Parkinson's & Gut Health- your microbiome

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Centre of Research Excellence in Digestive Health

In partnership with our community

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

NSW GOVERNMENT Health Hunter New England Local Health District

HMRI Hunter Medical Research Institute

NHMRC Centre of Research Excellence in Digestive Health

ira Australian Gastrointestinal Research Alliance

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

@CREDigestHealth

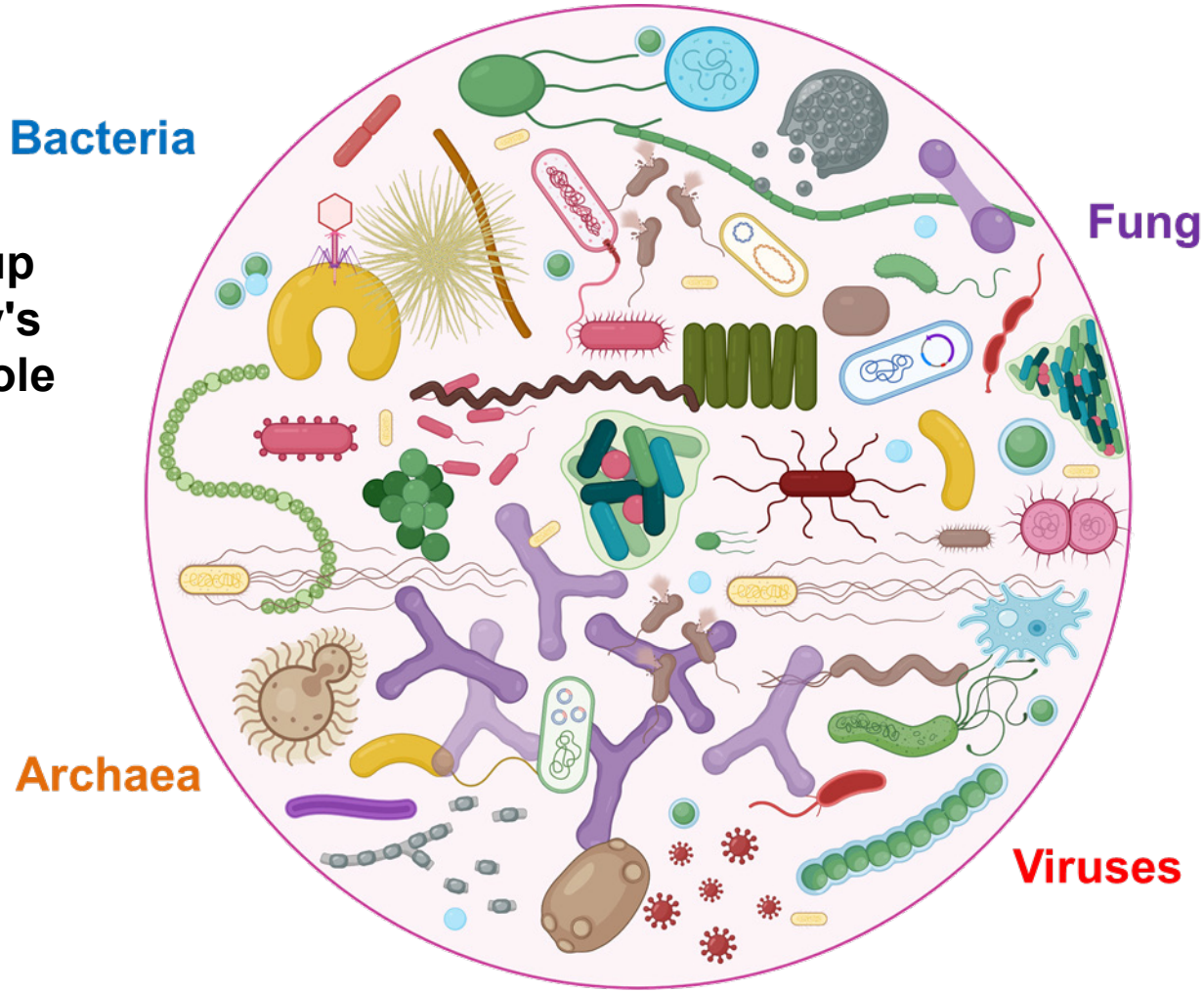
Acknowledgement of country

We would like to begin by acknowledging that this meeting is being held on the traditional lands of the Awabakal peoples and pay our respects to them and their Elders past, present, and emerging.

We extend that respect to Aboriginal and Torres Strait Islander peoples viewing today

The Microbiota

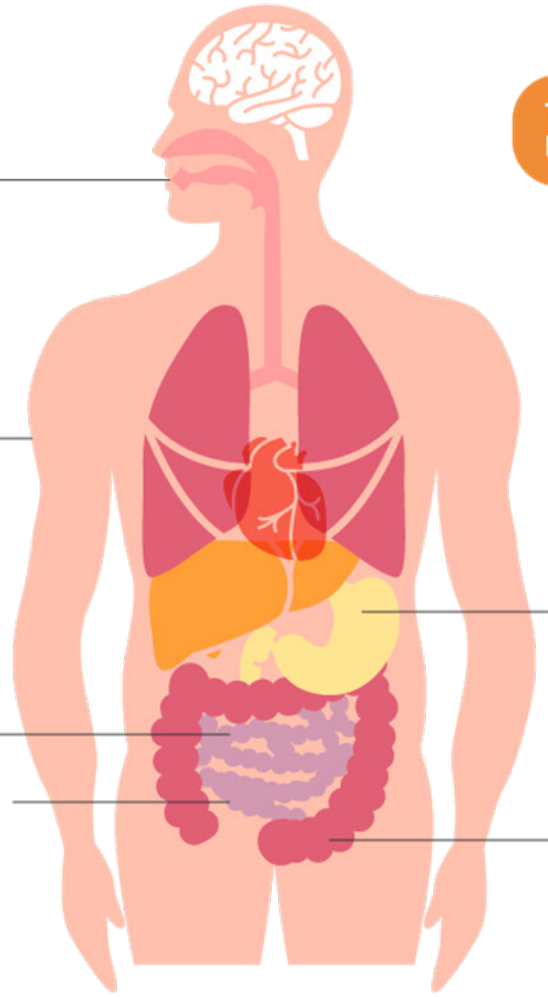
Our microbiota make up about 1-3% of the body's mass, and play a vital role in human health



The microbiome is about 150x bigger than the human genome

Created with BioRender.com

What is the gut microbiota?



Dental Plaque/Saliva
10^{11} - 10^{12} cells
Streptococcus spp
Actinomyces spp
Prevotella spp

Skin
10^{11} cells
Staphylococcus spp
Corynebacterium spp
Propionibacterium spp

Upper Small Intestine
10^{7} cells
Streptococcus spp
Lactobacillus spp
Veillonella spp

Lower Small Intestine
10^{11} cells
Streptococcus spp
Bacteroides spp
Prevotella spp

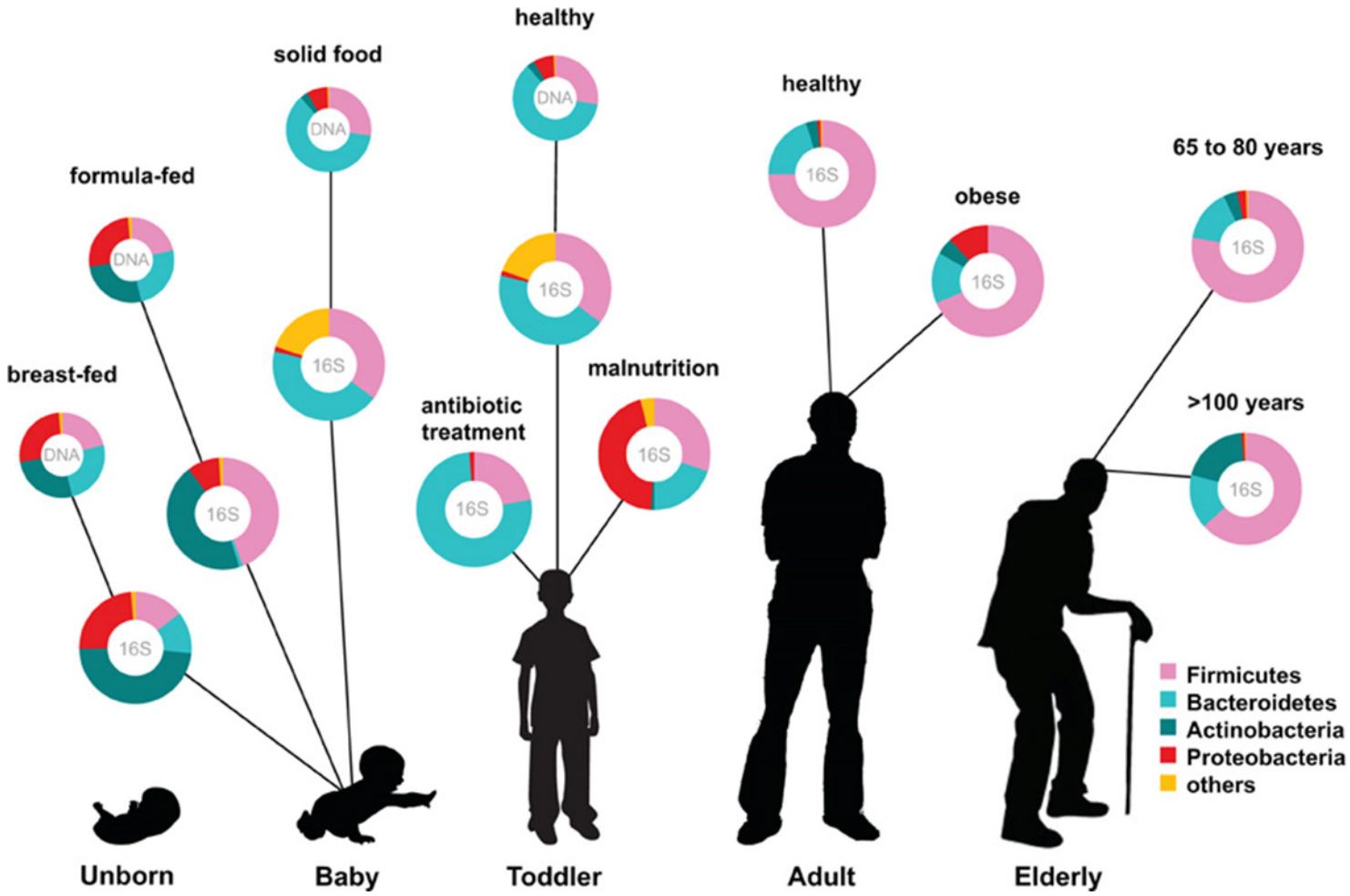
The large intestine houses the highest number of bacterial cells

Stomach
10^{7} cells
Streptococcus spp
Prevotella spp
Helicobacter pylori

Large intestine
10^{14} cells
Bacteroides spp
Ruminococcus spp
Prevotella spp

Gut microbiota and ageing

- Types and amounts of bacteria in the gut change as we age
- Certain bacteria are associated with age-related disease
- Mediterranean diet may ↑ healthy bacteria in older adults
- ↑ healthy bacteria associated with improved bone strength, cognitive function and memory and ↓ inflammation



Source: Ottman *et al.* (2012)

Chronic diseases *linked to* the gut microbiota

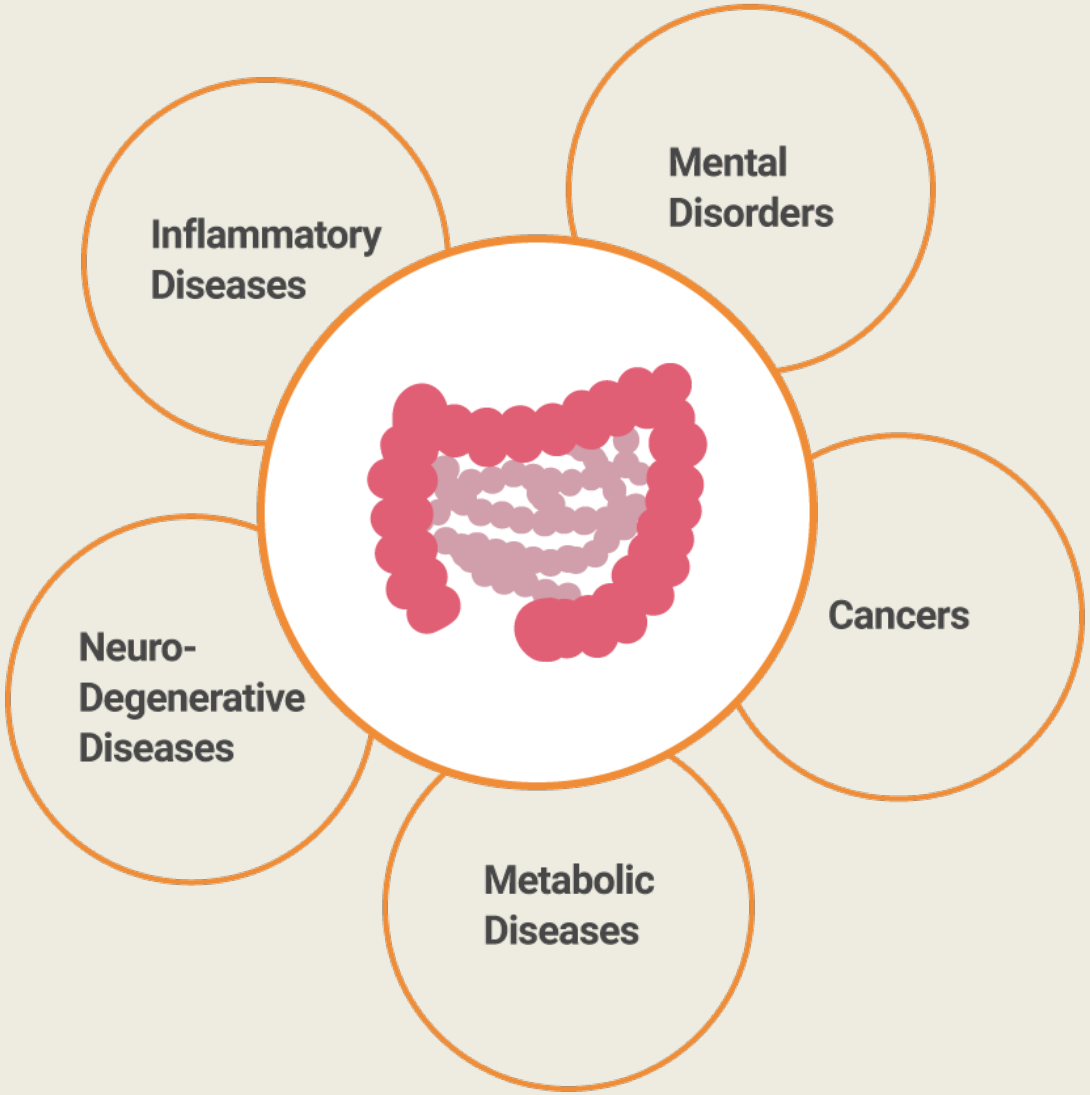
Inflammatory: Crohn's disease, ulcerative colitis, arthritis, asthma, multiple sclerosis

Metabolic: diabetes (T1 and T2), obesity, cardiovascular, NAFLD

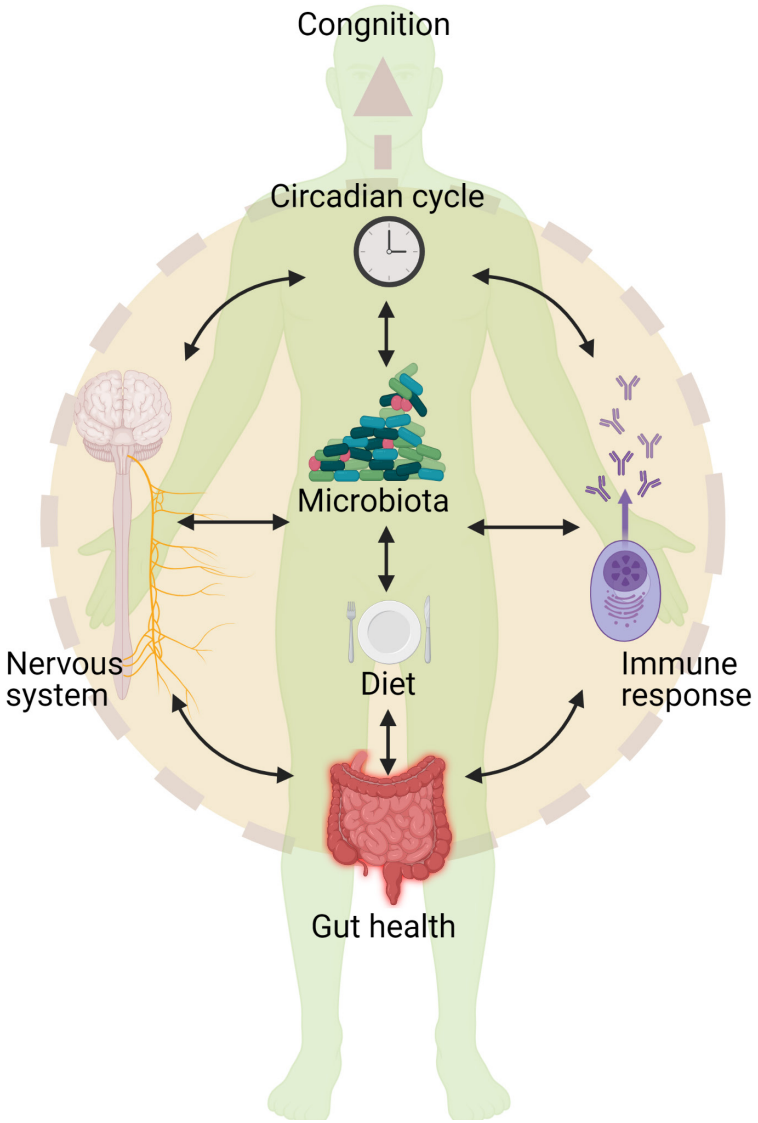
Cancers: colon, stomach, pancreatic, skin, prostate

Neurodegenerative: Parkinson's, Alzheimer's

Mental: depression, anxiety, PTSD, ADHD, schizophrenia



Pathways from the gut to the brain



Microbiome is a key regulator

- Affects digestion
- Responds to diet
- Interacts with host immunity
- Metabolises neurotransmitters
- Metabolises sleep hormones

The immune system in the gut

- Immune system evolves in conjunction with microbiota from birth → maintains healthy balance in the gut
- Particularly important in the gut, given regular exposure to potential threats (foods, pathogens etc)
- Alterations in the immune system influence the microbiota and vice versa
- We know ageing impacts the function and capability of the immune system → better understanding of how the immune system and microbiota interact may allow us to target this

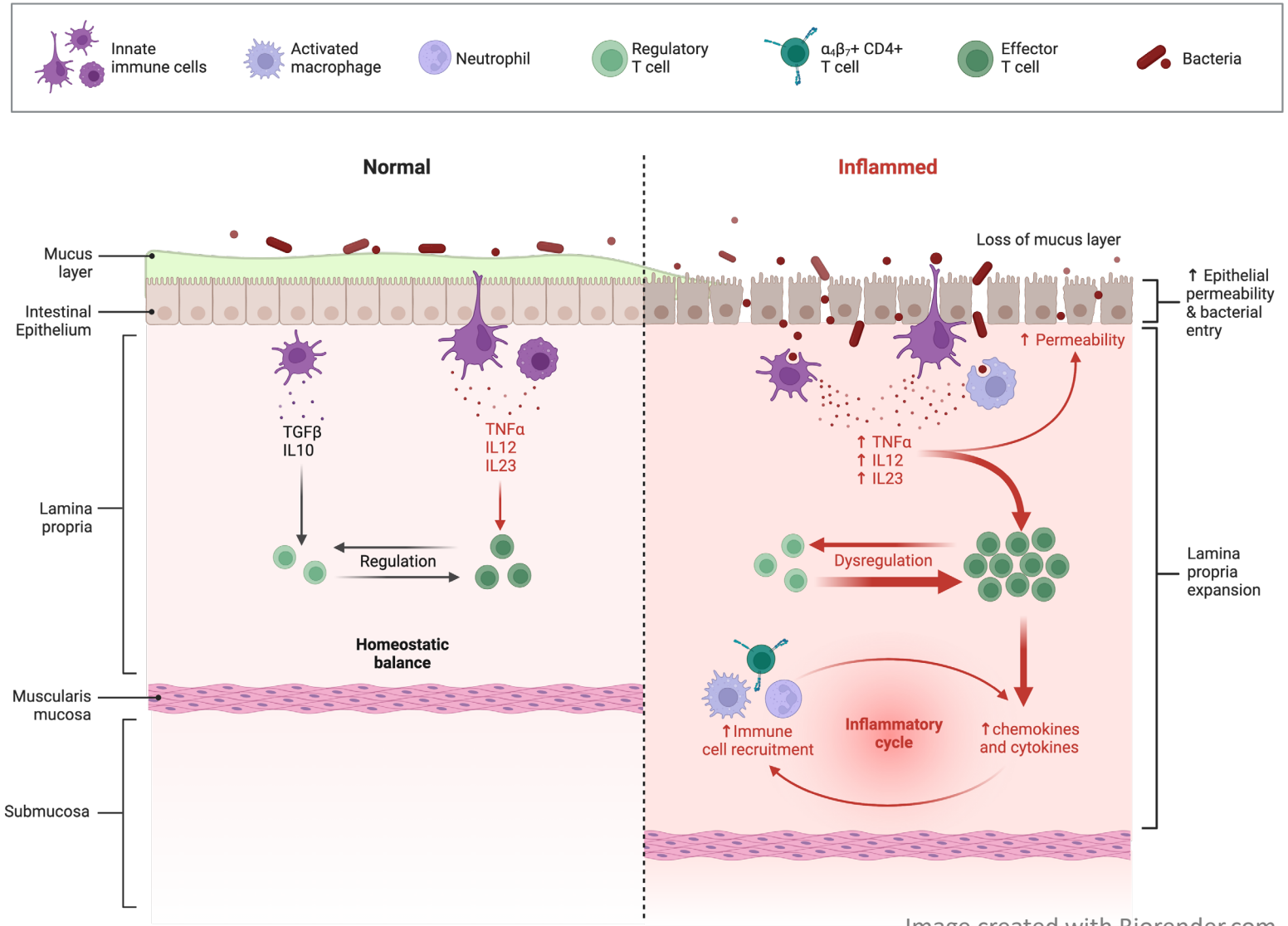
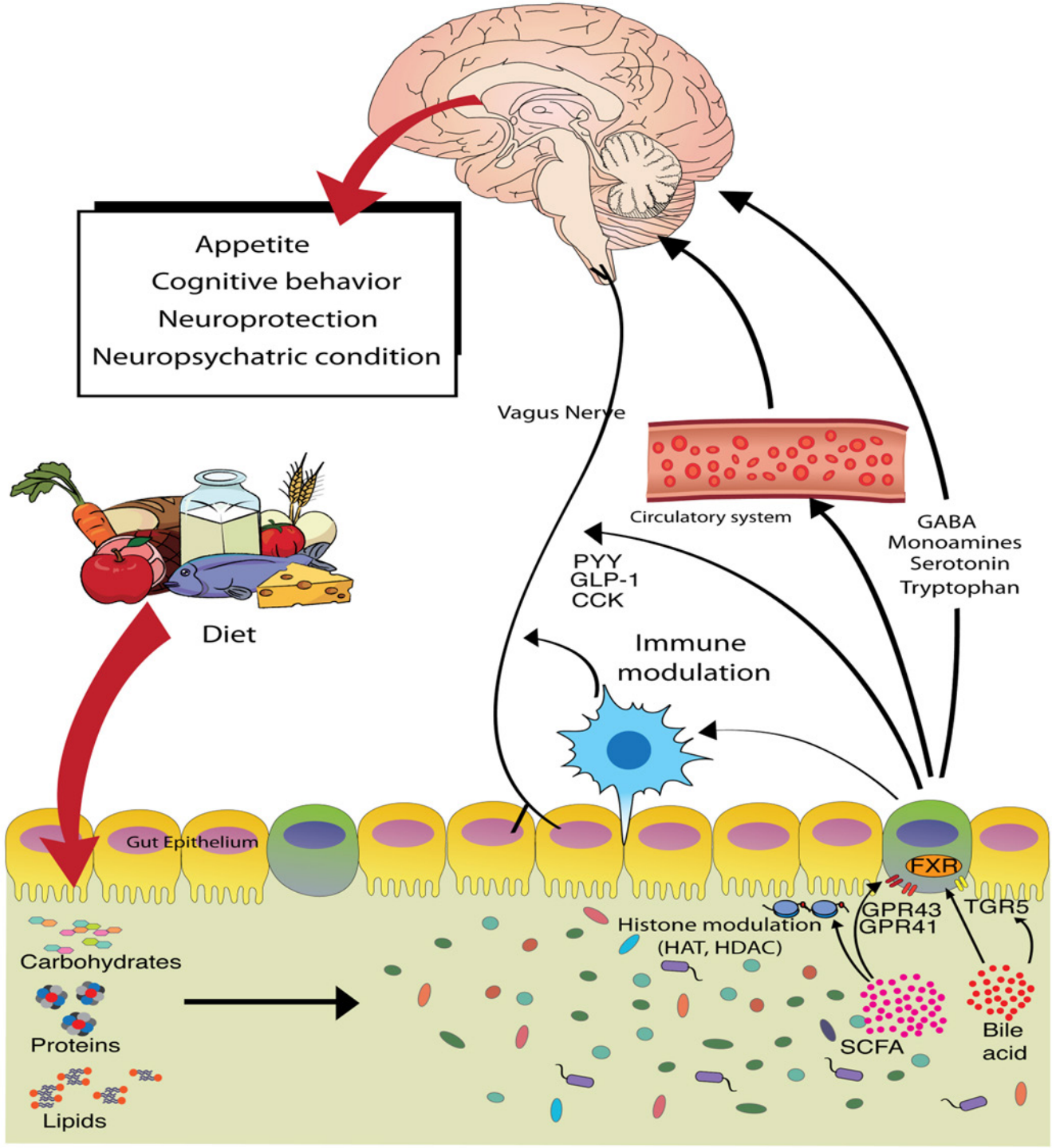


Image created with Biorender.com

Gut brain axis (GBA)

- Undigested food available to gut bacteria
- SCFAs signal cells in intestinal lining and internal body systems
- SCFAs and bile acids modulate gut hormones, satiety and immune responses



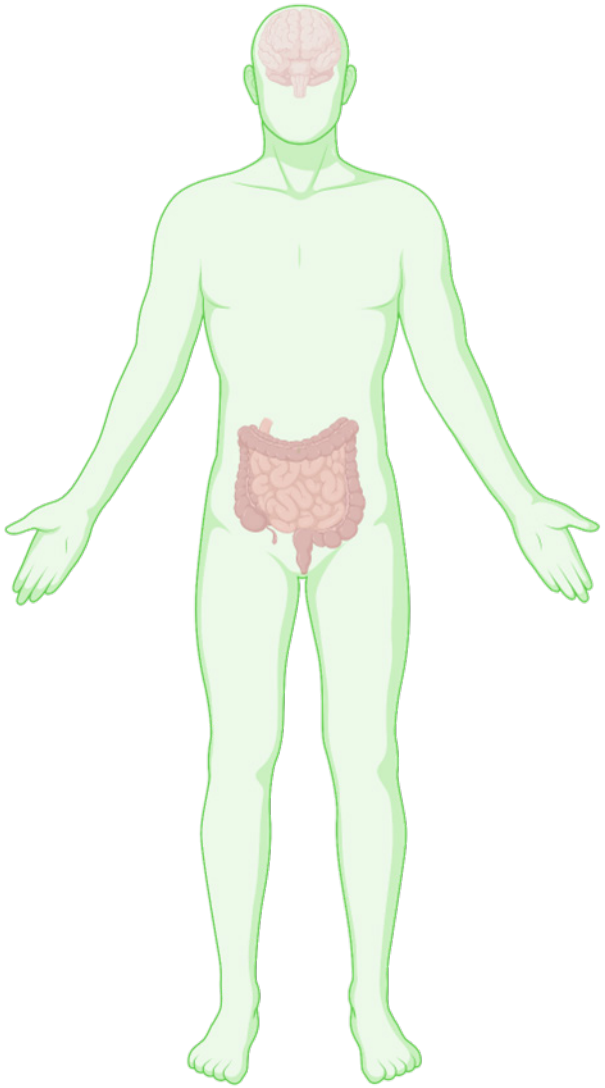
Sandhu, K.V., et al (2017)

Environmental factors that affect the microbiota

Unhelpful	Helpful
Caesarean section birth	Birth canal delivery
Lots of antibiotics in childhood	Minimal antibiotics in childhood
Very clean early life environment	Plenty of dirt to play in
Little contact with animals in early life	Lots of contact with animals in early life
Diet high in processed food (child)	Varied diet, low processed food (child)
Diet high in processed food (adult)	Varied diet, low processed food (adult)
High anxiety or stress	Low anxiety, low perceived stress
Gut bugs or parasite from travel	Minimal travel / no parasites

What can we control

Diet

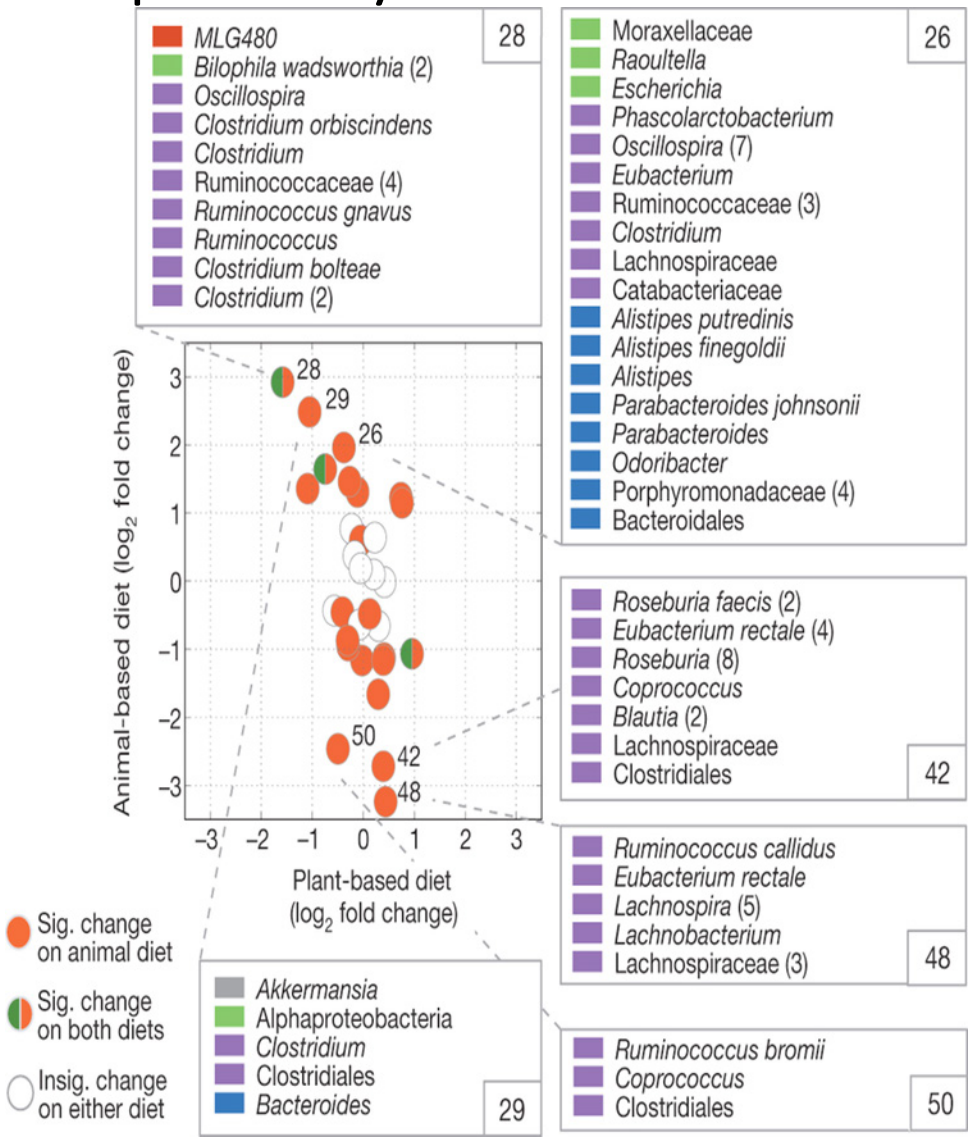


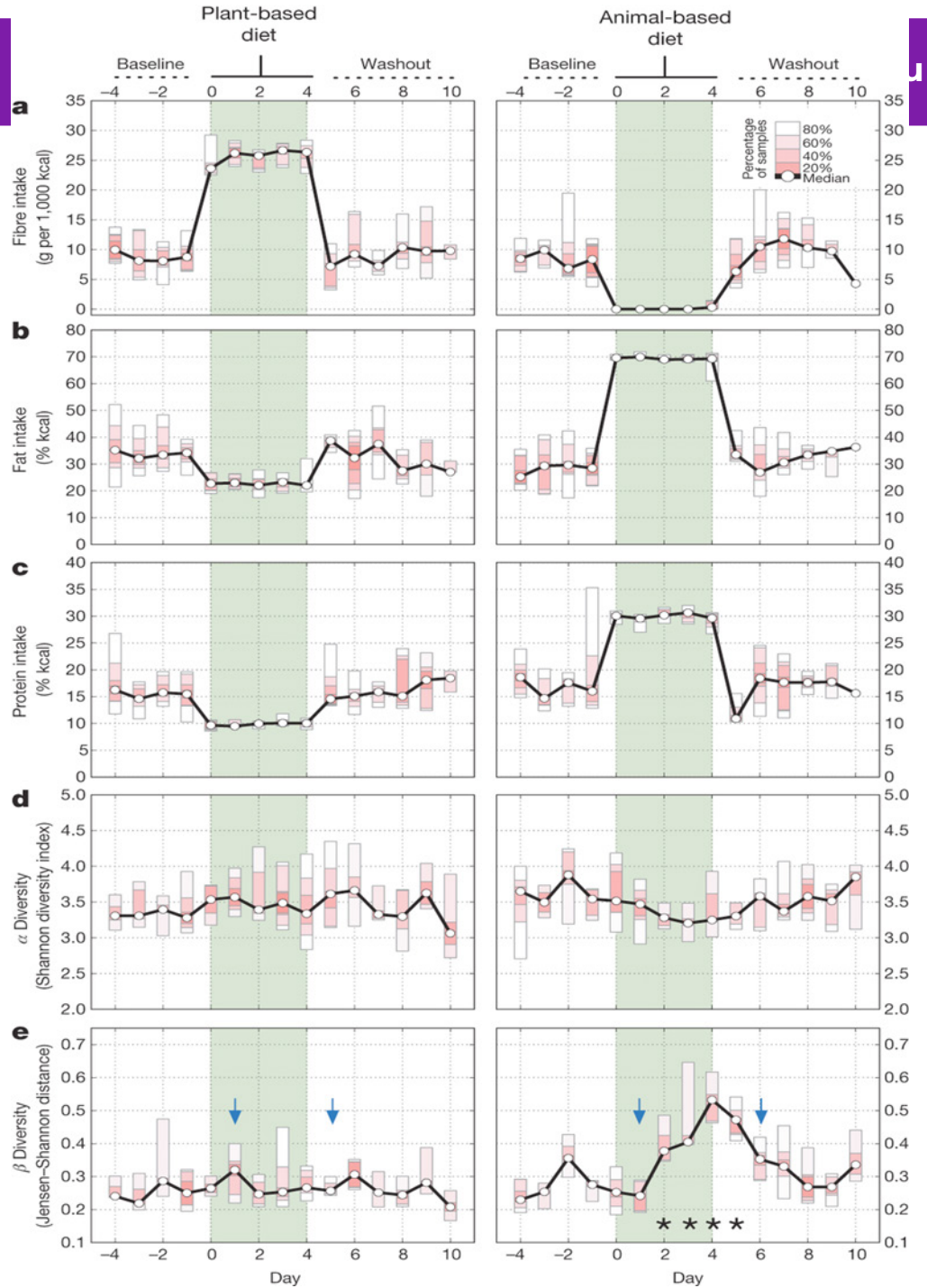
Supplements and drugs

Exercise

Sleep

Diet Rapidly and Reproducibly Alters the Human Gut Microbiome





David LA, et al. Nature. 2014;505:559-563

Digestion 101

MIXING, MULCHING

ABSORBING NUTRIENTS

FERMENTING - FEEDING BACTERIA

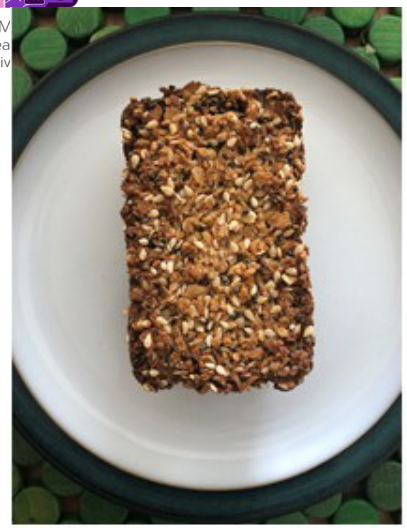
Digestion - what gets absorbed ?

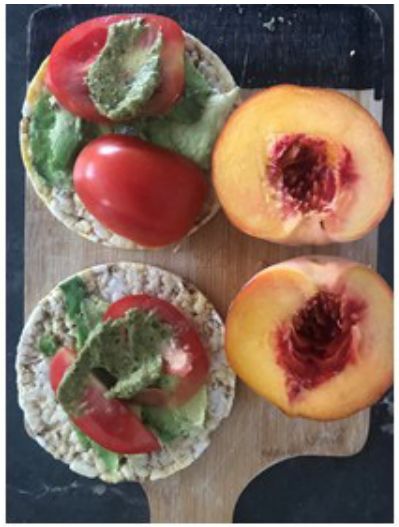
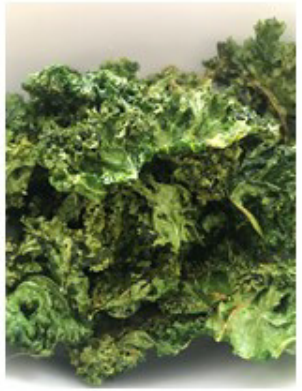
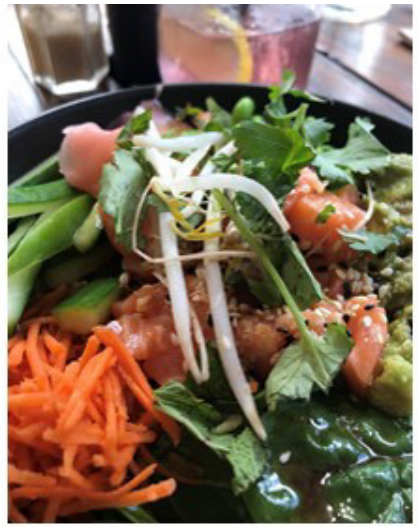
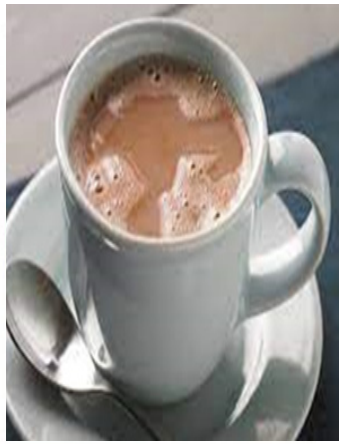
DIGESTIVE SYSTEM → **What is undigested?**

glucose
galactose
fructose

amino
acids

fatty acids



Fibre filled days = 40 grams of fibre





Fibre types

- ’Keep things moving’ fibre - fruits, vegetables, grains (e.g. All Bran)
- ‘Bulking’ soluble fibres
- FODMAPs
- ‘Resistant’ starches
  - ✓ ‘Hard to access’ (eg. grains, legumes)
  - ✓ ‘Cooked & cooled’ (eg. potato salad)
  - ✓ ‘Hard to break down’ (eg. unripe bananas)
  - ✓ ‘Novel fibre’ (high fibre, white bread)

Mediterranean Diet

- Rich in wholegrains, dairy, fruit and vegetables
- Legumes weekly
- >2 serves of oily fish, >2 eggs and >2 handfuls of nuts weekly
- Focus on lean meats or poultry
- Cook with olive oil
- Limit alcohol to 2 glasses/day (preferably red wine)
- Limited salt and sweets

Probiotics – do they work?

Commercial supplements

FERMENTED VEGETABLES: KIMCHI, SAUERKRAUT

FERMENTED LEGUMES: TEMPEH, MISO

FERMENTED MILKS, AGED DAIRY FOODS

FERMENTED DRINKS: KOMBUCHA, KEFIR

- Are probiotic strains helpful?
- What else is in fermented foods?
- Do probiotics survive and ‘stick’?
- What about supplements?

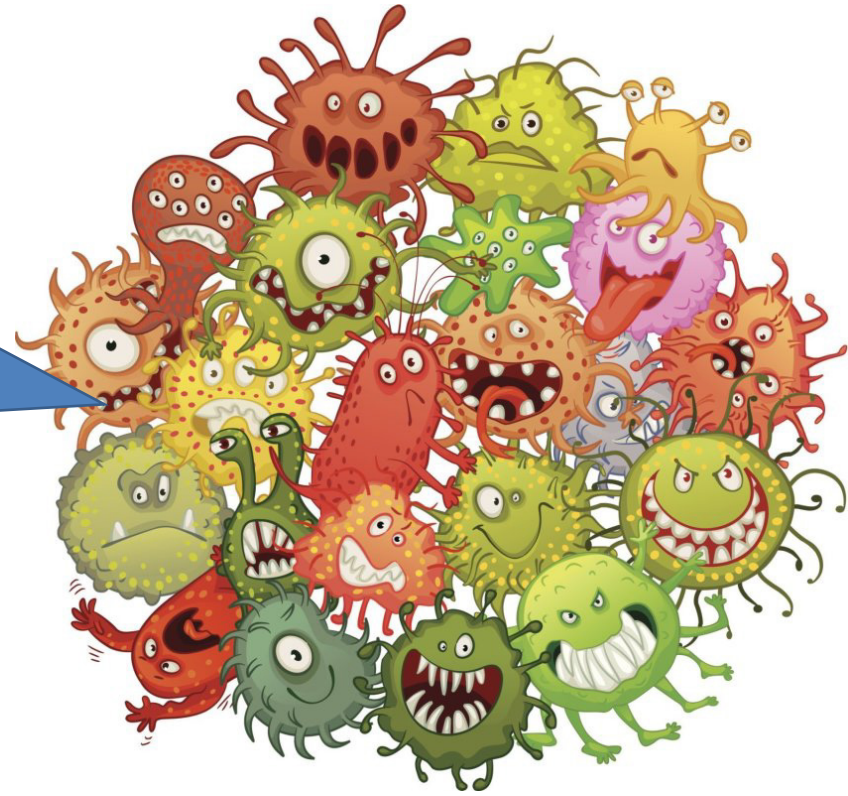
Microbiome – we now know….

- Links to mental wellbeing and neurodegenerative disorders
- Cancer prevention role – microbial by-products (SCFAs: i.e., butyrate)
- Research into chronic disease and obesity
- Links between fibre and fermentation
- Negative impact of sugar, processed foods
- Long term low FODMAP NOT recommended

Put it into practice – find your healthy gut

- Feeding your resident microbes, the best quality nutrients
- Increase amount and variety of fibres
- Prebiotics and probiotics
- Consult with a qualified dietitian
- Avoid overuse of antibiotics
- Lower stressors
- Regular exercise

What you can do to help us



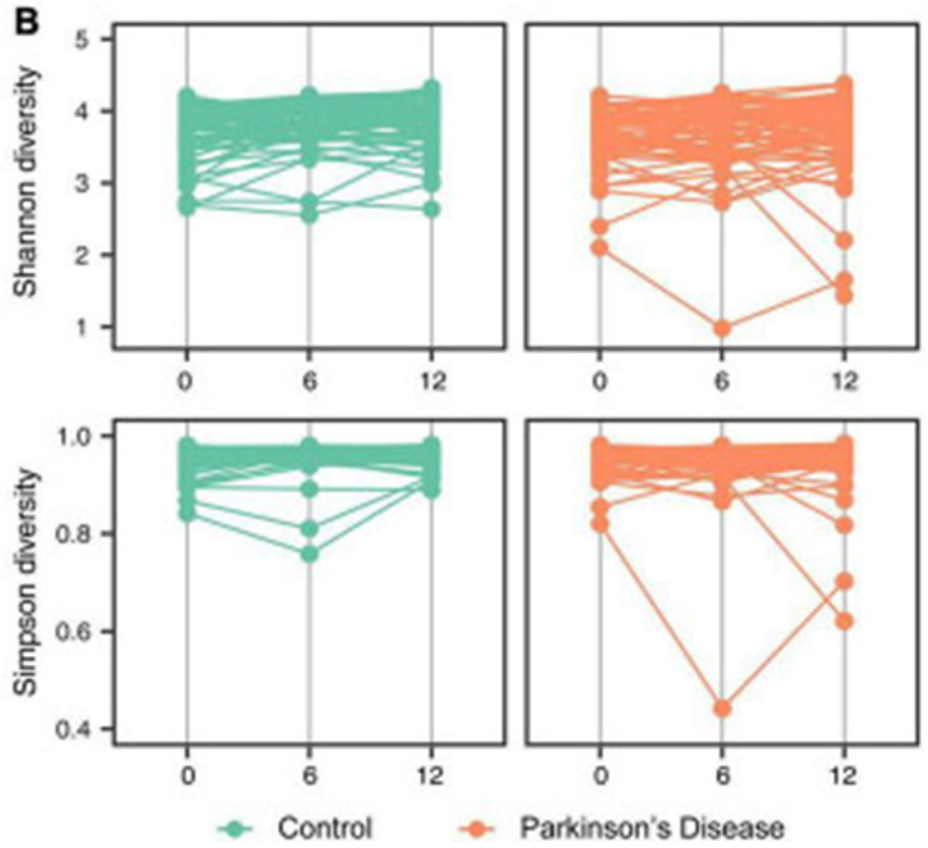
Our work at HMRI: Parkinson's Disease

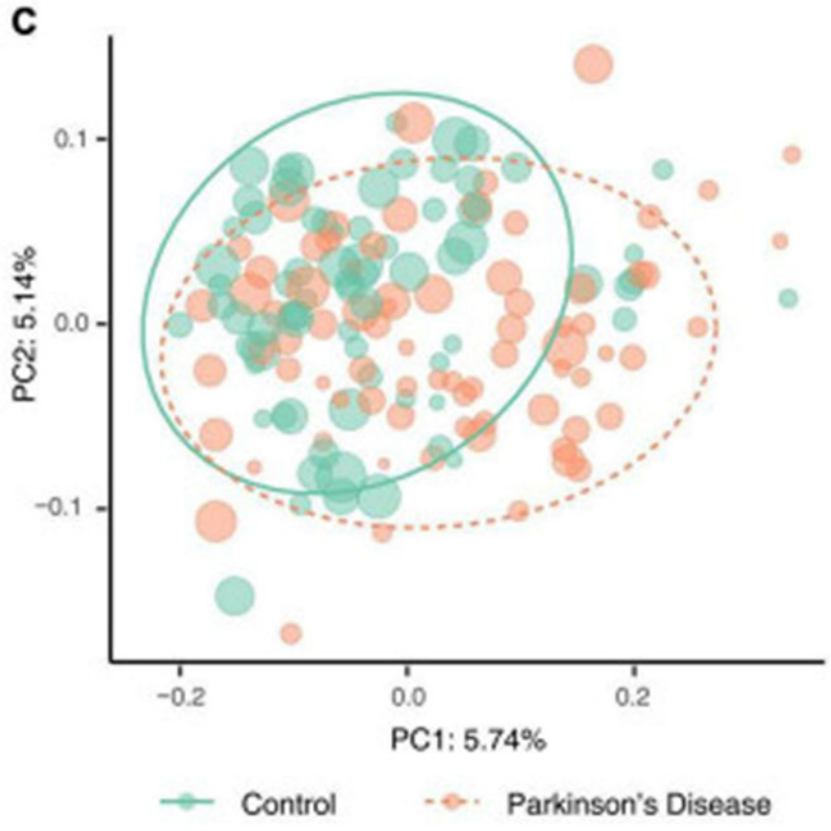
- Parkinson's disease is an unexplained neurodegenerative disease with symptoms including tremors, slowed movement, rigidity and often dementia

- Early signs of Parkinson's include impaired taste/smell, fatigue, sleep disturbances and gastrointestinal dysfunction

- Altered gut microbiome profiles have been observed in Parkinson's and associated with symptom profiles

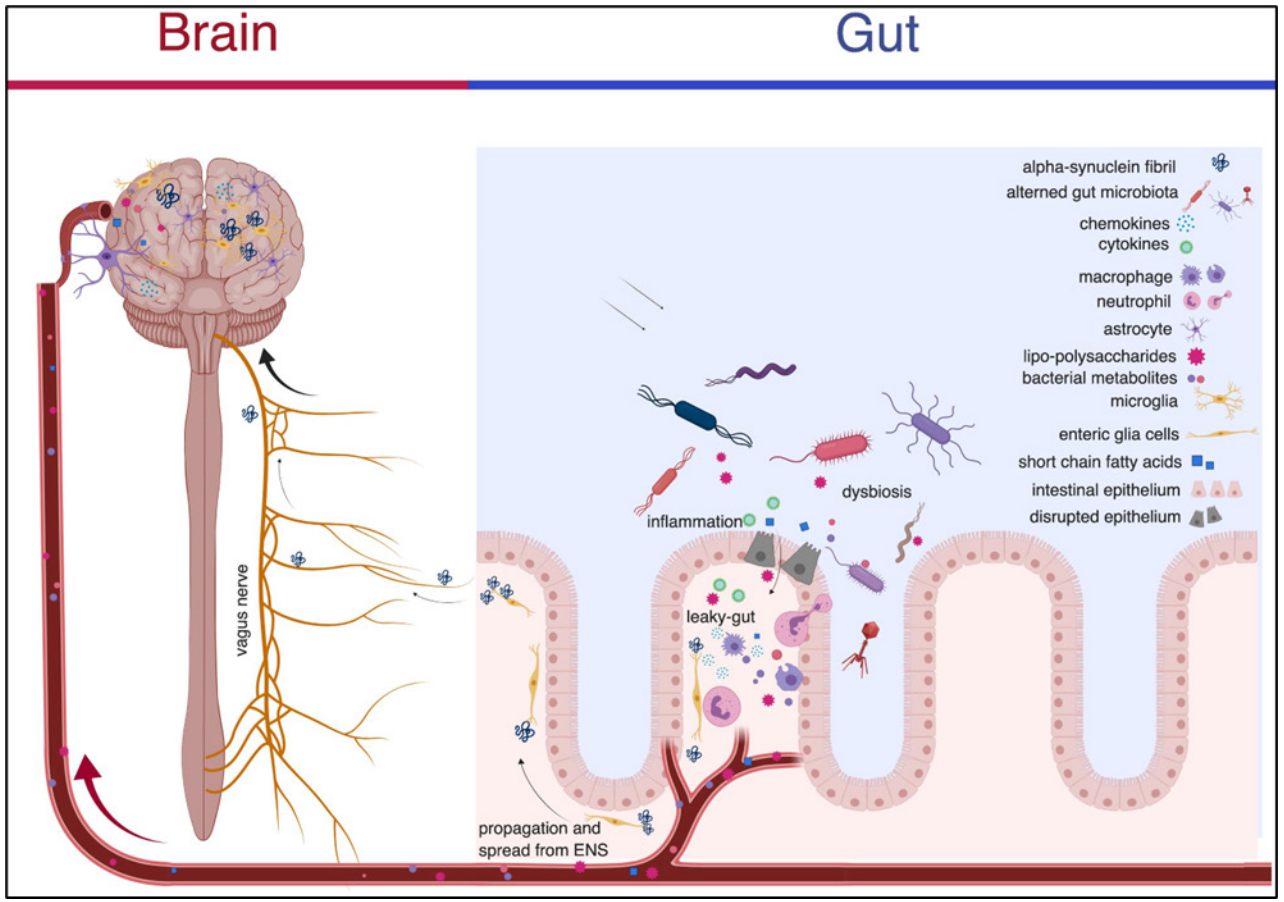
Alterations to gut microbiota in Parkinson's





Lubomski, *et al.* (2022) Frontiers in Ageing Neuroscience

The immune system in Parkinson's



Fitzgerald et al (2019) Frontiers in Neurosci.

- There is evidence of dysregulation in the gut immune system in Parkinson's patients
- Higher levels of a misfolded protein (Alpha-synuclein), associated with Parkinson's, have been shown in the gut of Parkinson's patients compared with healthy controls
- Experimental work has shown immune cells exhibit a response when introduced to this protein → could an inappropriate immune response contribute to Parkinson's disease?

Our research into gut-immune-brain axis in Parkinson's disease

- Investigating if there is a specific immune cell signature in the blood of patients that may link to the gut dysfunction reported by Parkinson's patients that is not seen in healthy individuals

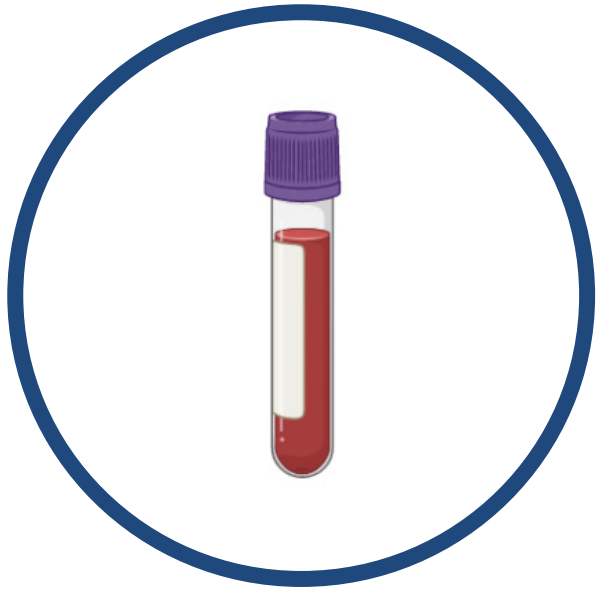
- Examining the oral and stool microbiomes from people with and without Parkinson's to determine if there is a specific microbiome signature for Parkinson's

- Then we would aim to investigate the relationships between our immune cell and microbiome profiles between PD and health, **with the overall hope of identifying targets for inhibiting the progression of Parkinson's Disease**

Our research into gut-immune-brain axis in Parkinson's disease

20 Parkinson's patients

20 healthy controls



Something for everyone

Healthy controls 'cast iron' guts

Gut brain axis (GBA) sleep, stress, anxiety, Parkinson's, medication

BIOBANK

- Eosinophilic disorders
- Microbiome in fatty liver
- Colonic spirochaetes
- Coeliac disease
- Diet is Crohn's
- Prebiotics for IBS

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www.digestivehealth.org.au

We will return for a panel session after break

Laureate Professor Nicholas Talley (Gastroenterologist)

Dr Emily Hoedt (Microbiologist)

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