



**~10 TRILLION**  
Number of microbes in or on the body

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**~3%** The microbiome constitutes up to 3% of our body mass

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**1-10x** Microbial cells to human cells





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**10-100X**  
Microbial genes to human genes

*Ryan Brewster*

## A Gut Feeling

The vast majority of microbes reside in the large intestine, where they help to:

-  Extract Nutrients
-  Regulate immunity
-  Regulate Metabolism
-  Produce Vitamins



# A Gut Feeling

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- 🏃 Regulate Metabolism
- 🛡️ Regulate immunity
- 💊 Produce Vitamins

## The microbiome & immune system co-develop in early life

MICROBIOME DIVERSITY

High

Low

Ryan Brewster

## Dietary choices throughout life dramatically impact the Gut Microbiome

OC[C@H]1O[C@@H](OC[C@H]2O[C@@H](O)[C@H](O)[C@@H]2O)[C@H](O)[C@@H](O)[C@H]1O

$\alpha$ -1,4  
 $2 < n < 20$

## The Microbiome Over Time

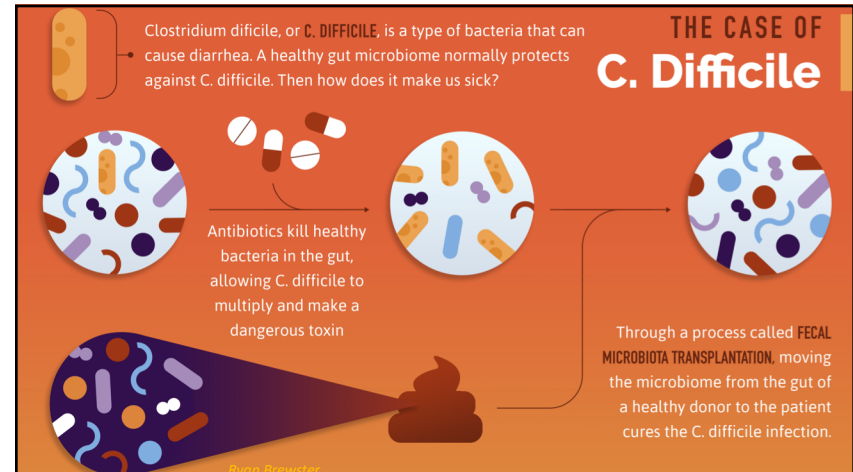
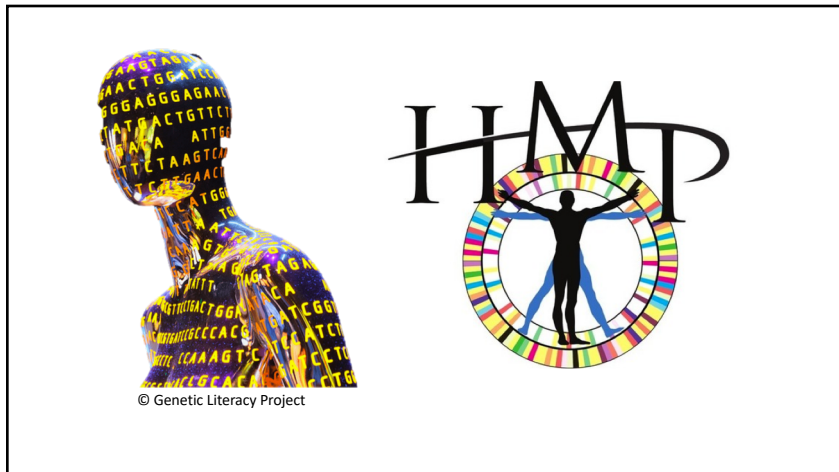
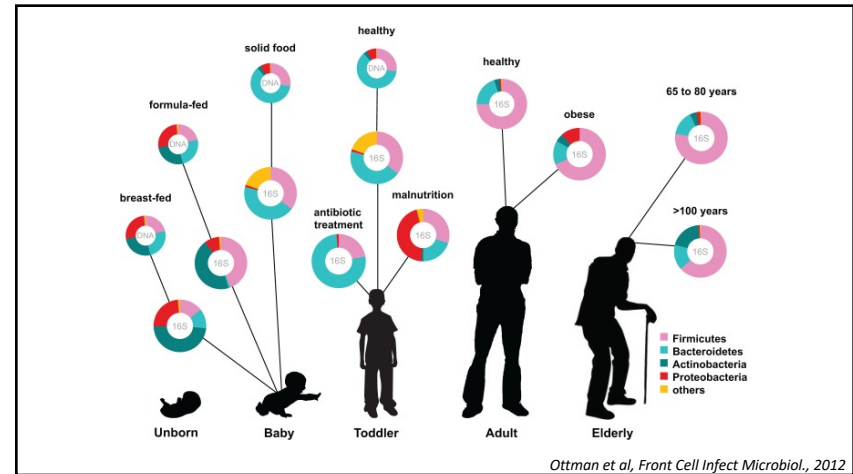
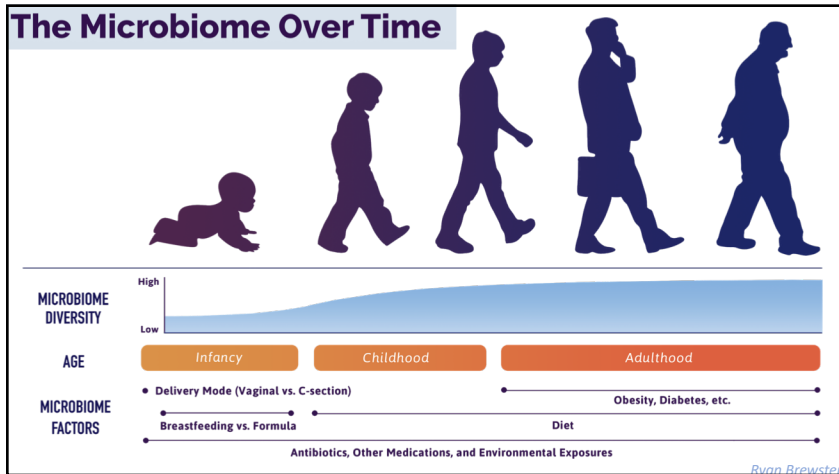
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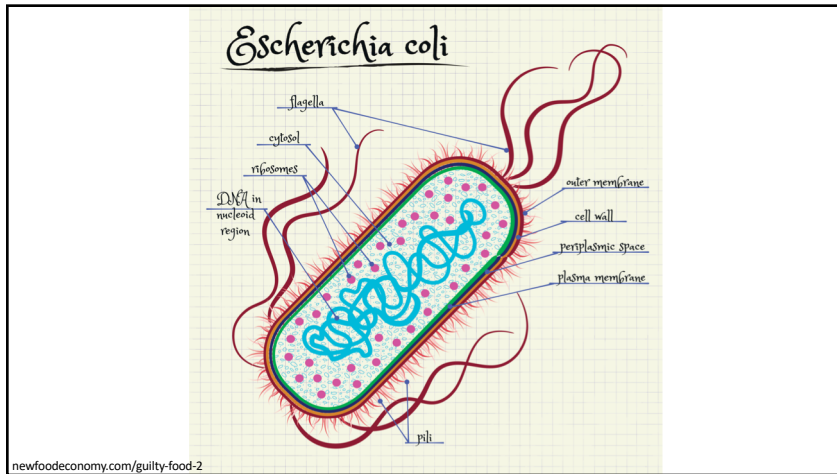
Ryan Brewster











Can new, **high resolution bacterial strain measurement** allow us to catch microbes in the act of **developing antibiotic resistance?**

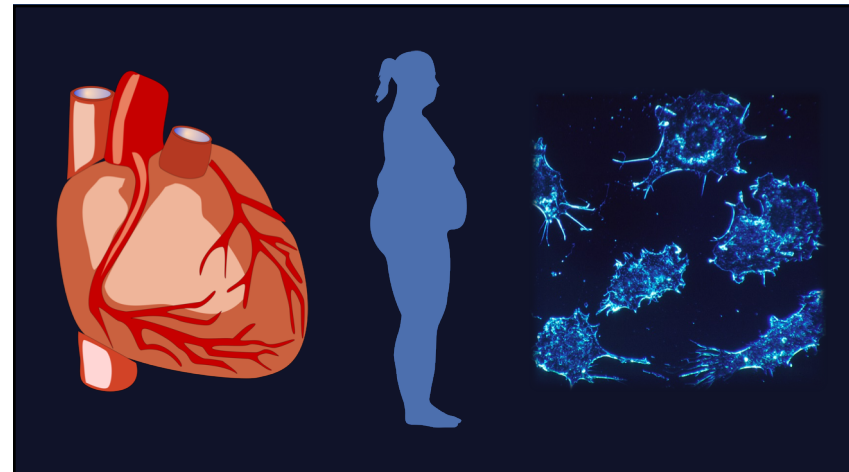
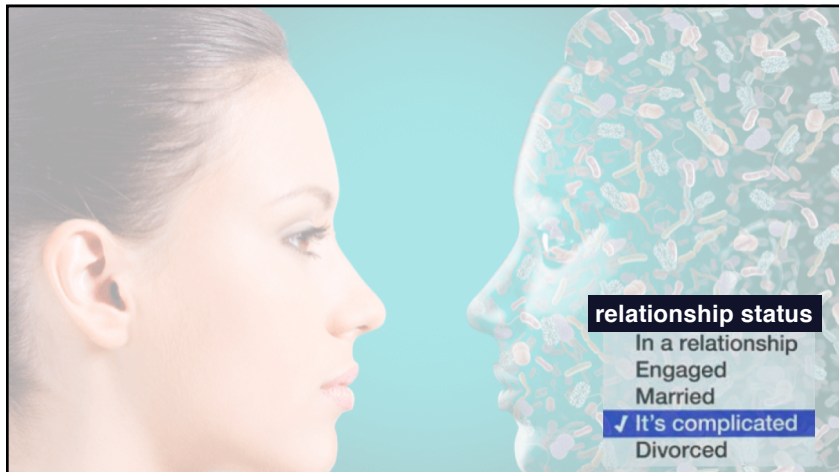
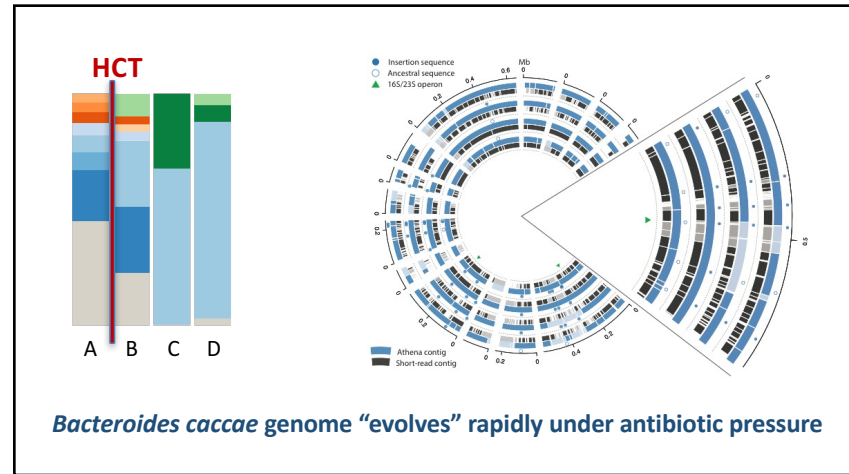
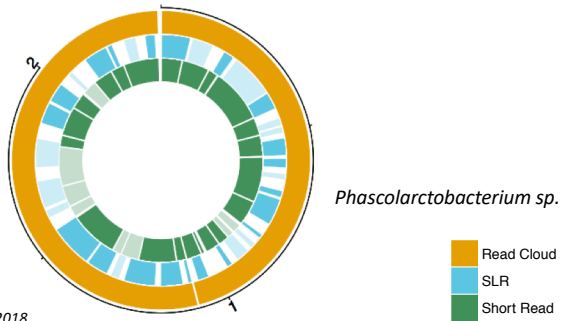
### WHAT WE WANT FROM OUR SEQUENCING APPROACH

### HUMAN GUT MICROBIOMES: STANDARD APPROACHES GENERATE **INCOMPLETE GENOMES**

*Phascolarctobacterium sp.*

- Read Cloud
- SLR
- Short Read

### HUMAN GUT MICROBIOMES: READ CLOUD & ATHENA ASSEMBLY → COMPLETE GENOMES





Adapted from:  
 "Could microbial therapy boost cancer immunotherapy?" Snyder A, et al. Science 350(6264) (2015). doi: 10.1126/science.aad7706



**Gut microbe.** *Bifidobacterium* is found in the intestines of most mammals, including humans.

**IMMUNOTHERAPY**

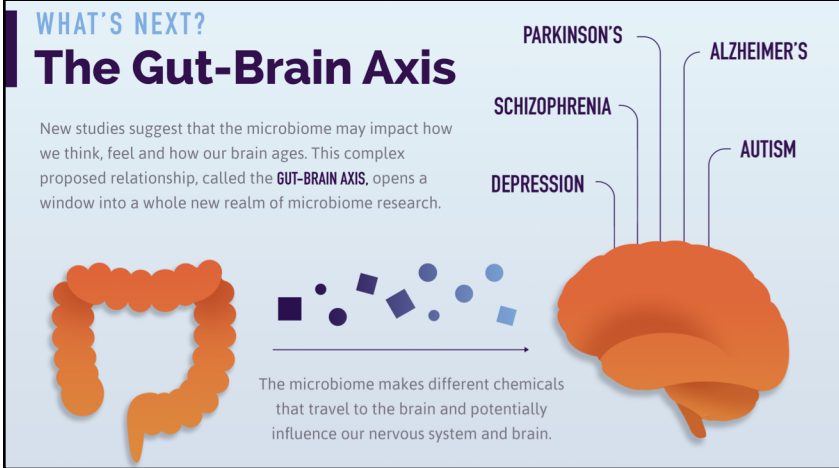
### Could microbial therapy boost cancer immunotherapy?

Intestinal microbes affect immunotherapy responses in mouse models of cancer

## WHAT'S NEXT?

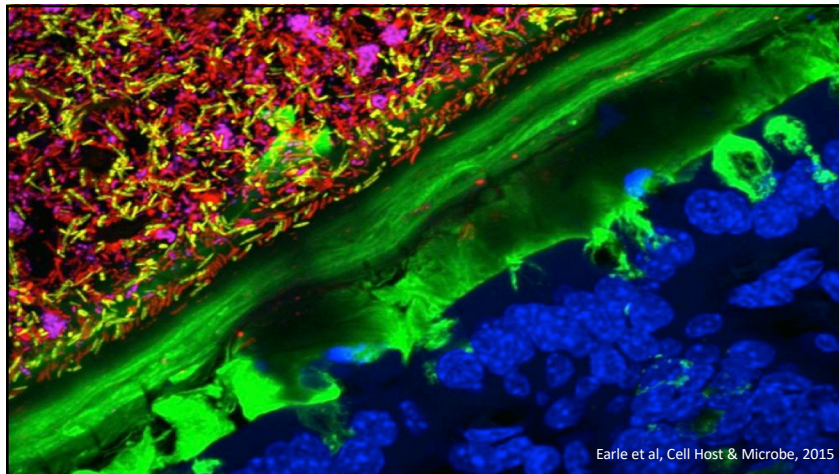

# The Gut-Brain Axis

New studies suggest that the microbiome may impact how we think, feel and how our brain ages. This complex proposed relationship, called the **GUT-BRAIN AXIS**, opens a window into a whole new realm of microbiome research.




PARKINSON'S  
 ALZHEIMER'S  
 SCHIZOPHRENIA  
 DEPRESSION  
 AUTISM

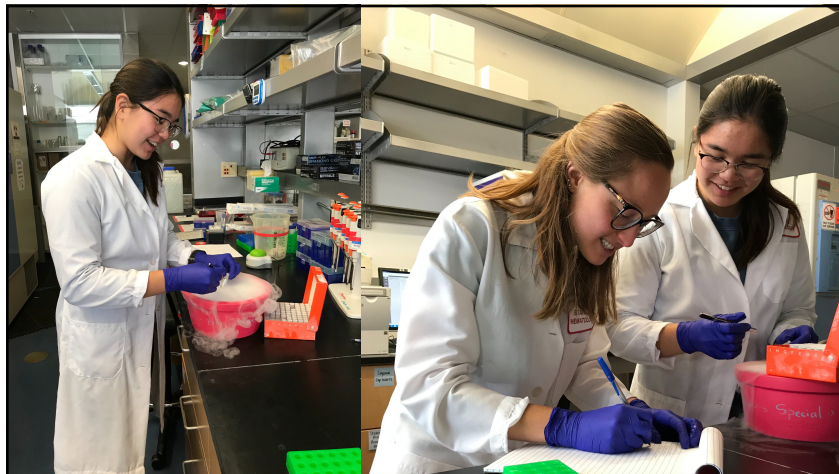
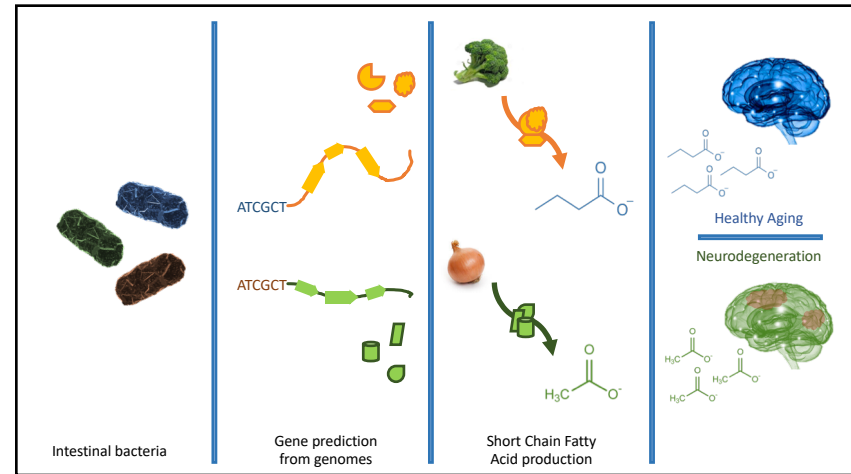
The microbiome makes different chemicals that travel to the brain and potentially influence our nervous system and brain.

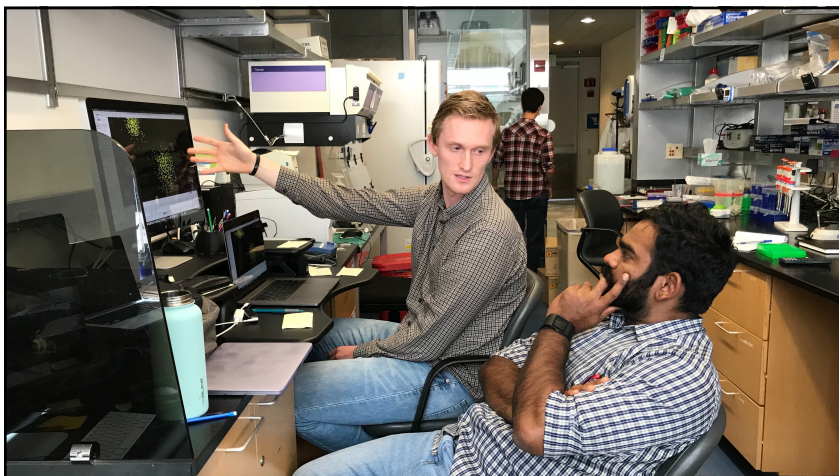
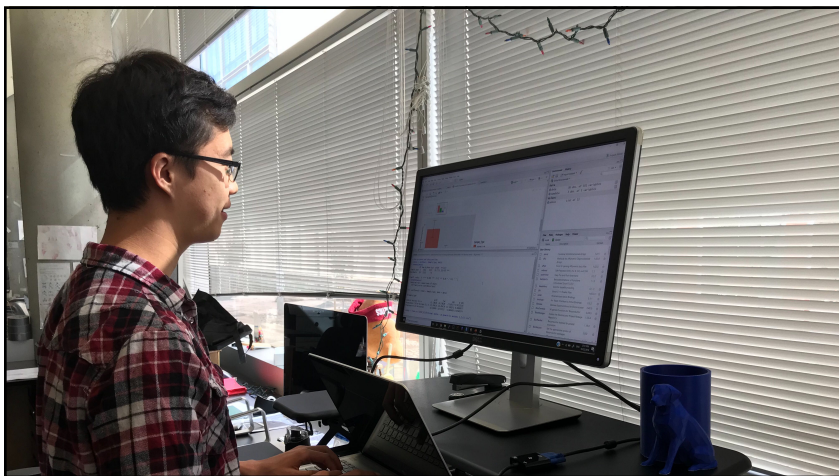
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Who's there?  
What are they doing?  
What do they make?









Thank you!