Experts discuss the 'second brain': The gut microbiome

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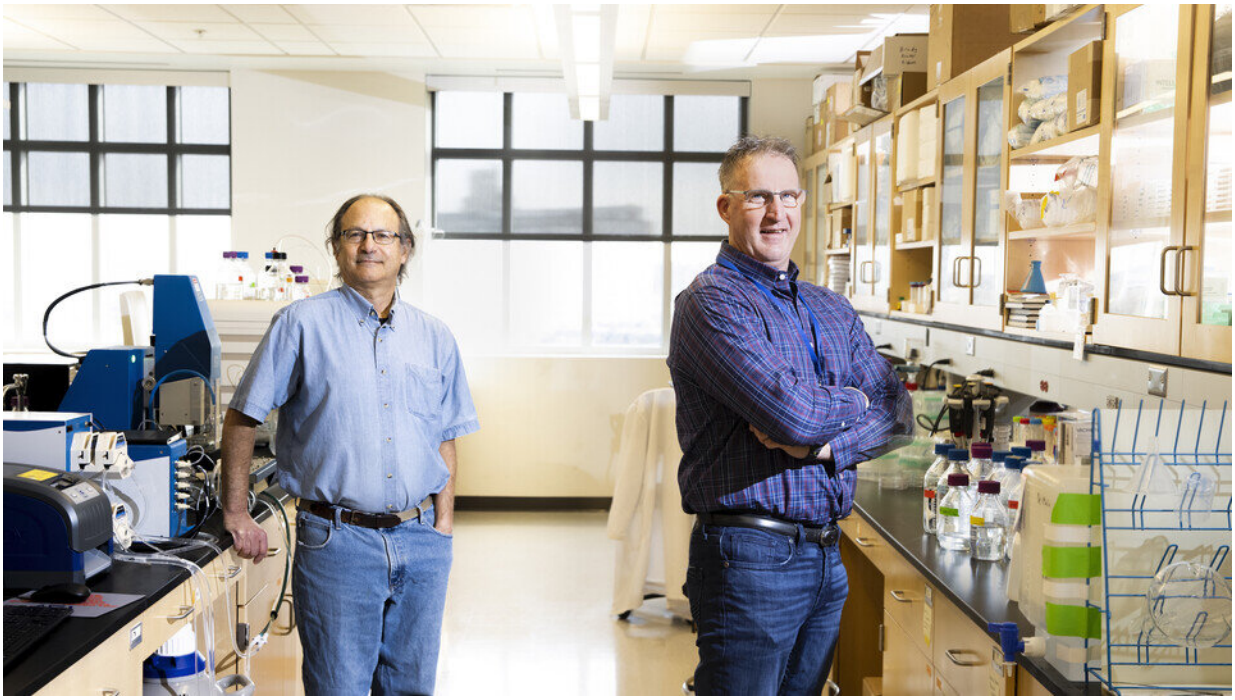

Robert Hutkins and Andy Benson are photographed in the Nebraska Food for Health Center. This image is a composite so the two researchers could appear in one photo without masks. Credit: Craig Chandler | University Communication

As researchers for the University of Nebraska–Lincoln's Food for Health Center, Andy Benson and Robert Hutkins are asking and answering questions about our second brain—the gut microbiome.

Using what they've learned in the laboratory, and the specialized strains of bacteria they developed, Benson and Hutkins, along with Nebraska animal scientist Tom Burkey and former Husker scientist Jens Walter, launched their own company to bring their research to the marketplace.

Synbiotic Health will provide something novel and clinically proven—a product that mixes beneficial microbes and the fiber-like fuel that feeds them—for health-conscious consumers.

Nebraska Today recently sat down for a conversation with Benson, professor of food science and director of the center, and Hutkins, Kem Shahani Distinguished Professor of Food Science, to discuss how our food choices affect our health, what sets Nebraska apart in the research of the gut microbiome, and what research will emerge following the COVID-19 pandemic.

What exactly is the gut microbiome and how does it affect our overall health?

Benson: The gut microbiome, so to speak, is this collection of hundreds of trillions of microorganisms—most of them bacteria—that live in our gastrointestinal tract. And they form a very complex ecosystem that does a number of things that contributes to our health and our wellness. For example, the microbiome plays a major role in training our immune system. We know from work in germ-free animals that their immune system does not develop or function normally without those organisms present. Another example is their role in breaking down dietary components, especially components such as fiber that our bodies don't break down. And they convert those components into different types of metabolites, some of which our body actually uses and are very beneficial to us.

What led you to study the gut microbiome?

Hutkins: Many years ago, I started off actually studying fermented foods and the bacteria that were in fermented foods. And then we realized as we began that project, that the microbes that were in the fermented foods were often the very microbes that come out at the other end. We realized they must be doing something along the way.

Benson: More than 10 years ago now, in the food science department, we were looking at future opportunities for research. And essentially, new technology became commercialized at that point that would allow us to study the hundreds of trillions of organisms that were in the GI tract. Microbiologists had dreamed about doing that for 200 years, since we've known that this was a rich environment with lots of organisms, but we never had a way to study them. And the commercialization of that technology was what really drove us down this path. We knew that it would open the doors to being able to study these organisms and how they contribute to our health and wellness.

What sets the Food for Health Center at Nebraska apart from other universities and institutions studying the gut microbiome?

Benson: One of the biggest things that differentiates us is the fact that our microbiome research—our research into the study of all these gut organisms—evolved in the context of a food science department. Most universities, their microbiome research centers are usually affiliated with medical schools, but we're one of the few institutions where the gut microbiome research actually grew up and grew out of the context of a food science department.

Why is it important to study the connection between the gut

microbiome and how our diets affect it?

Hutkins: The microbes that live in the gut depend on the food that we eat for them, and so it makes perfect sense that diet and food would have an impact on the gut microbiome, for better or for worse.

What role do fermented foods play in our gut microbiome?

Hutkins: The microbes transform proteins into amino acids and sugars into organic acids and they produce vitamins directly in the food. We benefit from that. For example, certain yogurts are more digestible and contain more vitamins than the milk from which they were made. Once we consume those products, the microbes have a chance to reach the gut. Now, we know they do not take up permanent residence, but they could live there for a short period of time and in doing so, they can outcompete pathogens, displace unwanted organisms, and again, produce vitamins and other bioactive molecules directly in the gut.

Speaking of food, are there one or two things we can do or eat, that we know from research has a benefit of keeping our gut microbiome healthy?

Hutkins: It turns out that there's some pretty compelling data now that the best thing that we could be eating is fiber-rich foods. In addition to many established benefits of fiber, we now know that fermentable fibers support growth of beneficial microbes that live in the gut.

Benson: The "fiber deficit" has emerged among the westernized diets because our fiber intake has declined steadily since WWII. Because dietary fibers are a major source of "food" for the gut microbiome, we believe the fiber deficit has had a major impact on the gut microbiome

and also on our health. That's clearly one general thing that most individuals can do is to increase the amount of fiber intake, which in turn serves to feed the organisms in the gastrointestinal tract.

Is there a quick fix, so to speak, to increase fiber intake? Are supplements an option?

Benson: Supplements is an approach, but including it in your actual dietary components is probably the best way to do it. Short of that, supplements can certainly be a way to augment your fiber intake.

What would you recommend to someone who is making a conscious decision to add more fermented foods to their diet, for their health benefits?

Hutkins: You have to be a careful shopper, because a lot of fermented foods will not contain live microbes. If you buy sauerkraut in a can that's stored at room temperature, it's almost certainly been heat treated, so there are no live microbes. You have to find the sauerkraut that's in the refrigeration section, and it might even say "not pasteurized" or "not heat treated." In addition to the billions of live microbes, they also have a fresher flavor and crunchier texture.

Yogurt is the easiest one, because yogurt will contain plenty of live microbes, and depending on the brand, even strains that have been assessed in clinical studies. Yogurt in the U.S. is rarely heat treated. Whether it's Greek yogurt or regular yogurt, whether it's flavored or plain, doesn't matter that much.

In this 2018 photo, Qinnan Yang, Nate Korth and Mallory Van Haute work with a machine that will deliver small samples of ground grains into fecal samples in the Nebraska Food for Health Center. Credit: Craig Chandler | University Communication

Tell us about your new company, Synbiotic Health.

Benson: Synbiotic Health is spin-off company from the Nebraska Food for Health Center. And the goal of that company is to produce ecologically-advanced products that impact the microbiome and are clinically proven to improve health and wellness. Now, the real novelty of the company builds upon the word ecology. That's important because we use ecological approaches to identify organisms and to select the growth substrates that they use in the gut. And we combine the microbes

that can compete in the gut ecosystem with growth substrates (unique types of fiber) that enable these organisms to compete.

We have two of them licensed already that were discovered here, largely due in part to Dr. Hutkins' and Dr. Walter's work. The company is now in the process of doing additional clinical studies to further define the health benefits.

Hutkins: What distinguishes Synbiotic Health is the very name, Synbiotic, where we combine the microbes with the fiber that they will grow on in the gut so that they have a much better chance of establishing themselves and providing health benefits. The development of these strains is done through a unique pipeline, that's based on ecological performance. And many of the products that we're competing with, to be quite honest, are lacking that kind of ecological rigor that we apply to our process.

The other thing that I think distinguishes our research platform is the potential for developing strains for personalized nutrition, tailored to one's microbiome. And that's really important for us.

Is there anything in the recent research or past research of the gut microbiome that can tell us what might help or hurt when we're battling viruses and pathogens like COVID-19?

Benson: We're starting to learn, in general, the concept of having a healthy microbiome, having a strong, resilient microbiome, is probably your first and best line of defense against any sort of infectious agent. One of the things that's been observed not only with COVID-19, but also other enteric infections or gut infections is that there is an impact on the gut microbiome.

Hutkins: It's still early, but I think we're going to see even more data come out in the next year or two, that will point to dietary factors that contributed or perhaps directly reduced the risk of COVID infections.

There are already suggestions that the having a healthy gut microbiome is protective against other infections. Certainly, a healthy immune system supported by healthy eating will probably turn out to be a very important protective measure.

Provided by University of Nebraska-Lincoln

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