

## Profile: Jeffrey Gordon

Jeffrey Gordon is an international force in the understanding of gut microbiology ecology and evolution. Using highly advanced sequencing data, Gordon's research is propelled by massive data sets he helped to create. By exploring the human microbiota, he has branched the new perspective that humans are as an ecosystem made up of symbiotic human and microbial parts (Association of American Medical Colleges).

Gordon completed his bachelor's degree in biology at Oberlin College and his MD at the University of Chicago Pritzker School of Medicine. His education continued with a residency in medicine at Barnes Hospital in St. Louis, a postdoctoral fellowship in biochemistry and molecular biology at the NIH, and yet another fellowship in gastroenterology at Washington University. His recent accomplishments are as follows: For the last 30 years he has taught at Washington University in St. Louis School of Medicine where he is the Dr. Robert J. Glaser Distinguished University Professor; Gordon is the director of the university's Center for Genome Sciences and Systems Biology where his teams have "developed and applied new and powerful experimental and computational approaches to characterize the assembly and dynamic operations of our human gut communities" (Shapiro).

Microbes outnumber one person's human cells by 10-fold. "The Gordon lab's work is providing a microbial view of human development, including how functional maturation of the gut microbiota is related to healthy growth of infants and children, and helping to usher in a new era of microbiota-directed therapeutics"

(University of Pittsburgh: The Dickenson Prize). By studying twins of different ages, locations, and cultures, using their microbial communities and placing them on sterile mice, Gordon and his team have brought new evidence and information about how the microbiome effects malnutrition, obesity, and metabolic abnormalities (University of Pittsburgh: The Dickenson Prize).

Gordon and his team transplanted microbial populations from both fat and thin mice into clean adult mice that had no previous exposure to any bacteria. The adult mice (now coined “gnotobiotic” mice) that received microbial residue, gained more fat than the adult mice that were exposed to the thin mice’s microbial content despite the fact that all mice were fed the exact same diet. This data has a major impact on human nutrition in that the “nutrient and caloric value of foods are not absolute in terms, but rather values that are influenced by the get microbiomes of consumers” (Shapiro).

The most surprising aspect of this set of studies was an experiment showing that microbes from a thin twin can take over the gut of a mouse that was previously exposed to a fat twin. Gordon calls this the “Battle of the Microbiota,” where gut microbes from thin twins were placed in the same cage as gut bacteria from fat twins. The mice in the cage ended up sharing bacteria and in the end the thin twin’s microbial community “result[ed] in weight loss and a correction of the metabolic abnormalities” (Kolata). With the right diet, the mouse lost weight. However, the opposite has not shown the same results. No matter what the mouse ingests, microbial content from a fat mouse cannot overcome the gut of a thin mouse.

Furthering the research, Vanessa Ridaura, then Gordon's colleague, determined from a national survey of what Americans eat – the healthiest and unhealthiest diets – and using this information, created mouse food of the same two compositions. Using this food, the researchers repeated the experiment putting thin and fat mice together in a cage and giving them either the healthy feed or unhealthy feed. The fat mice that received fatty food kept the microbial content and stayed fat. The thin microbial content prevailed only if the mice ate the healthy pellets. It seems, when properly nourished, gut bacteria can better sustain itself by picking up the “good” bacteria.

It appears that an individual's microbiome functions as a “second genome” and it may have an even larger impact than the genes we inherit from family. One major difference, however, being that inherited genes are generally stable, it may be possible to alter and improve the “second genome” (Pollan). Jeffrey Gordon has said, “We are not superior but assimilated by the microbes that dominate the planet. Like every other animal, we have to adapt, coexist, and benefit from the microbial world,” and rightfully so, he urges caution. It is still very unclear which bacteria are responsible for which effects. Gordon's hope, eventually, is to create pure mixtures of bacteria and to treat the failing microbiome with “synbiotics,” a sustainable and more powerful probiotic which, ideally, would be administered along with prebiotic nutrients. “The fecal transplant will give way to something far more targeted: a purified and cultured assemblage of a dozen or so microbial species that, along with new therapeutic foods, will be introduced to the gut community to repair ‘lesions’ – important missing species or functions” (Pollan).