Humans are never alone. Even in a room devoid of other people, they are always in the company of billions of microscopic beings. By residing in and on the human body, these bacteria, fungi, and viruses form complex ecosystems that exert powerful effects on a range of health conditions, such as antitumor responses, gut inflammatory diseases, and mental health.

With such striking effects, many scientists see modulating the microbiomes as a promising avenue for improving human health and wellbeing. In recent years, researchers have shown that tweaking the genomes of resident microorganisms offers new ways to treat and diagnose diseases.

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CRISPR-based approaches can help expand the genetic toolkit microbiome engineers have available, bringing them a step closer to understanding the roles and interactions between microbial community members and how these shape their communities and influence the organisms’ hosting them. “Every single function that a community of microbes outputs is encoded within their DNA. So, the DNA is really the blueprint that tells us what these microbes can do within that microbiome,” Cress said. “If we really hope to change the function of what these microbiomes can do, we really need to be manipulating that blueprint, and CRISPR is the tool that allows us to do that very precisely and very efficiently.”
Engineering Microbiomes with CRISPR

The microbes that make up an organism’s microbiome have a range of effects on the host. By using CRISPR systems to genetically manipulate specific bacterial species, for instance those in the gut microbiome, researchers are finding new ways to promote health and treat disease.