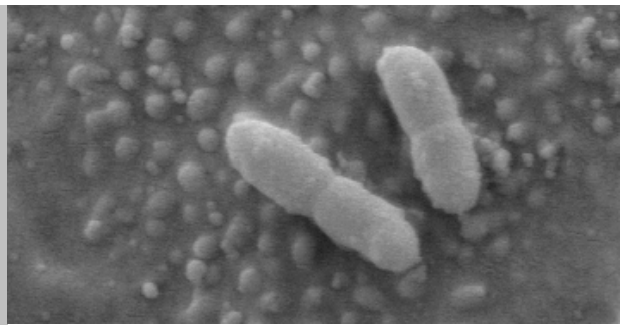
Biology 433/533
Bacterial-Host Interactions

Course Reference Number (CRN): 25416/25423
Instructor: Karen Guillemin
Class meeting time: Tue, Thu 2:00-3:20 PM
Class meeting location: Gerlinger 303
Office hours: Friday 10:30 AM -11:30 PM
in Klamath 203, or by appointment



Course description: This course examines how animals co-exist with bacteria. We will investigate the molecular mechanisms by which animal cells and associated bacteria communicate, and how these communications affect the biology of the host and the structure of its associated microbial communities. The course is based on primary research literature, drawing on examples of different bacterial-host interactions in a number of model systems to illustrate basic principles about the molecular and cellular natures of these interactions. The course will emphasize critical reading of the literature and critical thinking. During the course, each student will develop an original research proposal that addresses an unanswered question in the field, using experimental approaches covered in the course, and will present the proposal orally and as a final written grant application. This is an in-person course.

Learning Objectives:

- Gain a deep understanding of the emerging field of bacterial-host interactions in biology.
- Gain a working knowledge of modern molecular genetic experimental approaches using model eukaryotes and prokaryotes and gnotobiology.
- Become a critical reader of scientific research articles in the biomedical literature.
- Learn to navigate biomedical literature databases to explore new research topics.
- Develop the ability to formulate hypotheses about the mechanistic bases for biological phenomena.
- Learn to provide constructive critiques of your colleagues' scientific writing and presentations.
- Become proficient at designing experimental strategies to test hypotheses about the mechanistic bases for biological phenomena.
- Learn to give a concise and engaging oral presentation that identifies a scientific question, proposes a hypothetical answer to this question, and lays out a novel strategy to test this hypothesis.
- Learn to write a compelling research proposal that identifies a scientific question, proposes a hypothetical answer to this question, and lays out a novel strategy to test this hypothesis.

Course topics: The course is structured into four units. In the first unit, we will explore how the resident microbes of animals impact aspects of animal biology including morphogenesis, physiology, and neurobiology. We will read papers that present several of the most widely-used animal model systems for study host-microbe interactions, which will provide students with inspiration for designing their own research proposals. In the second unit, we will explore molecular genetic approaches to investigating the metabolic strategies used by different bacteria to inhabit animal tissues and how these strategies impact host health. In the third unit, we will explore major factors, including host diet, host genetics, and bacterial competition, that shape the composition of complex host-associated microbial communities. In the fourth unit, we will examine the application of these animal model systems and microbiome analysis approaches to tackle major human health challenges including infectious disease, undernutrition, and neurodevelopmental disorders. The final two weeks will be devoted to student presentations of their original research proposals and group work to refine their ideas for their written research proposal due on Thursday of finals week.

Technical Requirements
Canvas is the place to go for course information and engagement outside of class time. To access our course Canvas site, log into canvas.uoregon.edu using your DuckID. If you have questions about using Canvas, visit the Canvas support page. Canvas and Technology Support also is available by phone (541-346-4357) or by live chat on the Live Help webpage.

Course Materials
Assigned reading**:** For each topic covered, the assigned reading will consist of a combination of current review articles by leaders in the field and impactful original research articles. These will be posted, organized by week, in Canvas.

Reading responses**:** To prepare for class, you will be asked to complete 12 reading response assignments to help you engage with the assigned reading and develop skills for your research proposal assignments. These will not be graded, but you will receive credit for submitting them on Canvas **by noon** before class. Students are encouraged to discuss the reading material with each other and their answers to the reading response assignments, but they must submit their own original work. I strongly encourage you to **revise your reading responses for yourself after class** to solidify your learning and develop study materials for the reading quizzes. **No late assignments will be accepted, but you only need to complete 11/12 of the responses for full credit. Each reading response will comprise 1% of your final grade (12% in all).**

Reading quizzes: Four reading quizzes will be given throughout the term. These quizzes will be made available on Canvas for 48 hours (from Thursday at 5 pm to Saturday at 5 pm). These quizzes will test student understanding of the assigned reading. Students can refer to their reading, class notes and any other sources to complete the quizzes, but they are expected to complete this work independently without collaborating with their classmates. **Your lowest quiz score will be dropped and the remaining three will each comprise 8% of the final grade (24% in all).**

Proposal writing worksheets: We will hold two proposal writing sessions in weeks 3 and 4. In the first session you will start to develop skills for crafting the abstract and specific aims for your proposal. In the second workshop, you will hone your specific aims and develop skills for designing your proposed experiments. For each of these classes, you will be asked to complete a worksheet in preparation. These will not be graded, but you will receive credit for completing the assignment and submitting it **by noon** before class. **Each proposal worksheet will comprise 2% of the final grade (4% in all).**

Proposal group feedback**:** Each student will be assigned to a proposal group. You will work with your group members to help each other develop your proposals. You will be asked to complete three types of rubrics to provide constructive feedback on your group members' written work and oral presentations **due at 9 am** as indicated on the syllabus. **Your feedback will comprise 4% of the final grade.**

Additional class participation**:** Students will be graded for class participation -- absent/uninvolved (0), minimal involvement (1), engaged (2), major contributions (3) -- comprising **3% of the final grade**.

Original research proposal**:** Over the course each student will develop an original research proposal on a topic of their choice related to the course. At the end of the term each student will give a short oral presentation of their proposal and submit a final written proposal. These assignments will be graded according to provided rubrics. The graded components of the research proposal will be:

Abstract and specific aims revision (10% final grade)
Oral presentation (18% final grade)
Written proposal (25% final grade)

Grading Policy: The final grade for the course will be calculated on a curve. The rationale for this is that students are expected to develop their research proposals in stages, with the earlier stage work being less developed and unlikely to meet the rubric criteria (provided with each assignment on Canvas) for a polished final research proposal. Students should not be discouraged by scores on earlier stage proposal work that do not reflect full mastery of the proposal development process. Students who work

hard to develop their proposals and incorporate feedback throughout the proposal development process can expect to advance to mastery, which will be reflected in the final course grade.

Grading for undergraduates versus graduate students: Undergraduate and graduate students will be graded separately, based on different expectations of their background knowledge in scientific approaches. The expectations for the research proposal and scope of the project will be different for the undergraduate and graduate students. The expectation for the undergraduate research proposal will be that the student describes a single experimental strategy to address an unanswered question. The graduate students will be required to write a proposal that employ several independent approaches to address a well-defined research question, similar in scope to a professional predoctoral research fellowship proposal. The graduate students will be expected to lead group discussions in their assigned proposal writing groups and to provide more extensive feedback on the oral presentations of their group members.

Absences: This is a face-to-face course. Attendance is important because we will develop our knowledge through in-class activities that require your active engagement. We will have discussions, small group activities, and do activities that will be richer for your presence, and from which you wwill not be able to benefit if you are not there. Excessive absences make it impossible to learn well and succeed in the course. While there is not an automatic grade deduction for missing classes, it is unlikely that students who miss four or more classes will be able pass this course. The UO community is still navigating the COVID-19 pandemic and some students will need to isolate and rest if they get COVID. Please take absences only when necessary, so when they *are* necessary, your prior attendance will have positioned you for success. If you must miss a class, please email via Canvas to let me know that you will be missing and why.

Course Deadlines and Late Work: Course deadlines for assignments in this class are firm because the timing of submissions is tied to class activities. For example, reading response assignments for each class are **due at noon** on the day of class. I have set this deadline to give myself time to review your responses before class and adjust my lesson plan to better serve your learning. Similarly, proposal group feedback is **due at 9 am** as indicated on the syllabus to allow students time to review their group members' feedback and facilitate productive discussions in class. The proposal project assignments are timed to allow for the cycle of my feedback and your revisions. For these reasons, please submit your work on time. I have incorporated some flexibility into the evaluation of your assignments: i) you will receive full credit if you complete 11 of 12 of the reading responses, ii) I will drop your lowest reading quiz score, iii) your first abstract and specific aim submission will be evaluated by the grading rubric but only the revised version will be given a grade. I hope the regular deadlines combined with some leeway in grading supports your learning in the course.

Course Communications

How I will communicate course information:

Our class will communicate through our Canvas site. Announcements and emails are archived there and automatically forwarded to your UO email. Check and adjust your settings under Account > Notifications.

The Canvas course site is organized with folders for each week. Each folder will contain the assigned reading for that week and any assigned work due that week.

When I need to get in touch with individual students, I will email through Canvas.

When giving feedback on assignments, I will do so in Canvas. Please go into the gradebook and clink on the individual assignment to see my edits and comments to your submitted documents.

How you can communicate with me:

If your question (or comment) is

- *a practical, yes/no* one about an assignment, reading, or other component of our class, please post your question on the Discussion thread titled "Class Questions and Answers," which I respond to regularly, and where your peers can also pose questions and share answers.

- *about a technical challenge* with Canvas or another technology, please contact the UO Service Portal.
- *about course content or activities, about something personal, time sensitive, or something else* that doesn't feel like it fits above, please reach out to me by email or by attending office hours. To help me find your messages easily, please either email via Canvas or put "BI433" in the email message header.

I try to respond to questions within one business day.

Why you should communicate with me: I enjoy talking with students about our course material and helping students develop their research proposal projects. Please come to my office hour or reach out if you would like to discuss material from the course that is interesting or confusing. If you are finding aspects of the course challenging, please let me know and we can strategize. I believe every student can succeed in this course, and I care about your success.

Office hour details: I will host office hours each week on **Fridays from 10:30 to 11:30** in my office which is located on the north side of my research laboratory, **Klamath 203**. If this time does not work for you, please contact me and we can schedule another meeting time.

How members of the class should communicate with each other: All members of the class (both students and instructor) can expect to:
Participate and Contribute: All students are expected to participate by sharing ideas and contributing to the learning environment. This entails preparing, following instructions, and engaging respectfully and thoughtfully with others. Participation can take many forms, from speaking aloud in the full class and in small groups, to providing constructive feedback on group members' work, submitting questions prior to class, or engaging with Discussion posts.

Expect and Respect Diversity: All classes at the University of Oregon welcome and respect diverse experiences, perspectives, and approaches. What is not welcome are behaviors or contributions that undermine, demean, or marginalize others based on race, ethnicity, gender, sex, age, sexual orientation, religion, ability, or socioeconomic status. We will value differences and communicate disagreements with respect.

Help Everyone Learn: Part of how we learn together is by learning from one another. To do this effectively, we need to be patient with each other, identify ways we can assist others, and be open-minded to receiving help and feedback from others. Don't hesitate to contact me to ask for assistance or offer suggestions that might help us learn better.

Guidelines for using Canvas Discussion:

- Use subject lines that clearly communicate the content of your post
- Write concisely and be aware that humor or sarcasm doesn't always translate in writing.
- Be supportive and considerate when replying to others' posts. This means avoiding use of jargon or inappropriate language, and it means disagreeing with respect and providing clear rationale or evidence to support your different view.
- Keep focused on the topic and reference readings and other class materials to support your points (as applicable).
- Try to use correct spelling and grammar and proofread your submissions. After submitting, use the edit feature to make corrections and resubmit (don't create a new or duplicate post that corrects your error).
- Contribute and interact often.

Accessible Education
The University of Oregon is working to create inclusive learning environments. Please notify me if there are aspects of the instruction or design of this course that result in disability-related barriers to your participation. You are also encouraged to contact the Accessible Education Center in 360 Oregon Hall at 541-346-1155 or uoaec@uoregon.edu.

Accommodations for Religious Observances
The university makes reasonable accommodations, upon request, for students who are unable to attend a class for religious obligations or observance reasons, in accordance with the university discrimination policy which says "Any student who, because of religious beliefs, is unable to attend classes on a particular day shall be excused from attendance requirements and from any examination or other assignment on that day. The student shall make up the examination or other assignment missed because of the absence." To request accommodations for this course for religious observance, visit the Office of the Registrar's website and complete and submit to the instructor the "Student Religious Accommodation Request" PDF form prior to the end of the second week of the term.

Your Wellbeing
Life at college can be challenging and students can feel overwhelmed or stressed, experience anxiety or depression, struggle with relationships, or just need help navigating hurdles in their life. If you are facing such challenges, you do not need to handle them on your own and I urge you to seek out help and support on campus.

University Health Services helps students cope with difficult emotions and life stressors. If you need general resources on coping with stress or want to talk with another student who has been in the same place as you, visit the Duck Nest (located in the EMU on the ground floor) and get help from one of the specially trained Peer Wellness Advocates.

University Counseling Services (UCS) has a team of dedicated staff members to support you with your concerns, many of whom can provide identity-based support. All clinical services are free and confidential. Find out more at counseling.uoregon.edu or by calling 541-346-3227 (anytime UCS is closed, the After-Hours Support and Crisis Line is available by calling this same number).

Basic Needs
Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live and believes this may affect their performance in the course is urged to contact the Dean of Students Office (346-3216, 164 Oregon Hall) for support.
This UO Basic Needs Resource Guide webpage includes resources for food, housing, healthcare, childcare, transportation, technology, finances, and legal support.

Respect for Diversity
You can expect to be treated with respect in this course. Both students and your instructor(s) enter with many identities, backgrounds, and beliefs. Students of all racial identities, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, citizenship statuses, ability and other visible and non-visible differences belong in and contribute to this class and this discipline. All students are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

Class rosters are provided to instructors with students' legal names. Please let me know if the name or pronouns I have for you are not accurate. It is important to me to address you properly.

Please let me know if aspects of the instruction, course design, or class activities undermine these principles in any way. You may also notify the [Home Department] at [contact information]. For additional assistance and resources, you may also consider contacting the Division of Equity and Inclusion through their website or by phone (at 541-346-3175), or the Center for Multicultural Academic Excellence through their website or by phone (at 541-346-3479).

Academic Integrity
The University Student Conduct Code (available on the Student Conduct Code and Procedures webpage) defines academic misconduct. Students are prohibited from committing or attempting to commit any act that constitutes academic misconduct. By way of example, students should not give or receive (or attempt to give or receive) unauthorized help on assignments or examinations without express permission from the instructor. Students should properly acknowledge and document all sources of information (e.g. quotations, paraphrases, ideas) and use only the sources and resources

authorized by the instructor. If there is any question about whether an act constitutes academic misconduct, it is the students' obligation to clarify the question with the instructor before committing or attempting to commit the act. Additional information about a common form of academic misconduct, plagiarism, is available at the Libraries' Citation and Plagiarism page.

Student Experience Surveys
The midway and end-of-term Student Experience Surveys are important opportunities to provide feedback about your learning experiences. I value this feedback and am continually improving the course with students' responses in mind. The key parts of the survey are the open-ended questions where you share concrete, actionable feedback and about the teaching practices that stand out to you. Thank you for your thoughtful reflections!

Mandatory Reporter Status
I am a assisting employee. For information about my reporting obligations as an employee, please see Employee Reporting Obligations on the Office of Investigations and Civil Rights Compliance (OICRC) website. Students experiencing sex or gender-based discrimination, harassment or violence should call the 24-7 hotline 541-346-SAFE [7244] or visit safe.uoregon.edu for help. Students experiencing all forms of prohibited discrimination or harassment may contact the Dean of Students Office at 5411-346-3216 or the non-confidential Title IX Coordinator/OICRC at 541-346-3123. Additional resources are available at UO's How to Get Support webpage. I am also a mandatory reporter of child abuse. Please find more information at Mandatory Reporting of Child Abuse and Neglect."

Academic Disruption due to Campus Emergency
In the event of a campus emergency that disrupts academic activities, course requirements, deadlines, and grading percentages are subject to change. Information about changes in this course will be communicated as soon as possible by email, and on Canvas. If we are not able to meet face-to-face, students should immediately log onto Canvas and read any announcements and/or access alternative assignments. Students are also expected to continue coursework as outlined in this syllabus or other instructions on Canvas. In the event that the instructor of this course has to quarantine, this course may be taught online during that time.

Inclement Weather
It is generally expected that class will meet unless the University is officially closed for inclement weather. If it becomes necessary to cancel class while the University remains open, this will be announced on Canvas and by email. Updates on inclement weather and closure are also communicated as described on the Inclement Weather webpage.

BI433/533 Class Schedule 2023

1	January 10	Animals in a bacterial world	1. Review article: (McFall-Ngai et al. 2013) **Introductory questionnaire due 5 PM**
1	January 12	History of innate immune sensing of microbes	2. Review article: (Beutler and Rietschel 2003) 3. Review article: (Richter and Levin 2019) **Reading response 1 due at noon**
2	January 17	Bacterial modulation of animal morphogenesis (squid model)	4. Review article: (Nyholm and McFall-Ngai 2021) 5. Research article: (Koropatnick et al. 2004) **Reading response 2 due at noon**
2	January 19	Bacterial modulation of animal metabolism (fruit fly model)	6. Review article: (Leulier et al. 2017) 7. Research article: (Consuegra et al. 2020) **Reading response 3 due at noon**
2	January 21	**Reading quiz 1 on readings 1-7 due Saturday January 21 at 5 PM**	
3	January 24	Bacterial modulation of neuronal function (mouse model)	8. Review article: (Morais, Schreiber, and Mazmanian 2021) 9. Research article: (Hsiao et al. 2013) **Reading response 4 due at noon**
3	January 26	**Proposal writing**: identify a question, develop a hypothesis, write specific aims	10. Research article: (Sharon et al. 2019) **Proposal topic exercise due at noon**
3	January 30	**Proposal abstract and specific aims draft due Sunday January 30 at noon**	
4	January 31	Bacterial physiology of host colonization	11. Review article: (Tsolis and Bäumler 2020) 12. Research article: (Winter et al. 2010) **Reading response 5 due at noon**
4	February 2	**Proposal writing**: designing experiments to test a hypothesis	13. Research article: (Liou et al. 2022) **Proposal experimental design exercise due at noon**
4	February 4	**Reading quiz 2 on readings 8-13 due Saturday February 4 at 5 PM**	
5	February 7	Dietary determinants of microbiome assembly	14. Review article: (Gentile and Weir 2018) 15. Research article: (Johnson et al. 2019) **Reading response 6 due at noon**
5	February 9	Host genetic determinants of microbiome assembly	16. Review article: (Mallott and Amato 2021) 17. Research article: (Suzuki et al. 2022) **Reading response 7 due at noon**
5	February 12	**Revised abstract, specific aims, and experimental design due Sunday February 12 at noon**	
6	February 14	Bacterial competition in microbiome assembly	18. Review article: (Granato, Meiller-Legrand, and Foster 2019) 19. Research article: (Goodman et al. 2009) **Reading response 8 due at noon**
6	February 16	**Proposal writing: refining specific aims and experimental design**	**Proposal feedback rubric 1 due at 9 AM**
6	February 18	**Reading quiz 3 on readings 14-19 due Saturday February 18 at 5 PM**	
7	February 21	Microbiomes in undernutrition	20. Review article: (Barratt, Ahmed, and Gordon 2022) 21. Research article: (Huus et al. 2021) **Reading response 9 due at noon**
7	February 23	Microbiome-mediated therapies for undernutrition	22. Research article: (Chen et al. 2021) **Reading response 10 due at noon**
8	February 28	Microbiome-mediated therapies against bacterial infections	23. Review article: (Sorbara and Pamer 2022) 24. Research article: (Buffie et al. 2015) **Reading response 11 due at noon**
8	March 2	The future of probiotics and microbiome directed therapies	25. Review article: (Charbonneau et al. 2020) 26. Research article: (Stewart Campbell et al. 2022) **Reading response 12 due at noon**
8	March 4	**Reading quiz 4 on readings 20-26 due Saturday March 4 at 5 PM**	
9	March 7	**Proposal oral presentations session 1**	**Proposal feedback rubric 2 due March 8 at 9 AM**
9	March 9	**Proposal oral presentations session 2**	**Proposal feedback rubric 2 due March 10 at 9 AM**
10	March 14	**Proposal oral presentations session 3**	**Proposal feedback rubric 2 due March 15 at 9 AM**
10	March 16	**Proposal writing: refining your proposal ideas and polishing your communication**	**Proposal feedback rubric 3 due March 16 at 9 AM**
11	March 23	**Written research proposals due Thursday March 23 at 9 AM**	

Assigned Reading (available on Canvas)

1. McFall-Ngai M, Hadfield MG, Bosch TCG, Carey HV, Domazet-Lošo T, Douglas AE, Dubilier N, Eberl G, Fukami T, Gilbert SF, Hentschel U, King N, Kjelleberg S, Knoll AH, Kremer N, Mazmanian SK, Metcalf JL, Nealson K, Pierce NE, Rawls JF, Reid A, Ruby EG, Rumpho M, Sanders JG, Tautz D, Wernegreen JJ. Animals in a bacterial world, a new imperative for the life sciences. Proceedings of the National Academy of Sciences. 2013 Feb;110(9):3229–36.
2. Beutler B, Rietschel ET. Innate immune sensing and its roots: the story of endotoxin. Nat Rev Immunol. 2003 Feb;3(2):169–76.
3. Richter DJ, Levin TC. The origin and evolution of cell-intrinsic antibacterial defenses in eukaryotes. Curr Opin Genet Dev. 2019 Oct;58–59:111–22.
4. Nyholm SV, McFall-Ngai MJ. A lasting symbiosis: how the Hawaiian bobtail squid finds and keeps its bioluminescent bacterial partner. Nat Rev Microbiol. 2021 Oct;19(10):666–79.
5. Koropatnick TA, Engle JT, Apicella MA, Stabb EV, Goldman WE, McFall-Ngai MJ. Microbial factor-mediated development in a host-bacterial mutualism. Science. 2004 Nov 12;306(5699):1186–8.
6. Leulier F, MacNeil LT, Lee WJ, Rawls JF, Cani PD, Schwarzer M, Zhao L, Simpson SJ. Integrative Physiology: At the Crossroads of Nutrition, Microbiota, Animal Physiology, and Human Health. Cell metabolism. 2017 Mar;25(3):522–34.
7. Consuegra J, Grenier T, Baa-Puyoulet P, Rahioui I, Akherraz H, Gervais H, Parisot N, da Silva P, Charles H, Calevro F, Leulier F. Drosophila-associated bacteria differentially shape the nutritional requirements of their host during juvenile growth. PLoS Biol. 2020 Mar;18(3):e3000681.
8. Morais LH, Schreiber HL, Mazmanian SK. The gut microbiota-brain axis in behaviour and brain disorders. Nat Rev Microbiol. 2021 Apr;19(4):241–55.
9. Hsiao EY, McBride SW, Hsien S, Sharon G, Hyde ER, McCue T, Codelli JA, Chow J, Reisman SE, Petrosino JF, Patterson PH, Mazmanian SK. Microbiota modulate behavioral and physiological abnormalities associated with neurodevelopmental disorders. Cell. 2013 Dec 19;155(7):1451–63.
10. Sharon G, Cruz NJ, Kang DW, Gandal MJ, Wang B, Kim YM, Zink EM, Casey CP, Taylor BC, Lane CJ, Bramer LM, Isern NG, Hoyt DW, Noecker C, Sweredoski MJ, Moradian A, Borenstein E, Jansson JK, Knight R, Metz TO, Lois C, Geschwind DH, Krajmalnik-Brown R, Mazmanian SK. Human Gut Microbiota from Autism Spectrum Disorder Promote Behavioral Symptoms in Mice. Cell. 2019 May 30;177(6):1600-1618.e17.
11. Tsolis RM, Bäumler AJ. Gastrointestinal host-pathogen interaction in the age of microbiome research. Curr Opin Microbiol. 2020 Feb;53:78–89.
12. Winter SE, Thiennimitr P, Winter MG, Butler BP, Huseby DL, Crawford RW, Russell JM, Bevins CL, Adams LG, Tsolis RM, Roth JR, Bäumler AJ. Gut inflammation provides a respiratory electron acceptor for Salmonella. Nature. 2010 Sep 23;467(7314):426–9.
13. Liou MJ, Miller BM, Litvak Y, Nguyen H, Natwick DE, Savage HP, Rixon JA, Mahan SP, Hiyoshi H, Rogers AWL, Velazquez EM, Butler BP, Collins SR, McSorley SJ, Harshey RM, Byndloss MX, Simon SI, Bäumler AJ. Host cells subdivide nutrient niches into discrete biogeographical microhabitats for gut microbes. Cell Host Microbe. 2022 Jun 8;30(6):836-847.e6.
14. Gentile CL, Weir TL. The gut microbiota at the intersection of diet and human health. Science. 2018 Nov 16;362(6416):776–80.
15. Johnson AJ, Vangay P, Al-Ghalith GA, Hillmann BM, Ward TL, Shields-Cutler RR, Kim AD, Shmagel AK, Syed AN, Personalized Microbiome Class Students, Walter J, Menon R, Koecher K, Knights D. Daily Sampling Reveals Personalized Diet-Microbiome Associations in Humans. Cell Host Microbe. 2019 Jun 12;25(6):789-802.e5.
16. Mallott EK, Amato KR. Host specificity of the gut microbiome. Nat Rev Microbiol. 2021 Oct;19(10):639–53.
17. Suzuki TA, Fitzstevens JL, Schmidt VT, Enav H, Huus KE, Mbong Ngwese M, Grießhammer A, Pfleiderer A, Adegbite BR, Zinsou JF, Esen M, Velavan TP, Adegnika AA, Song LH, Spector TD, Muehlbauer AL, Marchi N, Kang H, Maier L, Blekhman R, Ségurel L, Ko G, Youngblut ND, Kremsner P, Ley RE. Codiversification of gut microbiota with humans. Science. 2022 Sep 16;377(6612):1328–32.
18. Granato ET, Meiller-Legrand TA, Foster KR. The Evolution and Ecology of Bacterial Warfare. Curr Biol. 2019 Jun 3;29(11):R521–37.
19. Goodman AL, McNulty NP, Zhao Y, Leip D, Mitra RD, Lozupone CA, Knight R, Gordon JI. Identifying genetic determinants needed to establish a human gut symbiont in its habitat. Cell Host Microbe. 2009 Sep 17;6(3):279–89.
20. Barratt MJ, Ahmed T, Gordon JI. Gut microbiome development and childhood undernutrition. Cell Host Microbe. 2022 May 11;30(5):617–26.
21. Huus KE, Hoang TT, Creus-Cuadros A, Cirstea M, Vogt SL, Knuff-Janzen K, Sansonetti PJ, Vonaesch P, Finlay BB. Cross-feeding between intestinal pathobionts promotes their overgrowth during undernutrition. Nat Commun. 2021 Nov 25;12(1):6860.
22. Chen RY, Mostafa I, Hibberd MC, Das S, Mahfuz M, Naila NN, Islam MM, Huq S, Alam MA, Zaman MU, Raman AS, Webber D, Zhou C, Sundaresan V, Ahsan K, Meier MF, Barratt MJ, Ahmed T, Gordon JI. A Microbiota-Directed Food Intervention for Undernourished Children. N Engl J Med. 2021 Apr 22;384(16):1517–28.

23. Sorbara MT, Pamer EG. Microbiome-based therapeutics. Nat Rev Microbiol. 2022 Jun;20(6):365–80.
24. Buffie CG, Bucci V, Stein RR, McKenney PT, Ling L, Gobourne A, No D, Liu H, Kinnebrew M, Viale A, Littmann E, van den Brink MRM, Jenq RR, Taur Y, Sander C, Cross JR, Toussaint NC, Xavier JB, Pamer EG. Precision microbiome reconstitution restores bile acid mediated resistance to Clostridium difficile. Nature. 2015 Jan 8;517(7533):205–8.
25. Charbonneau MR, Isabella VM, Li N, Kurtz CB. Developing a new class of engineered live bacterial therapeutics to treat human diseases. Nat Commun. 2020 Apr 8;11(1):1738.
26. Stewart Campbell A, Needham BD, Meyer CR, Tan J, Conrad M, Preston GM, Bolognani F, Rao SG, Heussler H, Griffith R, Guastella AJ, Janes AC, Frederick B, Donabedian DH, Mazmanian SK. Safety and target engagement of an oral small-molecule sequestrant in adolescents with autism spectrum disorder: an open-label phase 1b/2a trial. Nat Med. 2022 Mar;28(3):528–34.