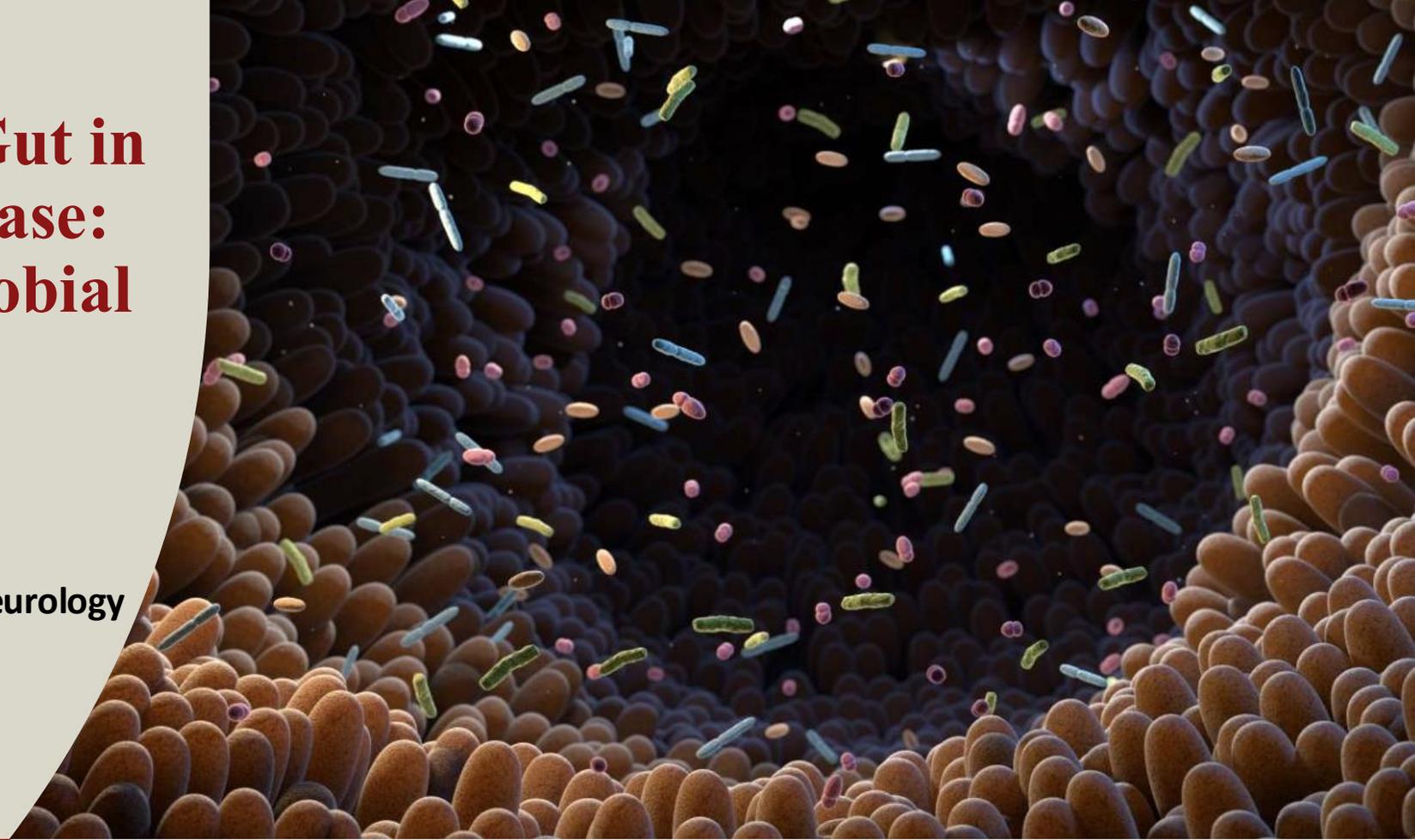


Rethinking the Gut in Parkinson's Disease: A declining microbial ecosystem?

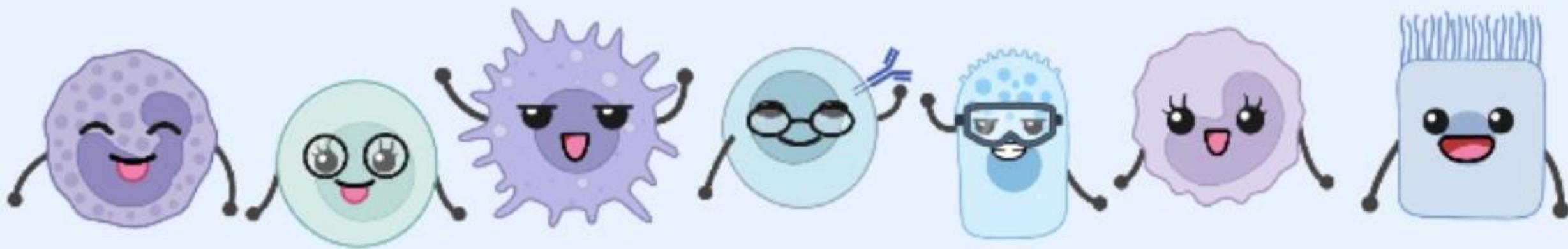
Bianca R. Palushaj, MD

Clinical Assistant Professor of Neurology

Division of Movement Disorders



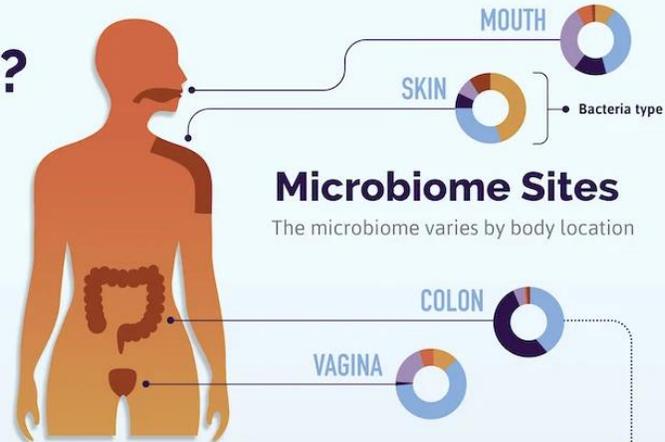
THANK YOU!



THE HUMAN Microbiome

WHAT IS THE Microbiome?

There are trillions of microorganisms - including bacteria, viruses, and fungi - that live in or on the human body. They are collectively called the **MICROBIOME**. The microbiome plays an important role in our health, from nutrition to the immune system.



By the Numbers

~10 TRILLION

Number of microbes in or on the body

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

1-10x Microbial cells to human cells

10-100X

Microbial genes to human genes

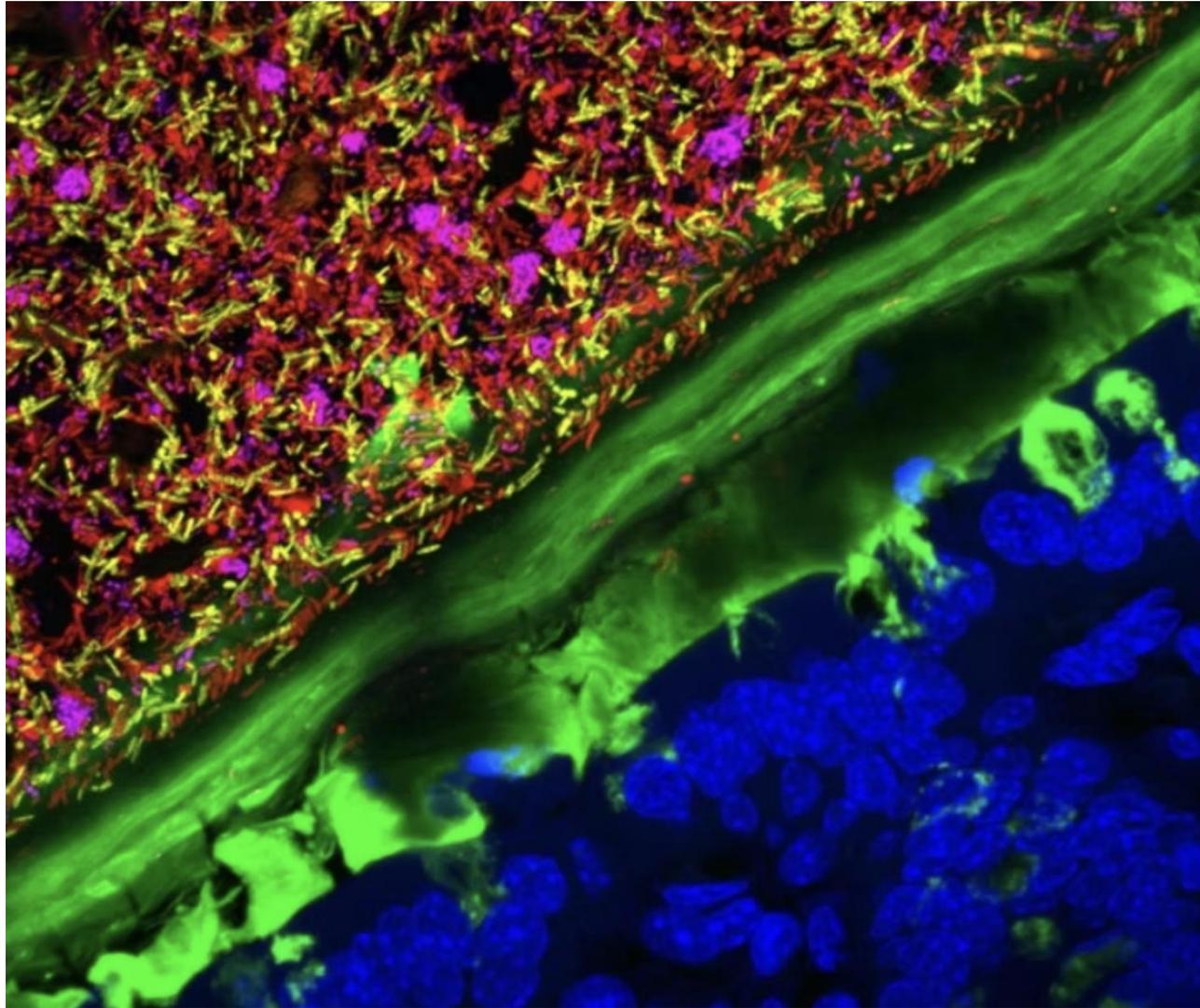
A Gut Feeling

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

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

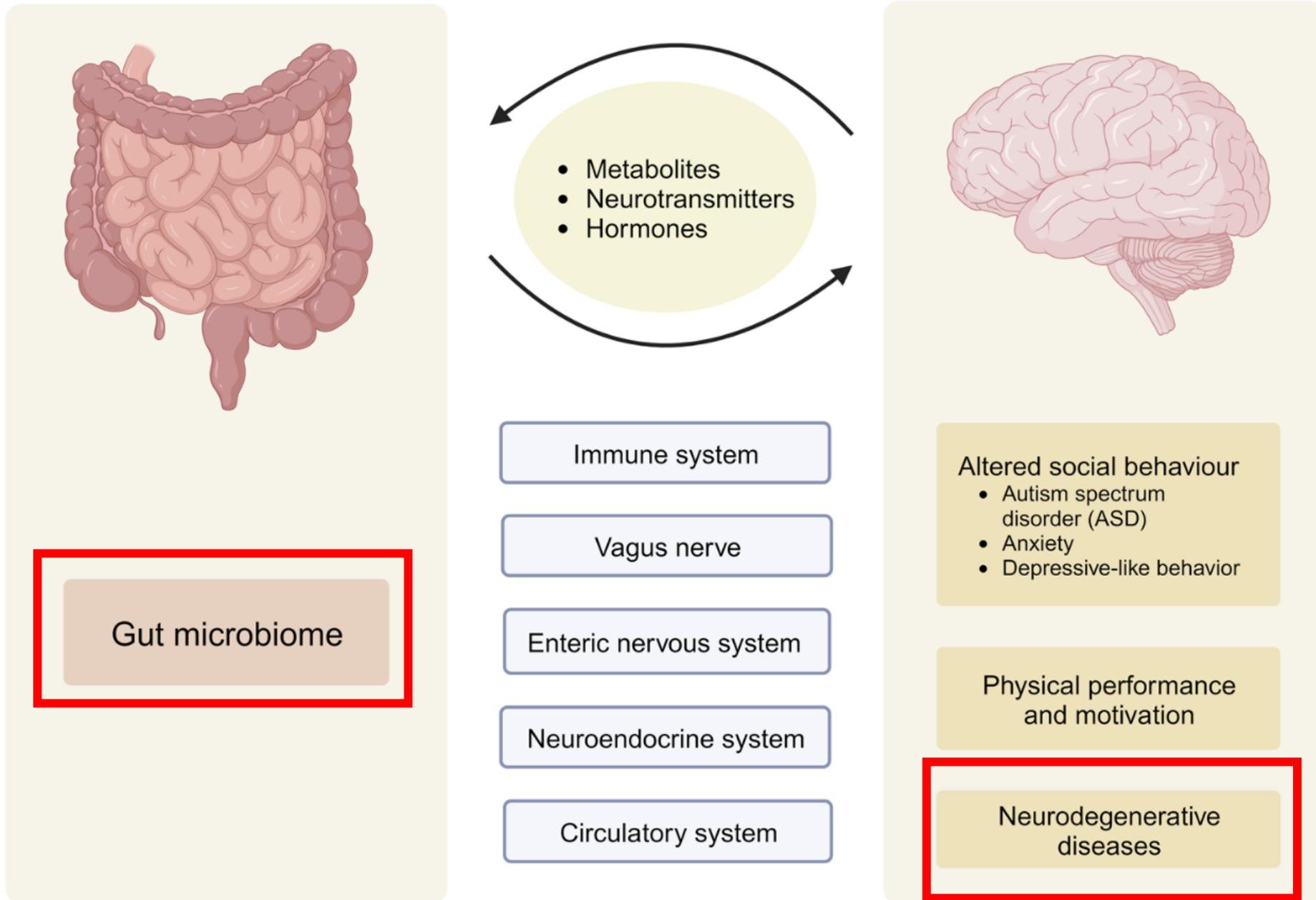
It is thus no surprise that alterations in the gut microbiome, called **DYSBIOSIS**, have been associated with many disease states:

- Diabetes
- Crohn's Disease
- Neurological Disease
- Cancer
- Obesity
- ...And many more...



Credit: Kristen Earle, Gabriel Billings, KC Huang, Justin Sonnenburg

Microbiota gut-brain axis





The Microbiome in Parkinson's Disease

- People with Parkinson's disease have a different microbiome than people without Parkinson's disease.
 1. Loss of beneficial microbes
 2. Overgrowth of potentially harmful microbes
 3. Altered microbial function
- This is known as **gut dysbiosis**.



How does gut dysbiosis contribute to the development of Parkinson's disease?

How does it influence disease progression?

How does it influence disease symptoms?

	Parkinson's Disease	Household Control
N enrolled	112	83
Sex (n, %)		
Male	55 (49.1%)	35 (42.2%)
Female	57 (50.9%)	48 (57.8%)
Age (Mean ± SEM)	70.1 ± 0.9	68.8 ± 1.1
BMI (Mean ± SEM)	23.9 ± 0.4	24.8 ± 0.4
Paired Collection (n,%)		
Yes	80 (71.4%)	80 (96.4%)
No	32 (28.6%)	3 (3.6%)

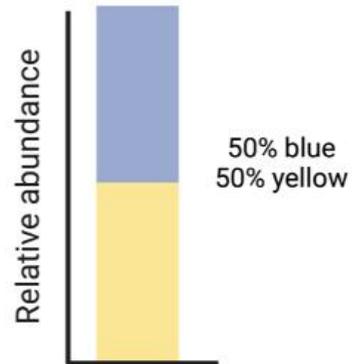
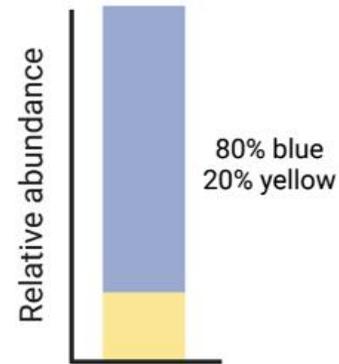
**193 participants
79 household pairs**

Standard “Relative Abundance” Studies Are Not the Full Picture

Parkinson’s Disease

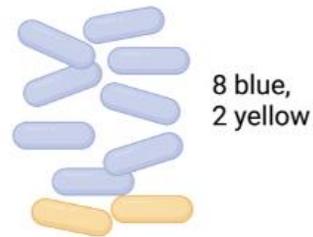
Non- Parkinson’s Disease

Relative Abundance



Yellow bacteria is decreased in PD and the blue bacteria is increased

Absolute Abundance



OR



A) Yellow bacteria is the same and blue bacteria is increased

OR

B) Yellow bacteria is decreased in PD and the blue bacteria is the same

Our Findings

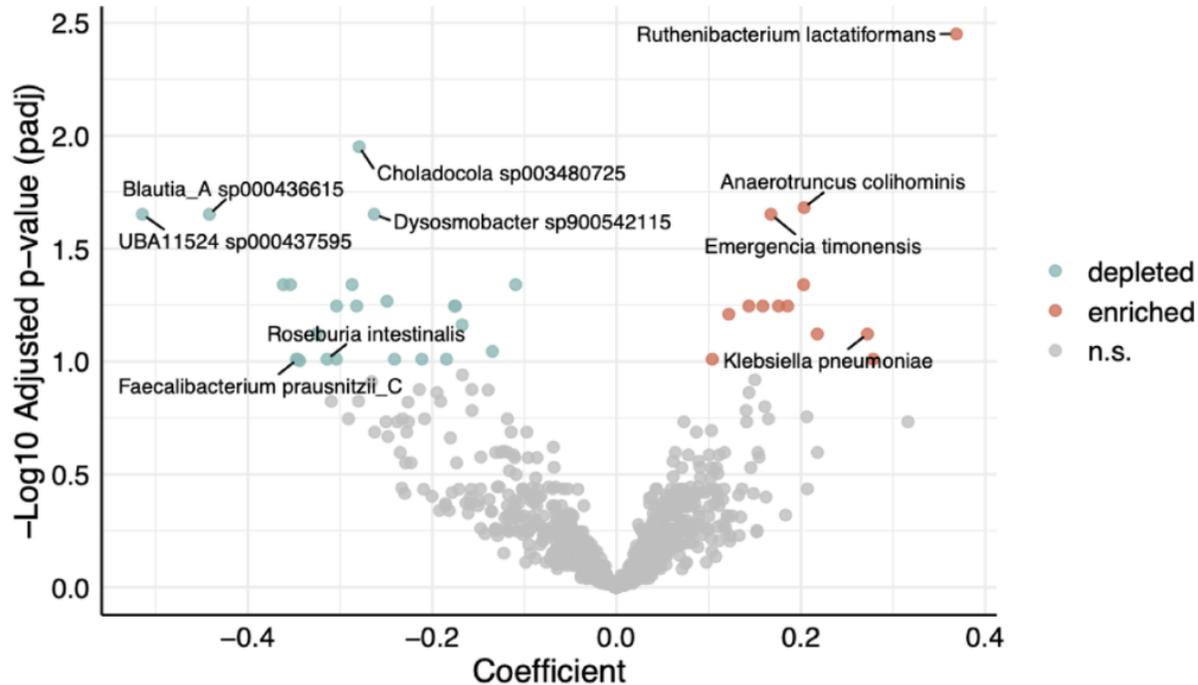


Bhatt Lab | Ami Bhatt, Meena Chakraborty, Imani Porter, Gabriella Green, Erin Brooks

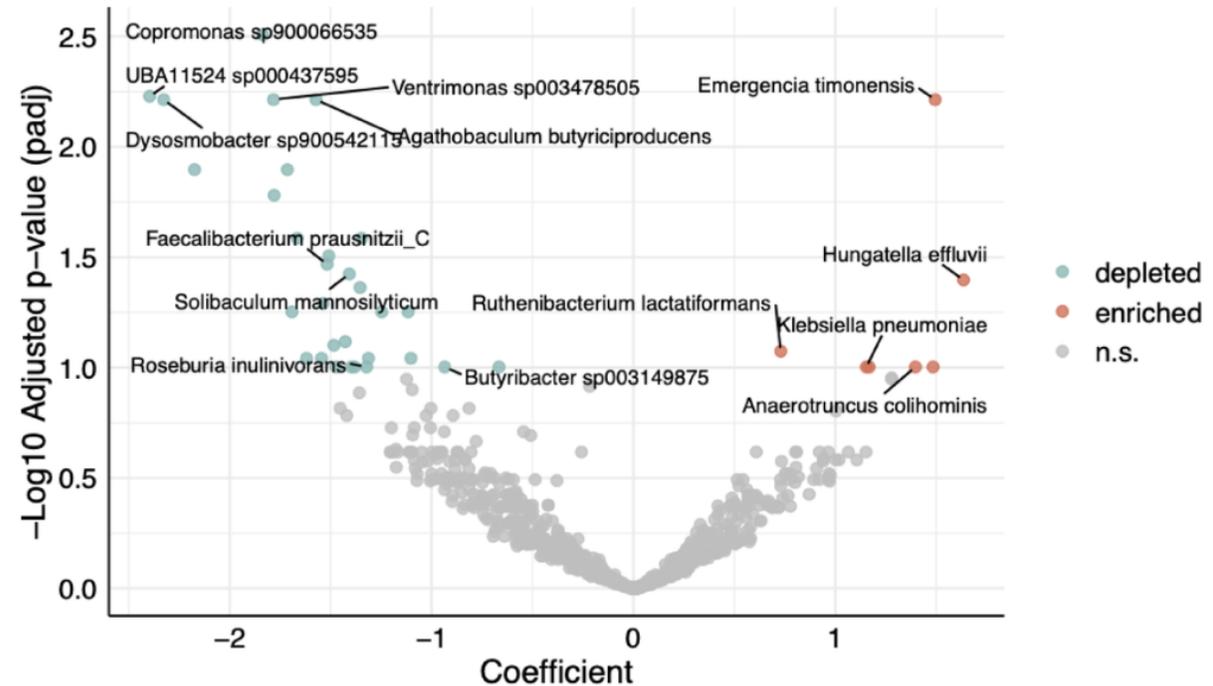
1. Differential absolute abundance corrects misleading conclusions that are drawn from relative abundance.

2. Bacteria associated with Parkinson's tend to be depleted, more so than enriched.

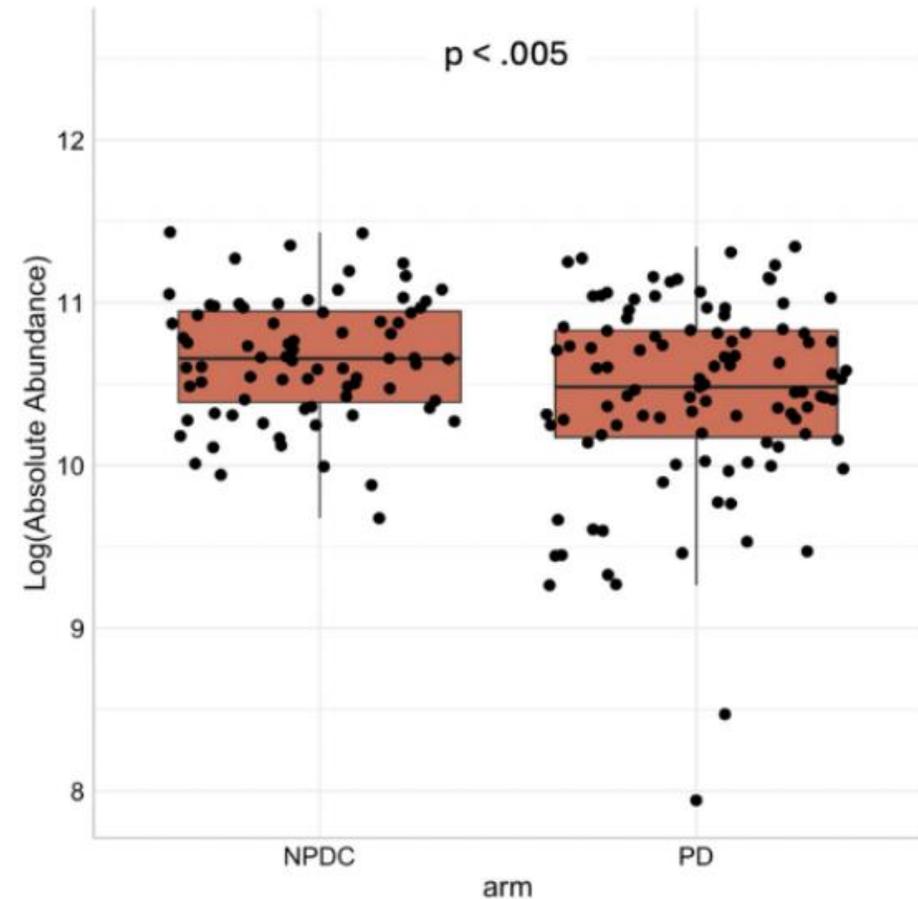
Differential Relative Abundance Analysis



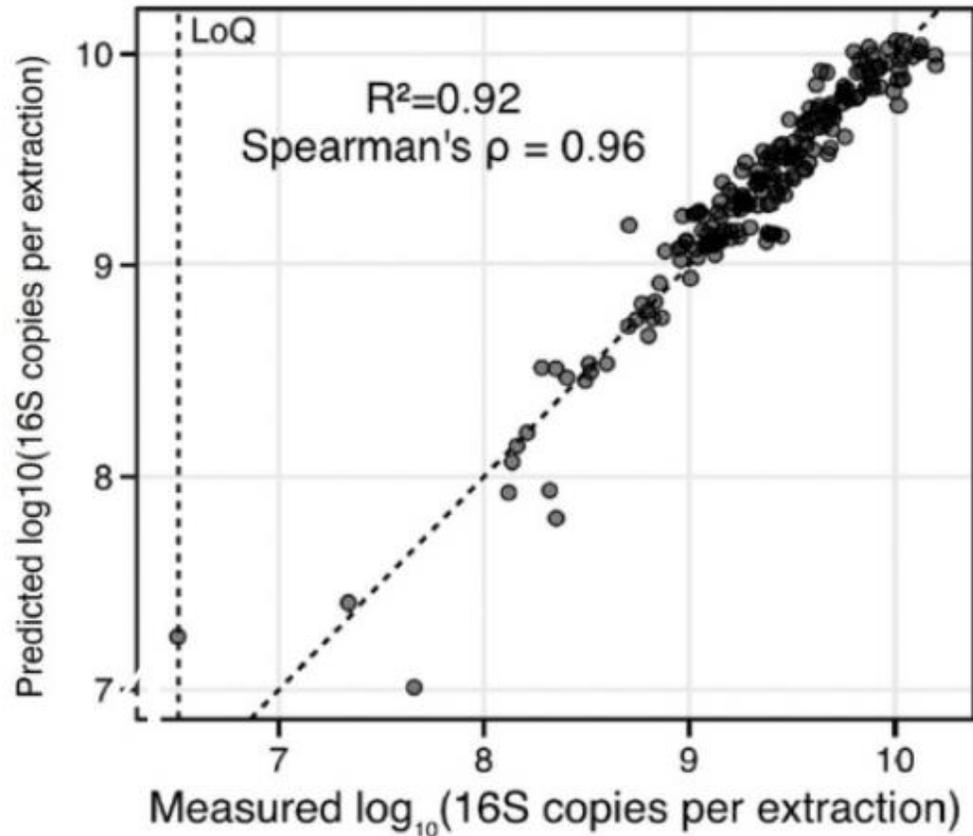
Differential Absolute Abundance Analysis



People with Parkinson's disease have fewer gut bacteria overall compared to people without Parkinson's disease.



Measured vs Predicted Total Microbial Load

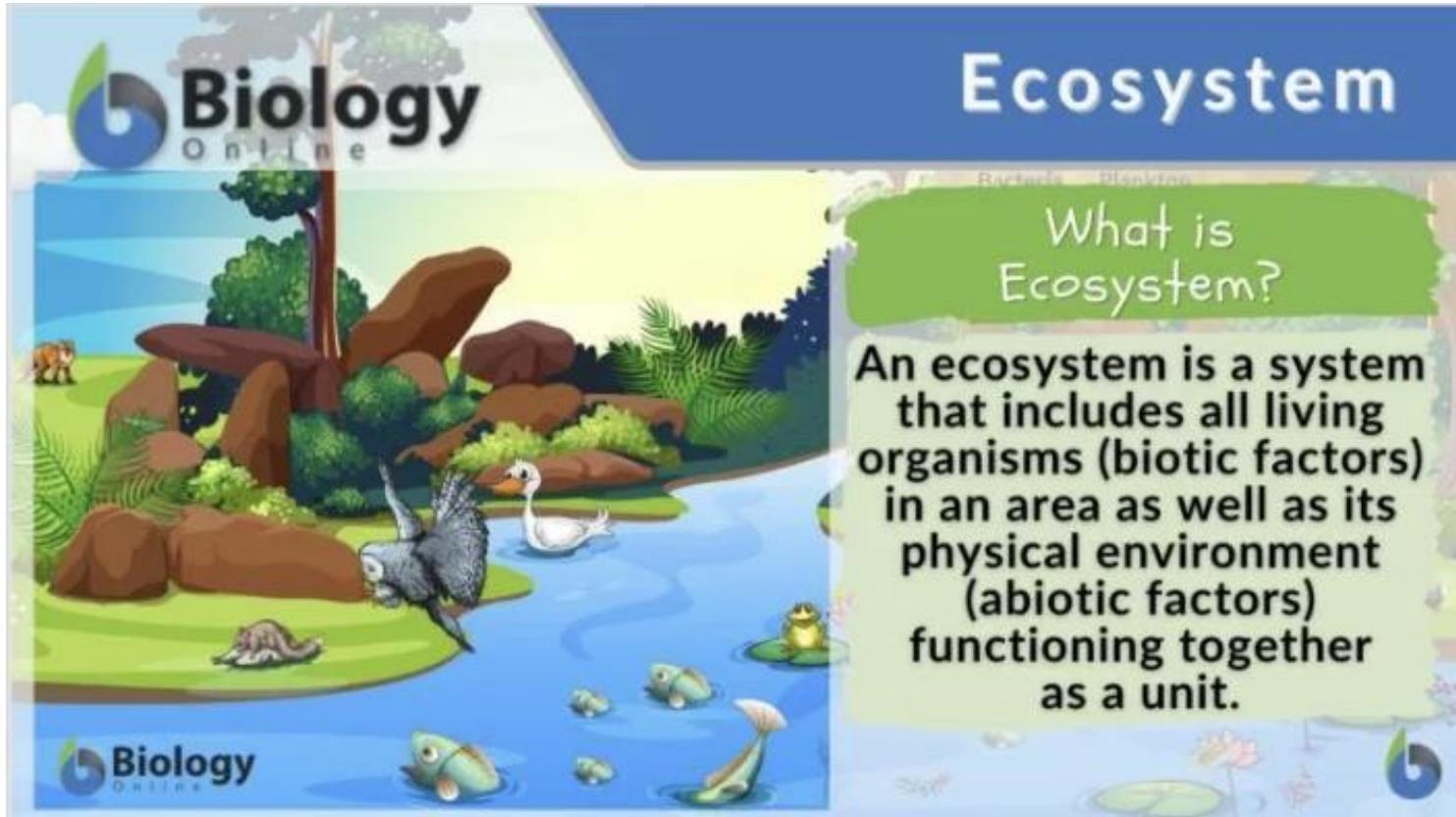


Our machine learning model can accurately predict the total microbial load.

What You Should Know

- We applied two new techniques:
 - 1) Absolute abundance (as opposed to relative abundance)
 - 2) Total microbial load, e.g. how many microbes are in the gut overall
- Bacteria associated with Parkinson's tend to be **depleted**, more so than enriched.
- People with Parkinson's disease have **fewer** gut bacteria overall.

Why It Matters: Where we go from here



Biology
Online

Ecosystem

What is Ecosystem?

An ecosystem is a system that includes all living organisms (biotic factors) in an area as well as its physical environment (abiotic factors) functioning together as a unit.

Biology
Online

The slide features a colorful illustration of a pond ecosystem with a tiger, a bird, a swan, a turtle, and various fish. The text is presented in a green, torn-paper style box.



Questions?

