

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 request 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.
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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	<ul style="list-style-type: none">• 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
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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
- Yes

Sought Concurrence

Attachments

- Vetprev_concurrence.pdf: VETPREV concurrence
(Concurrence. Owner: Kwiek, Jesse John)
- 7719_response.pdf: Response
(Cover Letter. Owner: Kwiek, Jesse John)
- VETPREVMICRO7719-Syllabus.v12.docx: 2cr syllabus
(Syllabus. Owner: Kwiek, Jesse John)
- VETPREVMICRO7719-Syllabus.3Credit.v14.docx: 3cr Syllabus_revised
(Syllabus. Owner: Kwiek, Jesse John)
- VETPREVMICRO7719-Syllabus.3Credit.v14.MarginComments.pdf: annotated syllabus
(Syllabus. Owner: Kwiek, Jesse John)

Comments

- Revisions described in cover letter. *(by Kwiek, Jesse John on 11/02/2022 08:56 AM)*
- Please see Panel feedback e-mail sent 10/13/22. *(by Cody, Emily Kathryn on 10/13/2022 01:00 PM)*

COURSE CHANGE REQUEST
7719 - Status: PENDING

Last Updated: Vankeerbergen, Bernadette
Chantal
11/10/2022

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
Revision Requested	Cody, Emily Kathryn	10/13/2022 01:00 PM	ASCCAO Approval
Submitted	Kwiek, Jesse John	11/02/2022 08:56 AM	Submitted for Approval
Approved	Kwiek, Jesse John	11/02/2022 08:56 AM	Unit Approval
Approved	Vankeerbergen, Bernadette Chantal	11/10/2022 10:14 AM	College Approval
Pending Approval	Cody, Emily Kathryn Jenkins, Mary Ellen Bigler Hanlin, Deborah Kay Hilty, Michael Vankeerbergen, Bernadette Chantal Steele, Rachel Lea	11/10/2022 10:14 AM	ASCCAO Approval

Dear members of the committee,

We are submitting an amended request to list our course, VETPREV/MICRO7719, as a 3 credit hour course this spring. We are attaching last year's syllabus (v12.docx) and this year's (v14.docx) including an annotated version showing the changes (pdf).

Our responses to the committee's questions are below:

- The Panel requests further signposting regarding changes to the course so the newer features that justify the increase from 2 to 3 credits hours are more readily apparent.
 - This is a good point. Initially, we decided to move to a 3 credit course because we found that as originally planned, the material was already overly ambitious to cover in the allotted time. In our student evaluations, we also received support from students for increasing from a 2 to a 3 credit hour course, so that we could cover in more detail some of the topics we had to skim or have students read on their own time. Also, at the time we submitted the course change request, the syllabus was still under revision. However, in this submission we have attached an updated syllabus showing an expanded reading list and an additional written assignment.
- What is the weekly format for the class? 1 3-hour meeting? 2 1.5 hour meetings? The Panel asks for additional clarification here.
 - We have divided the class into one 1-hour and one 2-hour session per week: Tuesdays 10:30-11:30am (1 hour); Thursdays 10:30am-12:30pm (2 hours)
- The reading lists seem nearly identical in the old vs. new version of the syllabus. What readings have been added to the class to correspond with the credit hour increase?
 - We have now substantially updated the reading list with additional readings, including some that were converted from optional to required.
- How will the grading percentages be restructured to address the ways the course components have been reshuffled in the 3-credit-hour version of the course?
 - We have updated the grading and have added an additional set of reflection questions, adjusting the percentages accordingly. Each set of reflection questions is now worth 15%, as is the quiz, and group presentation. The final project is still worth 25% of the grade. We have made these changes in these changes in the syllabus.
- It appears that 1 quiz of an hour in length will account for 25% of students' final grade in the course. Is this the case? This seems like a great deal of weight to put on a single, short assignment.
 - As above, we have updated the grading and the quiz is now only worth 15% of the students' grades.
- What assignments have moved from optional to mandatory in the 3-credit-hour version of the course? Please underscore this more readily and clearly in the proposal for the reviewing faculty.
 - As mentioned above, several readings have been moved from optional to required, and we have added an additional set of reflection questions.

Please let us know if the committee has any other questions. We are very excited to teach this new expanded version of the course, and are highly motivated to address any lingering concerns so that we can open registration as soon as possible.

Yours,

Prof. Patrick Bradley
Prof. Vanessa Hale

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
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: Tuesdays 10:30-11:30am; Thursdays 10:30am-12:30pm

- **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*	15
Reflection questions with reading 1	15
Reflection questions with reading 2*	15
Reflection questions with reading 3*	15
Microbial community dynamics group presentation*	15
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

Point total revised

Unknown Author
10/31/2022 22:00

New

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*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 (15 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 (15 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 and reading (Subject to change)
1	Introduction to the host-associated microbiome · Host ecosystems (niches) · Oral · Gastrointestinal · Skin · Urogenital · Nasal / Respiratory	<i>Tuesday</i> Lloyd-Price et al. 2017, Nature Strains, functions and dynamics in the expanded Human Microbiome Project https://www.nature.com/articles/nature23889
		<i>Thursday</i> Review figures in: Miller et al. 2021, Current Opinion in Microbiology. The longitudinal and cross-sectional heterogeneity of the intestinal microbiota. https://www.sciencedirect.com/science/article/pii/S1369527421001089 de Vos et al. 2021, BMJ Gut. Gut microbiome and health: mechanistic insights. https://gut.bmj.com/content/71/5/1020
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,	<i>Tuesday</i> Due: Reflection questions for Aagard reading 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
		Aagard et al., 2014 "The Placenta Harbors a Unique Microbiome"

New required reading

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New assignment

Unknown Author
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New required reading

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	<p>transcriptome</p> <ul style="list-style-type: none"> · Gnotobiotic models · Single cell technologies · Organoids · Culture and co-culture · Gut reactor models · In-silico models 	<p>https://www.science.org/doi/full/10.1126/scitranslmed.3008599</p> <p><i>Thursday</i> Yong, 2019</p> <p>The Atlantic - newspaper article on the placental microbiome https://www.theatlantic.com/science/archive/2019/07/placental-microbiome-should-be-cautionary-tale/595114/</p>
3	<p>Methods - How do we study the host-associated microbiome?</p> <ul style="list-style-type: none"> · 16S / Metagenomic analyses (QIIME2 Tutorial) · Metabolomic analyses · Correlation vs. causation · Statistical analysis methods · Longitudinal analyses 	<p><i>Tuesday</i> - Bring laptop for QIIME2 tutorial 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</p> <p><i>Thursday</i> - Bring laptop for introduction to computational methods</p> <p>Due: Download and install RStudio (https://www.rstudio.com/products/rstudio/download/#download)</p> <p>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</p>
4	<p>Strain variation and transfer</p> <ul style="list-style-type: none"> · Vertical transmission · Horizontal transmission · How to track transfer <p>**Take-home Quiz will be posted online by midnight Sept 16th</p>	<p><i>Tuesday</i> 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</p> <p>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</p> <p><i>Thursday</i> - Bring laptop for in class dry-lab Nayfach et al. 2015, PLOS Computational Biology From "Accurate metagenome annotation clarifies community functional diversity and identifies biomarkers" on; Figs. 6-7 https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1004573</p>
5	<p>Microbial community acquisition</p> <ul style="list-style-type: none"> · Primary and secondary succession · Early colonization · Post disturbance colonization · What is healthy? · Community stability / stable states · Age 	<p><i>Tuesday:</i> Due: Take-home Quiz 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</p> <p><i>Thursday:</i> Small group activity - choose one paper below and read before class. Half the class will read one one article and the other half the class will read the other article. Dethlefsen and Relman. 2011, PNAS Incomplete recovery and individualized responses of the</p>

New required reading

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New required reading

Unknown Author
10/31/2022 22:03

		<p>human distal gut microbiota to repeated antibiotic perturbation https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3063582/ OR David et al., 2014, Genome Biology Host lifestyle affects human microbiota on daily timescales https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4405912/</p>
6	<p>Factors that shape the gut microbiome: Diet · How does diet alter the microbiome? · Co-evolution of hosts / microbial communities related to diet</p>	<p>Due: Reflection Questions 2 (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 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 OR David et al. 2013, Nature Diet rapidly and reproducibly alters the human gut microbiome https://www.nature.com/articles/nature12820 OR 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 OR 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 OR 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 OR Carmody et al. 2019, Nat. Microbiol Cooking shapes the structure and function of the gut microbiome https://pubmed.ncbi.nlm.nih.gov/31570867/ OR Zeevi et al. 2015, Cell Personalized Nutrition by Prediction of Glycemic responses https://www.cell.com/fulltext/S0092-8674(15)01481-6</p>

7	<p>Other factors that shape the microbiome</p> <ul style="list-style-type: none"> · Xenobiotics · Chemical exposures (e.g pesticides, plastics) · Drugs (toxicity, activation, inactivation, side effects) · Chemotherapies · Exercise 	<p>Tuesday: 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 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</p> <p>OPTIONAL Chiu et al. 2020, Toxicological 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/ 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</p> <p>Thursday: Come prepared for group presentations (FitBiomics) 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</p>
8	<p>Microbial community dynamics</p> <ul style="list-style-type: none"> · Type of interactions: parasitism, predation, competition, mutualism, commensalism, ammensalism · Keystone species · Predator/prey dynamics · How can community dynamics change in disease? 	<p>Tuesday: D'hoel et al., eLife, 2018 "Integrated culturing, modeling and transcriptomics uncovers complex interactions and emergent behavior in a three-species synthetic gut community" https://elifesciences.org/articles/37090</p> <p>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</p> <p>Thursday: 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/ OR Smillie et al. 2018, Cell Host & Microbe Strain Tracking Reveals the Determinants of Bacterial</p>

New required reading (was optional)

Unknown Author
10/31/2022 22:03

Substituted for Kehe et al. paper

Unknown Author
10/31/2022 22:05

New optional reading

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10/31/2022 22:06

		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	Tuesday 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 Thursday Due: Reflection Questions 3 Choose one of the following papers to read: 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 OR Dizman et al. 2022, Nature Medicine Nivolumab plus ipilimumab with or without live bacterial supplementation in metastatic renal cell carcinoma: a randomized phase 1 trial https://www.nature.com/articles/s41591-022-01694-6
10	Distal effects of the microbiome: Cardiovascular disease and the gut-brain axis · Microbe-host-neuron interactions · Role of microbes in behavior	Tuesday 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 Thursday Yap et al., 2021, Cell Autism-related dietary preferences mediate autism-gut microbiome associations https://pubmed.ncbi.nlm.nih.gov/34767757/
11	Microbiome and Cardiovascular disease and microbial interactions with the immune system · How do microbes shape host metabolism? · Immune development · Microbe-host signaling · Vaccine responses and the microbiome	Tuesday: Choose one of the following papers to read Zhu et al. 2016, Cell Gut Microbial Metabolite TMAO enhances platelet hyperreactivity and thrombosis risk https://www.sciencedirect.com/science/article/pii/S0092867416301131#undfig1 OR 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 Thursday: Due: Topic for Final Project TBD: Guest lecture by Dr. Prosper Boyaka
12	Gastrointestinal pathogens and the gut	Tuesday:

New required reading (was one option in Thursday's set)

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10/31/2022 22:06

Substituted reading from last year

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New required reading

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New required reading (was optional)

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	microbiome · Invasion, recovery · Susceptibility and colonization resistance (microbial and metabolic) · Gut microbial metabolites · Transmission · Asymptomatic carriage · FMT / Cdiff	Litvak et al. 2019, Cell Host & Microbe Commensal Enterobacteriaceae Protect against Salmonella Colonization through Oxygen Competition https://www.sciencedirect.com/science/article/pii/S1931312818306309 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 <i>Thursday:</i> Buffie et al. 2014, Nature Precision microbiome reconstitution restores bile acid mediated resistance to C. difficile https://www.nature.com/articles/nature13828 Remaining time - office hours for final presentations
Week 13	Microbiota targeted therapies · Prebiotics / probiotics / synbiotics (for gut and skin) · FMTs · Phage therapy · CRISPR-Cas	<i>Tuesday:</i> TBD Guest Lecture on Microbiota Targeted Therapies <i>Thursday:</i> Due: Rough draft of presentation for peer feedback TBD Guest Lecture on Microbiota Targeted Therapies / Commercial Microbiota Options Final Project Peer Feedback Time
Week 14	Clinical diagnostics / commercial profiling · What is on the market now – strengths and limitations Potential of microbiome profiling / metagenomics in clinical practice	<i>Tuesday and Thursday:</i> Due: Final Project Presentations

New required reading (this paper and Buffie et al. on Thursday were either-or last year)
 Unknown Author
 10/31/2022 22:08

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.

Harassment 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

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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, Veterinary Medicine Academic Building (VMAB) 084

- **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 Aug 26	Introduction to the host-associated microbiome <ul style="list-style-type: none"> • Host ecosystems (niches) • Oral • Gastrointestinal • Skin • Urogenital • Nasal / Respiratory 	Readings Lloyd-Price et al. 2017, Nature <i>Strains, functions and dynamics in the expanded Human Microbiome Project</i> https://www.nature.com/articles/nature23889
2 Sept 2	Methods - How do we study the host-associated microbiome? <ul style="list-style-type: none"> • Sample collection considerations • Sample storage / preservation • Sample extraction and controls • Review (covered in M5155) • Composition: 16S, metagenomes <ul style="list-style-type: none"> ○ 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 <i>Best practices for analysing microbiomes</i> https://www.nature.com/articles/s41579-018-0029-9 Read up to the "Higher-level analyses" section of this paper

	<ul style="list-style-type: none"> • Gut reactor models • In-silico models 	
3 Sept 9	<p>Methods - How do we study the host-associated microbiome?</p> <ul style="list-style-type: none"> • 16S / Metagenomic analyses • Metabolomic analyses • Correlation vs. causation • Statistical analysis methods • Longitudinal analyses 	<p>Readings: Knight et al., 2018 <i>Best practices for analysing microbiomes</i> https://www.nature.com/articles/s41579-018-0029-9</p> <p>Read the remainder of the Knight paper</p> <p>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</p>
4 Sept 16	<p>Strain variation and transfer</p> <ul style="list-style-type: none"> • Vertical transmission • Horizontal transmission • How to track transfer <p>**Take-home Quiz will be posted online by midnight Sept 16th</p>	<p>Readings: Nayfach et al. 2016, Genome Research https://genome.cshlp.org/content/early/2016/10/05/gr.2018.63.115</p> <p>AND</p> <p>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</p>
5 Sept 23	<p>Microbial community acquisition</p> <ul style="list-style-type: none"> • Primary and secondary succession • Early colonization • Post disturbance colonization • What is healthy? • Community stability / stable states • Age 	<p>Due: Take-home Quiz</p> <p>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</p>
6 Sept 30	<p>Factors that shape the gut microbiome: Diet</p> <ul style="list-style-type: none"> • How does diet alter the microbiome? • Co-evolution of hosts / microbial communities related to diet 	<p>Due: Reflection Questions 1 (due at the END of class, but please complete questions 1-6 BEFORE class)</p> <p>Select ONE paper from the options below</p> <p>Readings: Hryckowian et al. 2018, Nature Microbiology <i>Microbiota-accessible carbohydrates suppress Clostridium difficile infection in a murine model</i> https://www.nature.com/articles/s41564-018-0150-6</p> <p>Gehrig et al. 2019, Science Effects of microbiota-directed food in gnotobiotic animals and undernourished children https://science.sciencemag.org/content/365/6449/eaau4732</p> <p>David et al. 2013, Nature Diet rapidly and reproducibly alters the human gut microbiome https://www.nature.com/articles/nature12820</p> <p>Hehemann et al., 2012, PNAS</p>

		<p><i>Bacteria of the human gut microbiome catabolize red seaweed glycans with carbohydrate-active enzyme updates from extrinsic microbes</i> https://www.pnas.org/content/109/48/19786.short</p> <p>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</p> <p>Chassaing et al. 2016, Gut <i>Dietary emulsifiers directly alter human microbiota composition and gene expression ex vivo potentiating intestinal inflammation</i> https://gut.bmj.com/content/66/8/1414</p> <p>Carmody et al. 2019, Nat. Microbiol Cooking shapes the structure and function of the gut microbiome https://pubmed.ncbi.nlm.nih.gov/31570867/</p> <p>Zeevi et al. 2015, Cell Personalized Nutrition by Prediction of Glycemic responses https://www.cell.com/fulltext/S0092-8674(15)01481-6</p>
<p>7 Oct 7</p>	<p>Other factors that shape the microbiome</p> <ul style="list-style-type: none"> • Xenobiotics • Chemical exposures (e.g pesticides, plastics) • Drugs (toxicity, activation, inactivation, side effects) • Chemotherapies • Exercise 	<p>Readings: Koppel et al. 2018, eLife <i>Discovery and characterization of a prevalent human gut bacterial enzyme sufficient for the inactivation of a family of plant toxins</i> https://elifesciences.org/articles/33953</p> <p>AND</p> <p>Scheiman et al. 2019, Nature Medicine Meta'omic analysis of elite athletes identifies a performance-enhancing microbe that functions via lactate metabolism https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7368972/</p> <p>Optional readings:</p> <p>Chiu et al. 2020, Toxicological Sciences The Impact of Environmental Chemicals on the Gut Microbiome https://academic.oup.com/toxsci/article/176/2/253/5835885</p> <p>Koppel et al. 2018, Science Chemical transformation of xenobiotics by the human gut microbiota https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5534341/</p> <p>Wu et al, 2017, Nature Medicine</p>

		<p>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</p> <p>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</p>
8 Oct 21	<p>Microbial community dynamics</p> <ul style="list-style-type: none"> Type of interactions: parasitism, predation, competition, mutualism, commensalism, ammensalism Keystone species Predator/prey dynamics How can community dynamics change in disease? 	<p>Due: Microbial Community Dynamics Group Presentations</p> <p>Readings: Kehe et al. 2021, bioRxiv Positive interactions are common among culturable bacteria https://www.biorxiv.org/content/10.1101/2020.06.24.169474v1.full</p> <p>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</p>
9 Oct 28	<p>Inflammatory Bowel Disease, Cancer and the microbiome</p> <ul style="list-style-type: none"> Interactions between microbes and host cells and the immune system 	<p>Due: Reflection Questions 2 – Due at the beginning of class</p> <p>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</p> <p>OR</p> <p>Kostic et al. 2013, Cell Host Microbe <i>Fusobacterium nucleatum</i> potentiates intestinal tumorigenesis and modulates the tumor-immune microenvironment http://www.ncbi.nlm.nih.gov/pubmed/23954159</p> <p>OR</p> <p>Roberts et al. 2014, Science Translational Medicine Intratumoral injection of <i>Clostridium novyi</i>-NT spores induces antitumor responses https://stm.sciencemag.org/content/6/249/249ra111</p>
10 Nov 4	<p>Distal effects of the microbiome: Cardiovascular disease and the gut-brain axis</p> <ul style="list-style-type: none"> How do microbes shape host metabolism? Microbe-host-neuron interactions Role of microbes in behavior 	<p>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</p> <p>Optional readings: Zhu et al. 2016, Cell</p>

		<p><i>Gut Microbial Metabolite TMAO enhances platelet hyperreactivity and thrombosis risk</i> https://www.sciencedirect.com/science/article/pii/S0092867416301131#undfig1</p> <p>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</p>
11 Nov 18	<p>Microbial interactions with the immune system</p> <ul style="list-style-type: none"> • Immune development • Microbe-host signaling • Vaccine responses and the microbiome 	<p>Due: Topic for Final Project TBD: Guest lecture by Dr. Prosper Boyaka</p>
12 Dec 2	<p>Gastrointestinal pathogens and the gut microbiome</p> <ul style="list-style-type: none"> • Invasion, recovery • Susceptibility and colonization resistance (microbial and metabolic) • Gut microbial metabolites • Transmission • Asymptomatic carriage • FMT / Cdiff 	<p>Readings: Litvak et al. 2019, Cell Host & Microbe <i>Commensal Enterobacteriaceae Protect against Salmonella Colonization through Oxygen Competition</i> https://www.sciencedirect.com/science/article/pii/S1931312818306309</p> <p>OR</p> <p>Buffie et al. 2014, Nature Precision microbiome reconstitution restores bile acid mediated resistance to <i>C. difficile</i> https://www.nature.com/articles/nature13828</p> <p>Optional: Mullineaux-Sanders et al. 2018, Nature Microbiology <i>Sieving through gut models of colonization resistance</i> https://www.weizmann.ac.il/immunology/elinav/sites/immunology.elinav/files/2018_elinav_nature_micro.pdf</p>
	<p>Microbiota targeted therapies</p> <ul style="list-style-type: none"> • Prebiotics / probiotics / synbiotics (for gut and skin) • FMTs • Phage therapy • CRISPR-Cas <p>Clinical diagnostics / commercial profiling</p> <ul style="list-style-type: none"> • What is on the market now – strengths and limitations • Potential of microbiome profiling / metagenomics in clinical practice 	<p>Due: Final Project Presentations</p>

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.

Harassment 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



Shannon Binkley (she/her/Miss)
Graduate Program Coordinator
Comparative Biomedical Sciences Graduate Program
College of Veterinary Medicine
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1900 Coffey Rd, Columbus, OH 43210 | (614)247-9243 Office
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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 Greenville and the forced removal of tribal nations through the Indian Removal Act of 1830.