects in this work? (3 points)
- Manuscript options and a more detailed rubric will be provided for guidance.
- You will be placed into small groups of 2-3 unless you opt out to do this project individually.

Take home quizzes: There will be two take-home quizzes that will cover material from weeks 1-6 and weeks 6-12 (ranges are *inclusive,* meaning the first quiz includes week 6 and the second quiz includes week 12). Quizzes must be submitted by the *beginning* of the class in which they are due, listed below. Late quizzes will only be accepted with an approved excuse. While we highly encourage you to discuss the readings together, the quizzes should be completed by yourself. We suggest budgeting one hour per quiz.

Week	**Topic**	Assignments (Subject to change)
1	Introduction to the host-associated microbiome • Host ecosystems (niches) • Oral • Gastrointestinal • Skin • Urogenital • Nasal / Respiratory	**Readings** Lloyd-Price et al. 2017, Nature *Strains, functions and dynamics in the expanded Human Microbiome Project* https://www.nature.com/articles/nature23889

2	Methods - How do we study the host-associated microbiome?
	• Sample collection considerations
	• Sample storage / preservation
	• Sample extraction and controls
	• Review (covered in M5155)
	• Composition: 16S, metagenomes
	  ○ Functional potential: metagenomes, putative function predictors
	  ○ Function: Metabolome, proteome, transcriptome
	• Gnotobiotic models
	• Single cell technologies
	• Organoids
		Readings
		Sarangi et al. 2019, J. of Clinical and Experimental Hepatology
		Methods for Studying Gut Microbiota: A Primer for Physicians
		https://www.sciencedirect.com/science/article/pii/S0973688318300604

	• Culture and co-culture • Gut reactor models • In-silico models	
3	Methods - How do we study the host-associated microbiome? • 16S / Metagenomic analyses • Metabolomic analyses • Correlation vs. causation • Statistical analysis methods • Longitudinal analyses	**Readings:** Knight et al., 2018 *Best practices for analysing microbiomes* https://www.nature.com/articles/s41579-018-0029-9
4	Microbial community acquisition • Primary and secondary succession • Early colonization • Post disturbance colonization • What is healthy? • Community stability / stable states	**Readings**: York, A. 2019 *Microbiota succession in early life* https://www.nature.com/articles/d42859-019-00010-6 AND Option 1: Chen et al. 2020, Microbiome *Maternal gut microbes shape the early-life assembly of gut microbiota in passerine chicks via nests* https://microbiomejournal.biomedcentral.com/articles/10.1186/s40168-020-00896-9 OR Option 2: Robertson et al. 2019, Trends in Microbiology *The Human Microbiome and Child Growth – First 1000 Days and Beyond* https://www.cell.com/action/showPdf?pii=S0966-842X%2818%2930204-X
5	Factors that shape the gut microbiome: Diet • How does diet alter the microbiome? • Co-evolution of hosts / microbial communities related to diet (e.g. seaweed degradation gene) • Diet and disease (e.g. colorectal cancer, GI pathogens)	**Readings**: Hryckowian et al. 2018, Nature Microbiology *Microbiota-accessible carbohydrates suppress Clostridium difficile infection in a murine model* *https://www.nature.com/articles/s41564-018-0150-6* OR Gehrig et al. 2019, Science Effects of microbiota-directed food in gnotobiotic animals and undernourished children https://science.sciencemag.org/content/365/6449/eaau4732 **Optional readings:** Hehemann et al., 2012, PNAS *Bacteria of the human gut microbiome catabolize red seaweed glycans with carbohydrate-active enzyme updates from extrinsic microbes* https://www.pnas.org/content/109/48/19786.short Delsuc et al 2014, Molecular Ecology https://www.zoology.ubc.ca/~parfrey/parfrey_lab/wp-content/uploads/2017/06/Delsuc_convergence_myrm_microbiome_2013.pdf Chassaing et al. 2016, Gut *Dietary emulsifiers directly alter human microbiota composition and gene expression ex vivo potentiating intestinal inflammation* https://gut.bmj.com/content/66/8/1414
6	Other factors that shape the microbiome • Host genetics • Age	**Due: Take-home Quiz 1** **Readings**: Koppel et al. 2018, eLife

	• Xenobiotics • Smoking • Chemical exposures (e.g pesticides, plastics) • Drugs (toxicity, activation, inactivation, side effects) • Chemotherapies	*Discovery and characterization of a prevalent human gut bacterial enzyme sufficient for the inactivation of a family of plant toxins* https://elifesciences.org/articles/33953 OR Wallace et al. 2015, Chemistry & Biology Structure and inhibition of microbiome beta-glucuronidases essential to the alleviation of cancer drug toxicity https://www.sciencedirect.com/science/article/pii/S1074552115003257 **Optional readings:** University of Illinois at Urbana-Champaign, News Bureau, 2020 *Environmental contaminants alter gut microbiome, health* https://www.sciencedaily.com/releases/2020/05/200521112605.htm#:~:text=%22Chemicals%20such%20as%20bisphenols%2C%20phthalates,associated%20with%20adverse%20health%20outcomes.%22 Freire et al. 2020, Scientific Reports *Longitudinal Study of Oral Microbiome Variation in Twins* https://www.nature.com/articles/s41598-020-64747-1
7	Microbial community dynamics • Type of interactions: parasitism, predation, competition, mutualism, commensalism, ammensalism • Keystone species • Predator/prey dynamics • How can community dynamics change in disease?	**Readings**: Smith et al. 2019, Frontiers in Ecology and Evolution *The Classification and Evolution of Bacterial Cross-Feeding* https://www.frontiersin.org/articles/10.3389/fevo.2019.00153/full OR Arevalo et al. 2019, Cell A reverse ecology approach based on a biological definition of microbial populations https://www.sciencedirect.com/science/article/pii/S0092867419307366
8	Microbial interactions with the immune system • Immune development • Microbe-host signaling • Vaccine responses and the microbiome	**Due**: **Critical Review of a Manuscript** **Readings**: Hagan et al. 2020, Cell *Antibiotics-Driven Gut Microbiome Perturbation Alters Immunity to Vaccines in Humans* https://www.cell.com/cell/pdf/S0092-8674(19)30898-0.pdf
9	Inflammatory Bowel Disease, Cancer and the microbiome • Interactions between microbes and host cells and the immune system	**Readings:** Halfvarson et al. 2017, Nature Microbiology Dynamics of the human gut microbiome in inflammatory bowel disease https://www.nature.com/articles/nmicrobiol20174 OR Wong & Yu 2019, Nature Review Gastroenterology & Hepatology Gut microbiota in colorectal cancer: mechanisms of action and clinical applications https://www-nature-com.proxy.lib.ohio-state.edu/articles/s41575-019-0209-8

10	Distal effects of the microbiome: Cardiovascular disease and the gut-brain axis • How do microbes shape host metabolism? • Microbe-host-neuron interactions • Role of microbes in behavior	**Readings**: Zhu etal. 2016. Cell *Gut Microbial Metabolite TMAO enhances platelet hyperreactivity and thrombosis risk* https://www.sciencedirect.com/science/article/pii/S0092867416301131#undfig1 OR Schmidtner et al. 2019, Translational Psychiatry *Minocycline alters behavior, microglia and the gut microbiome in a trait-anxiety-dependent manner* https://www.nature.com/articles/s41398-019-0556-9 **Optional reading:** Reitmeier et al. 2020, Cell Host & Microbe *Arrhythmic Gut Microbiome Signatures Predict Risk of Type 2 Diabetes* https://www.sciencedirect.com/science/article/pii/S1931312820303437
11	Gastrointestinal pathogens and the gut microbiome • Invasion, recovery • Susceptibility and colonization resistance (microbial and metabolic) • Gut microbial metabolites • Transmission • Asymptomatic carriage • FMT / Cdiff	**Due: Topic for Final Project** **Readings**: Litvak et al. 2018, Cell Host & Microbe *Commensal* Enterobacteriaceae *Protect against* Salmonella *Colonization through Oxygen Competition* https://www.sciencedirect.com/science/article/pii/S1931312818306309 OR Mullineaux-Sanders et al. 2018, Nature Microbiology *Sieving through gut models of colonization resistance* https://www.weizmann.ac.il/immunology/elinav/sites/immunology.elinav/files/2018_elinav_nature_micro.pdf
12	Strain variation and transfer • Vertical transmission • Horizontal transmission • How to track transfer	**Due: Take-home Quiz 2** **Readings**: Brito et al. 2019, Nature Microbiology Transmission of human-associated microbiota along family and social networks https://www.nature.com/articles/s41564-019-0409-6 OR Brooks et al. 2017, Nature Communications Strain-resolved analysis of hospital rooms and infants reveals overlap between the human and room microbiome https://www.nature.com/articles/s41467-017-02018-w
13	Microbiota targeted therapies • Prebiotics / probiotics / synbiotics (for gut and skin) • FMTs • Phage therapy • CRISPER-Cas • Media vs. mechanistic science	**Due: Final Project Presentations**
14	Clinical diagnostics / commercial profiling • What is on the market now – strengths and limitations • Potential of microbiome profiling / metagenomics in clinical practice	**Due: Final Project Presentations**

Course and University Policies

Attendance and Participation: Attendance and participation are strongly encouraged.

Late Assignments: Late assignments will only be accepted with an approved excuse. If you are submitting an assignment that is or will be late, please inform us immediately to request approval for your submission.

Academic Misconduct: It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct http://studentlife.osu.edu/csc/.

Mental Health: As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273-TALK or at suicidepreventionlifeline.org.

Diversity: The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

Harrassment and Assault: Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at http://titleix.osu.edu or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu

Accessibility: The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

From: Binkley, Shannon <binkley.45@osu.edu>
Sent: Wednesday, July 27, 2022 12:27 PM
To: McKinniss, Staci N. <mckinniss.17@osu.edu>
Subject: FW: Course change Request - VETPREV 7719

Hello Staci –

Are you the correct contact for MICROBIO course changes? Drs. Bradley and Hale have requested that "Microbiome in Health and Disease" (VETPREV 7719/M7719) be offered in SP instead of AU and counted as 3 instead of 2 CR HR moving forward.

Thank you for any assistance you can offer!
Shannon

THE OHIO STATE UNIVERSITY

Shannon Binkley (she/her/Miss)
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Office Hours: **8am-5pm Monday & Tuesday.**
I am currently working remotely Weds-Fri.

Land Acknowledgement
The Ohio State University occupies the ancestral and contemporary lands of the Shawnee, Potawatomi, Delaware, Miami, Peoria, Seneca, Wyandotte, Ojibwe, and Cherokee peoples. The university resides on land ceded in the 1795 Treaty of Greeneville and the forced removal of tribal nations through the Indian Removal Act of 1830.