

Hi! We're scientists from the Dunn Lab in the Department of Applied Ecology at North Carolina State University, and we study the biodiversity and ecology of microbes in things like Sourdough bread, insects and in human homes, Ask us anything!

DunnLab¹and/ScienceAMAs¹

¹Affiliation not available

April 17, 2023

Abstract

Update: We're all finished answering questions for the day. Thank you for all of the great questions and interest in our work! Thanks, The Dunn Lab. Microbes live everywhere, and are linked to everything we do. The Dunn lab aims to tell the stories of the small species – whether on our bodies, in our homes or our backyards – that humans interact with every day but tend to ignore. The ecology and evolution of these species has barely begun to be explored. We are tackling the unknown with the help of the public, through citizen science research. Here are some of our projects: The Sourdough Project: Humans have baked bread for over 10,000 years. All over the world, different cultures bake their own unique breads – and have for centuries. Yet we know almost nothing about the microbes that truly make a traditional sourdough bread. We have collected over 500 sourdough starters from 17 countries and are now engaging middle school students to grow and study their own starters, on a quest to understand the microbial zoos that transform flour and water into fluffy, nutritious, aromatic bread. The Crop Mutualist Project: Crop plants have many kinds of mutualists. Flies, bees, and wasps pollinate many crops and in many cases those relationships are specific. But others of the mutualists are smaller, they include the fungi and bacteria that aid plant roots in finding nutrients and also the fungi and bacteria that dwell in and on plant leaves and, in doing so, help to defend them against pathogens and, in some cases, against pests. It is these microscopic partners on which we will initially focus. The Great Pumpkin Project: We are documenting the insects and microbes that visit all cucurbit plants, including pumpkins (which are native to the Americas) and cucumbers (which are native to Asia). These plants are now grown and enjoyed throughout the world, yet we know very little about the microbes and insects that grow with them. The Wild Life of Our Homes: Human homes are often considered to be unique from the environments in which we evolved. Though we now spend most of our lives indoors, it has only been in recent years that we have started to fully explore the diversity of microbes which colonize and persist in these spaces. With the help of citizen scientists, our lab has studied the differences among interior surfaces within homes from North America (e.g., how microbial communities vary on pillows compared to toilet seats). We are now expanding this research to include differences in home design, as well as to consider how our species interactions may have changed throughout human history. We're doing this AMA as part of the National Human Genome's National DNA Day Reddit AMA series to celebrate how genomics is used in our everyday lives. Ask us anything about our work on microbial ecology in guts, crops, homes, sourdough, and other fermented foods! Your hosts today are: Dr. Rob Dunn, professor of applied ecology Dr. Erin McKenney, postdoctoral researcher studying microbial community dynamics and the relationship between taxonomy, function, and niche space in sourdough and guts. I'm interested in coupling research and education, and I am also a blacksmith. Dr. Anne A. Madden, postdoctoral researcher studying the bacteria and fungi of diverse environments (not limited to fermented foods and beverages, insects, and built environments) and developing human applications from these insights. Dr. Lori Shapiro, postdoctoral researcher studying how agricultural systems change selective pressures on plant-insect and plant-microbe interactions. I use cucurbits as model systems to investigate how landscape scale changes associated with agriculture affect crop mutualists. Megan Thoemmes, doctoral candidate studying the interface between the human body and

the indoor environment. I am interested in how our species interactions have changed over time, as our homes have become more permanent and further removed from the natural world. Lauren Nichols, research technician studying how species adapt to their environment and how this affects inter-species interactions and evolutionary diversification, particularly in the context of anthropogenic environmental changes. Learn more about the Dunn lab: <http://robdunnlab.com/> Learn more about our citizen science projects: <http://studentsdiscover.org/> Ongoing work in the Dunn lab considers the role of wasps and ants in traditional vineyards, the biology of pants, the potential value of microbes in camel crickets to industrial waste remediation, and the biology of foods such as sourdough bread. In general, Dr. Dunn uses insights from basic ecology and evolution to make new discoveries but also to achieve applied goals.

[REDDIT](#)

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DUNN_LAB [R/SCIENCE](#)

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CORRESPONDENCE:

DATE RECEIVED:

April 28, 2018

DOI:

10.15200/winn.152483.33448

ARCHIVED:

April 27, 2018

CITATION:

Dunn_Lab , r/Science , Hi!
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Do we really need off the shelf probiotics to encourage or maintain gut health and balance, or is this something that should/will occur naturally?

[Rick the P is silent](#)

In general there is accumulating evidence that we have over-sterilized our surroundings, and that the vast majority of environmental microbes are neutral or beneficial. While we are generally beginning to understand that we need more, and not less, exposure to environmental microbes, we do not know specifically whether probiotics are helpful, or in what way they may be helpful.

Historically, we acquired all of the microbes we need from nature. No problems. Just as does a lemur or a giraffe. But, in the last two hundred years we have moved indoors and begun to clean too much, sterilize too much, scrub too much and in doing so have ended up (very often) without the microbes we need. In theory, probiotics can help restore some of those lost microbes. In practice, most probably don't. It is an unregulated market and so telling the wondrous and beneficial from the bullshit is hard.

Prebiotics (that is, eating foods with nutrients that sustain beneficial microbial communities) may be more effective long-term solutions than probiotics (supplements of specific living microbes).

This is because in a stable community, all of the resources will be used – there's no space for newcomers – so a probiotic may not be able to stick around. But if you consume a diet with specific nutrients (i.e. fiber), you'll provide specific resources that promote the growth of a diverse, beneficial community.

Hi!! My four sons love science and experimenting (12, 10, 6, &5) at home. What kind of experiments should I try out or do you suggest to foster their love of science? How did y'all get into science as a profession? Also, kinda cheesy, but what was your all time favorite experience in your field?

[TheG0dd3ssB4k3r](#)

Questions 1: "What kind of experiments should I try out or do you suggest to foster their love of science?"

Did someone put you up to this? This is one of our favorite questions! Beyond simply encouraging their curiosity, there are many ways for kids (of all ages) to get involved with real science through Citizen Science research projects. Check out the experiments that are available on [Scistarter.com](https://www.scistarter.com) (e.g. eBird),

[StudentsDiscover.org](#), the [American Society for Microbiology website](#), or, of course, one of our lab's Citizen Science projects on the [Dunn Lab website](#). There are so many great ones to choose from! In fact, this weekend is the [City Nature Challenge 2018](#), a great opportunity to go out and explore the world in your own backyard, park or playground.

Also, good ol' fashioned field guides are a great way to get started! Once you can identify even a few species around you, the world becomes more personal.

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Question 2: "How did y'all get into science as a profession?"

As you might expect, each of us has a slightly different story.

Megan: I have always loved details, creating collections, climbing trees, and learning about dinosaurs, but it was my college mentors that influenced me the most. They inspired me, supported me, and gave me opportunities to work on an array of projects.

Lori: As an undergraduate, I earned an international fellowship that allowed me to spend six months abroad. I was able to work on a heritage cacao farm and participate in the entire process, from farm to fermentation to harvest, and hear about the challenges facing small growers when trying to find international markets.

Lauren: Growing up, I didn't particularly enjoy my science classes and instead I preferred literature, art, and creative writing. But I've always loved building and making things, being outside, and am fascinated by the diversity of life forms and strategies. It wasn't until college that I learned that doing science is more about curiosity and creativity than it is about memorization. I switched my major to Biology and I've been hooked ever since.

Anne: I had the lucky experience of studying poison dart frogs in the rainforest of costa rica. Everything around me was new and a great adventure. I loved the idea of being surrounded by unknown life. I came back to my college and took a course in microbiology. I was astounded to learn that I didn't have to go to the jungle to find unknown life. We are surrounded by mysterious creatures in our own homes! Not only are these species unknown, but they can do new things for us (like create novel antibiotics, degrade plastics, and produce better tasting food). I was hooked :)

Erin: As a kid, I wanted to be a veterinarian – so my mom arranged an after-school volunteer gig with our vet. Over 10 years, I saw (and assisted) hundreds (maybe thousands) of surgeries, and learned a lot about the intricate puzzle of good health. After college, I didn't get into vet school – but I did land an internship in nutrition and research at Disney's Animal Kingdom. That's where I learned that good health is founded in solid nutrition, and that gut microbes are a HUGE player in both, no matter what animal species. That sealed the deal: it's been food, guts, and bugs for me since then.

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Question 3: "what was your all time favorite experience in your field?"

Rob: I most enjoy when, as a group, we come up with wild new ideas. I like the moment before those ideas are tested when we get to pause and imagine we've figured out some new essential truth of the universe. Sometimes we get lucky and we have, but it is fun either way.

Anne: It's nearly impossible to pick just one. I think it was a few years ago when I walked into a bar with my dad and ordered a beer made with a yeast that we discovered that lives in a wasp. It was a moment where brewers were using a tool we had created/discovered because it helps them make sour beer faster and without bacteria. It was a moment where my dad—and the business world—got to see why diverse microorganisms in our environment can be important to study. It was also a moment where I got to taste a beer made from a yeast that for >150 million years has been living quietly inside a wasp. That might be one of my favorite moments.

Erin: There's a point in every project when I'm combing through results, and a lot of pieces just "click" into place so I can see the bigger picture. It's amazing – the story comes together and the world shifts, because in one moment I can understand how everything fits together – but at the same time, I realize how much we don't know yet, and my mind starts buzzing with all the "next steps" and experiments that need to be done, to really get to the next part of the story.

What is a potent way to rid my home of insects?

[HeisenBohr](#)

The best way to get rid of insects in your home? Encourage spiders to take up residence instead! After all, spiders are arachnids, not insects. This may seem like a cheeky answer, but we have surveyed houses around the world and find that they all have insects and other arthropods. The average house has more than a hundred species. We suspect that a house with more kinds of arthropods is more likely to be a house with less of the arthropods people dislike (in the houses where we did find fewer than forty species, they were all cockroaches). In other words, there is no good way to get rid of all of the arthropods in your home, so rather than fight an uphill battle you can't win, think about how you are selecting for or against certain kinds of arthropods in your home. And, anyway, we are people who love insects. We are the ones to ask if you want to figure out how to get more kinds of insects in your house. As for our favorite insects in houses? We enjoy the small wasps that lay their eggs in the bodies of cockroaches, where those eggs hatch, develop and devour the roach from the inside out.

What's the story behind the deadliest microbe you've ever come across?

[-Greenlung-](#)

The deadliest microbes are things like the tuberculosis microbe (*Mycobacterium tuberculosis*) and the cholera microbe (*Vibrio cholerae*). These beasts have killed hundreds of millions of individuals throughout human history. Add to these the malaria parasite (a protist, but microscopic). Maybe also the plague bacterium. Then bacteria resistant to antibiotics. The flu. Among these beasts you have some of the horsemen of real horror. All of these species make sharks look silly and cuddly by comparison. As for "come across," many of these bacteria remain around us, held at bay (when they are) by hand washing, vaccination, effective waste treatment and clean drinking water supplies. Yet, they are around, waiting for when we screw things up--by failing to vaccinate our children, by overusing antibiotics (and triggering resistance), or by taking clean drinking water for granted--so they can rise again.

Dr. Anne Madden here. I used to work for a company that looked for soil bacteria that could produce novel antibiotics. As part of that research I had to work with deadly pathogens to see if the new antibiotics would kill them. I got to work with *Yersinia pestis* (the black death) and *Bacillus anthracis* (it

makes anthrax). I was also working with MRSA and VRE. Each microbe needs to be handled carefully, and with great respect. What always surprised me was that the very closest relatives of these microorganisms are often completely harmless, and sometimes even beneficial to our health. For example, one species of "staph" can cause infections, while another species that lives on our skin actually helps prevent these infections. There are trillions of microorganisms in this world and each one has a story.

Could geneedited microbes be an untapped actor to passive greenhousegas capturing solutions?

[Jimhead89](#)

Yes. Definitely. There is some work on this now. But microbes offer extraordinary solutions. We might not even need transgenic microbes. Often we just need to make certain microbes more common to get more benefit from them. We've discovered, for example, microbes that can turn the waste from the paper pulp industry into energy. We didn't need to add any new genes, they can just do it as is, off nature's shelf.

We've also discovered new yeasts that live in wasps and bumblebees that make better, cheaper sour beers. Some of the yeasts we've found in insects are even capable of producing the building blocks of biodegradable plastics. Other 'wild' microorganisms are naturally capable of producing antibiotics (that's where we get many of them from.) A fungus that you can find in your carpet right now makes our best cholesterol lowering medication. Many fungi that are related to mildews make our vitamins and a bacterium that lives in a plant makes the goo (xanthan gum) that is used in many foods, cosmetics, and toothpastes to produce a creamy texture.

We are not limited by what microorganisms can do, but by what we dream they can do.

How beneficial is something like Kombucha? Is it just a drop in the ocean of our gut bio-dome or does it actually make a difference?

[kodheaven](#)

Great question! I would say both, to some extent. On the one hand, if you have a healthy, stable community of diverse gut microbes, then any supplemental ("probiotic") microbes will have a hard time making a permanent home in your gut – even if they do amazing things. Luckily, the microbes in kombucha produce helpful compounds when they ferment the tea – so even if the microbes themselves can't stick around, you still get a nice dose of vitamins and antioxidants in every glass of kombucha.

As climate changes and more northern landscapes, such as tundra, begin to thaw do you perceive any potential dangers from the exposure of ancient microbes once trapped in ice or permafrost?

[ToxicPlayer1](#)

One the one hand – yes, tundra thaw will undoubtedly release microbes that modern human and animal populations haven't been in contact with for a long time (or, ever). So our immune systems are more likely to be susceptible (poorly adapted) to these "novel" diseases.

But some of these novel microorganisms may also have abilities that are beneficial – or they may be the keys to understanding how microbes (including diseases) evolve over time, and how the immune system recognizes and interacts with different strains.

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