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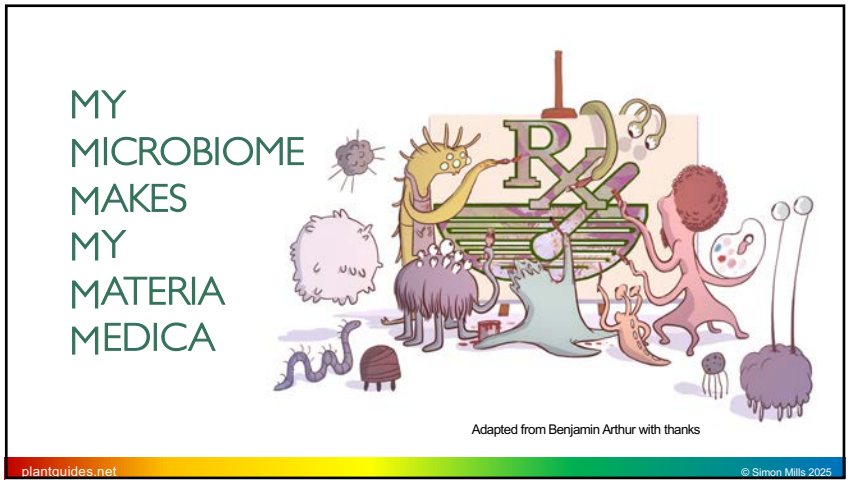

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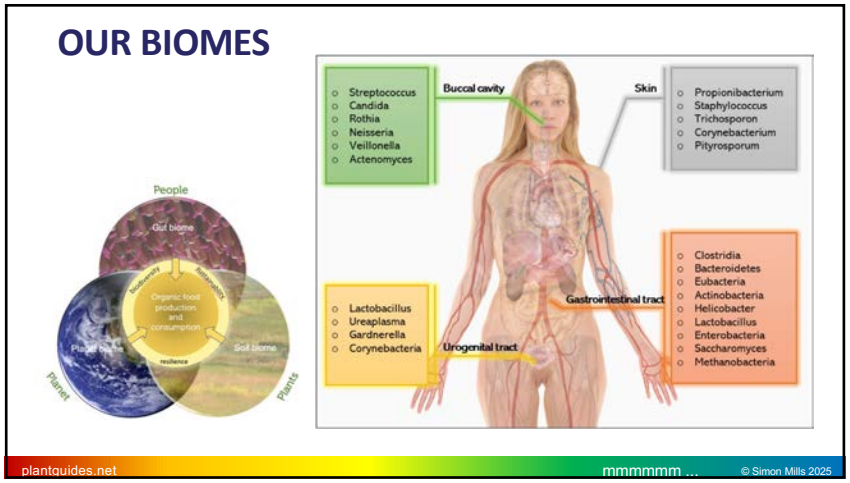

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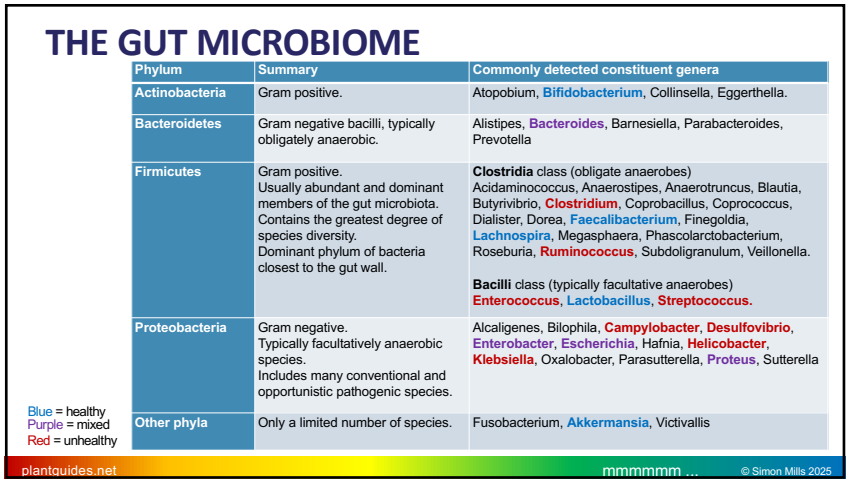
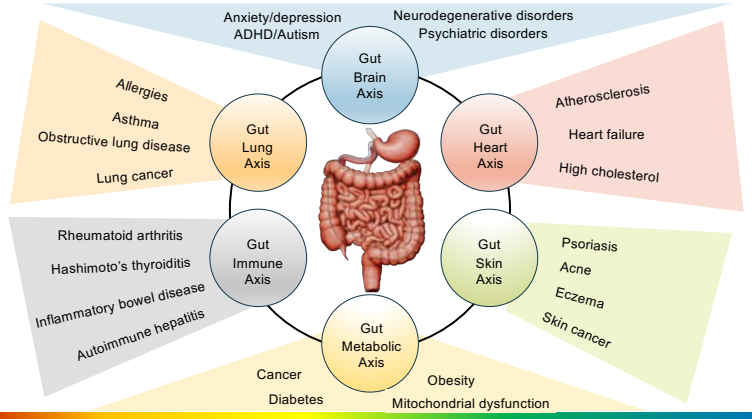


Phylum	Summary	Commonly detected constituent genera
Actinobacteria	Gram positive.	Atopobium, **Bifidobacterium**, Collinsella, Eggerthella.
Bacteroidetes	Gram negative bacilli, typically obligately anaerobic.	Alistipes, **Bacteroides**, Barnesiella, Parabacteroides, Prevotella
Firmicutes	Gram positive. Usually abundant and dominant members of the gut microbiota. Contains the greatest degree of species diversity. Dominant phylum of bacteria closest to the gut wall.	**Clostridia** class (obligate anaerobes) Acidaminococcus, Anaerostipes, Anaerotruncus, Blautia, Butyrivibrio, **Clostridium**, Coprobacillus, Coprococcus, Dialister, Dorea, **Faecalibacterium**, Finegoldia, **Lachnospira**, Megasphaera, Phascolarctobacterium, Roseburia, **Ruminococcus**, Subdoligranulum, Veillonella. **Bacilli** class (typically facultative anaerobes) **Enterococcus**, **Lactobacillus**, **Streptococcus.**
Proteobacteria	Gram negative. Typically facultatively anaerobic species. Includes many conventional and opportunistic pathogenic species.	Alcaligenes, Bilophila, **Campylobacter**, **Desulfovibrio**, **Enterobacter**, **Escherichia**, Hafnia, **Helicobacter**, **Klebsiella**, Oxalobacter, Parasutterella, **Proteus**, Sutterella
Other phyla	Only a limited number of species.	Fusobacterium, **Akkermansia**, Victivallis

4

THE GUT AT THE CORE



5

For example:

OUR MICROBIOMES MAY DETERMINE OUR PAIN!

A new study adds to what has been emerging in the literature —that there appear to be gut microbiome "signatures" for various pain conditions.

In studies in two continents the gut microbiome was shown to reflect who had fibromyalgia and other complex pain syndromes, and who did not, with about a 90% accuracy.

in a pilot clinical study, transplanting microbiota from healthy donors led to a reduction in pain and other symptoms in women with treatment-resistant fibromyalgia. Two species, *Dialister succinatiphilus* and *Phascolarctobacterium faecium* – were enriched in patients with pain syndromes, while three — *Ligilactobacillus salivarius, Bifidobacterium dentium,* and *Bifidobacterium adolescentis* were relatively predominant in controls.

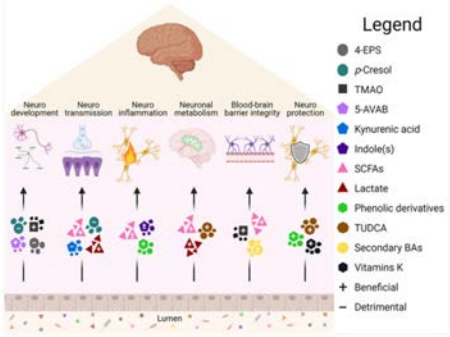
Levels of SCFA production were inversely associated with pain symptoms.

Gonzalez E, Sahar T, Haddad M, et al. (2025) Altered Gut Microbiome Composition and Function in Individuals with Complex Regional Pain Syndrome. *Anesthesiology.*143(1): 142-155. PMID: **40042519**

6

MY MICROBIOME DOES TUNE MY BRAIN

We really do have gut feelings!



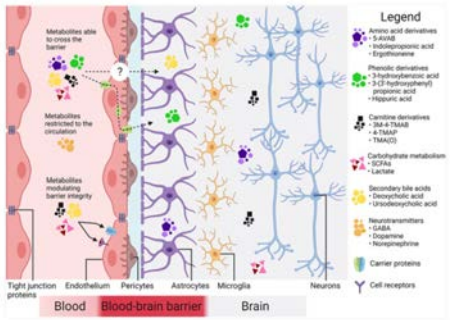
In the intersection of the gut–brain axis signaling: Selected microbiota metabolites and associated neurological functions.

Ahmed H, Leyrolle Q, Koistinen V, et al. (2022) Microbiota-derived metabolites as drivers of gut-brain communication. *Gut Microbes.* 14(1): 2102878. PMID: **35903003**

7

MY MICROBIOME DOES TUNE MY BRAIN

The connections are tangible



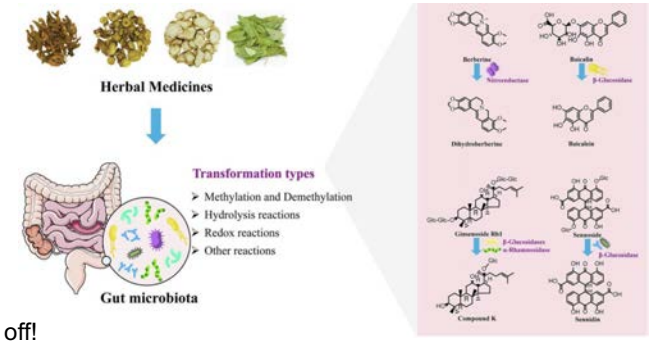
The integrity and selectivity of the blood–brain barrier in terms of microbial metabolites.

Ahmed H, Leyrolle Q, Koistinen V, et al. (2022) Microbiota-derived metabolites as drivers of gut-brain communication. *Gut Microbes.* 14(1): 2102878. PMID: **35903003**

8

We now know

OUR MICROBIOMES ALSO TRANSFORM OUR MATERIA MEDICA

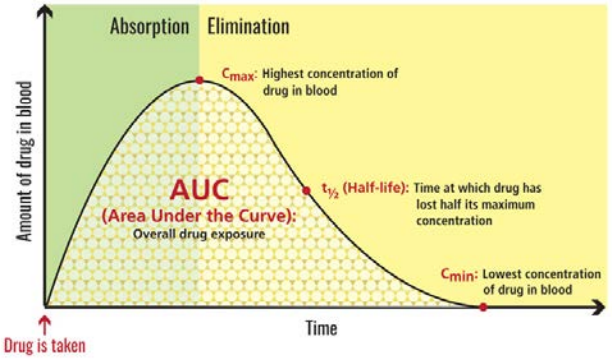


It's all kicking off!

Chen Y, Lei Z, Gu D, et al. (2025) Gut microbiota: A potential enhancing factor for the therapeutic efficacy of bioactive compounds in herbal medicines. *Fitoterapia*. 183: 106570. PMID: **40288589**

9

A PHARMACOKINETICS 101



NIH

10

MICROBIAL CONVERSION OF TERPENOIDS

Constituent	Herb	Processes	Microbiota	Metabolites	Chnge:
Ginsenoside Rb_1	*Panax ginseng*	deglycosylation	*Bifidobacterium* *Eubacterium* *Bacteroides* *Fusobacterium*	ginsenosides Rd, F2, gypenoside XVII, compound K, 20(S)-protopanaxadiol	AUC, Cmax ↑ Bioavailability ↑ Anti-cancer ↑ Anti-aging ↑
Ginsenoside Re	*Panax ginseng*	deglycosylation	*Bacteroides*	ginsenosides Rg_1, 20(S)-Rg_2	Bioavailability↑ Anti-aging↑ Neuroprotection↑
Glycyrrhizin	*Glycyrrhiza spp*	deglycosylation dehydrogenation	*Eubacterium* *Streptococcus*	glycyrrhetic acid monoglucuronide, glycyrrhetinic acid, 3-oxo-glycyrrhetinic acid	Bioavailability ↑ Antihepatotoxicity↑ Antiviral↑
Saikosaponins	*Bupleurum spp*	deglycosylation	*Bifidobacterium*	prosaikogenins saikogenins	Bioavailability ↑ Antidepressant↑ Hepatotoxicity ↓

Chen Y, Lei Z, Gu D, et al. (2025) Gut microbiota: A potential enhancing factor for the therapeutic efficacy of bioactive compounds in herbal medicines. *Fitoterapia*. 183: 106570. PMID: **40288589**

11

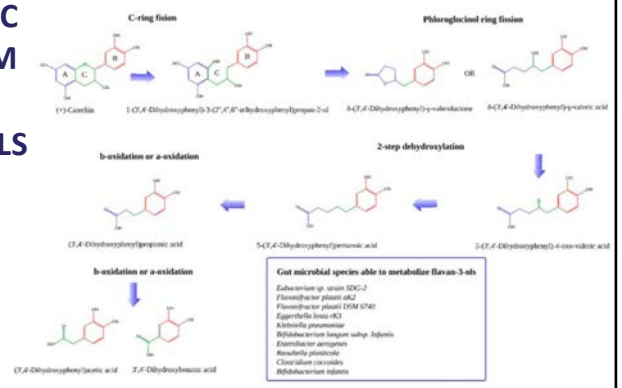
MICROBIAL CONVERSION OF FLAVONOIDS

Constituent	Herb	Processes	Microbiota	Metabolites	Change
rutin	*Ruta graveolens*	deglycosylation, ring fission	*Bifidobacterium* *Bacteroides* *Fusobacterium* *Eubacterium* *Streptococcus* *Lactobacillus*	quercetin, 4-hydroxybenzoic acid; 3,4-dihydroxybenzoic acid; 3,4-dihydroxyphenylacetic acid	AUC, Cmax↑ bioavailability ↑ antioxidant ↑
catechin	*Camellia sinensis*	ring fission	*Streptococcus* *Lactobacillus* *Bifidobacterium*	4-hydroxybenzoic acid, 2,4,6-trihydroxybenzoic acid, phloroglucinol, 4-methoxysalicylic acid	anti-platelet ↑ anti-tumour ↑
baicalin	*Scutelleria baicalensis*	deglycosylation methylation hydroxylation	*Coryneum* *Chaetomium* *Escherichia coli*	baicalein, oroxylin A, 4,5,6,7-tetrahydroxyflavone	AUC, Cmax↑ bioavailability ↑ anti-pruritic ↑ anti-inflammatory↑
wogonoside	*Scutelleria baicalensis*	deglycosylation	Various	wogonin	AUC, Cmax↑ bioavailability ↑ anti-inflammatory↑ anti-cancer↑

Chen Y, Lei Z, Gu D, et al. (2025) Gut microbiota: A potential enhancing factor for the therapeutic efficacy of bioactive compounds in herbal medicines. *Fitoterapia*. 183: 106570. PMID: **40288589**

12

MICROBIOTIC METABOLISM OF POLYPHENOLS



Pérez-Burillo S, Navajas-Porras B, López-Maldonado A, et al. (2021) Green Tea and Its Relation to Human Gut Microbiome. *Molecules.* 26(13):3907. PMID: **34206736**

13

MICROBIOTIC METABOLISM IS VARIABLE

Intraindividual variation in the composition of the microbiota may result in large interindividual variations in effectiveness of plant constituents.

Anthocyanins

Dihydroxylation or decarboxylation yields a plethora of phenolic derivatives such as protocatechuic acid, vanillic acid, caffeic acid, phloroglucinaldehyde, syringic acid and ferulic acid.

A preponderance of *Lactobacillus* and *Bifidobacterium* produce the highest levels of β-glucosidase and produce relatively large quantities of protocatechuic and ferulic acids. An increase in the proportion of *Actinomycetes* and *Bacillus*, which produce large amounts of β-d-glucuronidase increase the production and metabolism of vanillic acid.

Morris G, Gamage E, Travica N, et al. (2021) Polyphenols as adjunctive treatments in psychiatric and neurodegenerative disorders: Efficacy, mechanisms of action, and factors influencing inter-individual response. *Free Radic Biol Med.* 172:101-122. PMID: **34062263**

14

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This is a two-way conversation.
Anthocyanins elevate levels of Bifidobacterium, and also of *Roseburia, Eubacterium, Barnesiella, Collinsella and Lactobacillus*

Morris G, Gamage E, Travica N, et al. (2021) Polyphenols as adjunctive treatments in psychiatric and neurodegenerative disorders: Efficacy, mechanisms of action, and factors influencing inter-individual response. *Free Radic Biol Med.* 172:101-122. PMID: **34062263**

15

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Resveratrol

Three major metabolites are formed, dihydroresveratrol, 3,4′-dihydroxy-trans-stilbene and lunularin.

The microbiota of lunularin producers contains a higher abundance of *Bacteroidetes*, *Verrucomicrobia*, *Actinobacteria* and *Cyanobacteria* and a reduced *Firmicutes* population than individuals producing either dihydroresveratrol or a mixed metabolite population.

Morris G, Gamage E, Travica N, et al. (2021) Polyphenols as adjunctive treatments in psychiatric and neurodegenerative disorders: Efficacy, mechanisms of action, and factors influencing inter-individual response. *Free Radic Biol Med.* 172:101-122. PMID: **34062263**

16

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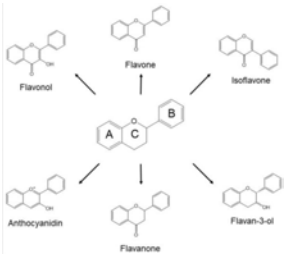
This is a two-way conversation.
A significant relative increase in the population of *Bacteriodetes* has been reported in overweight or marginally obese men following resveratrol supplementation at 80 mg/day over a 12-week period.

Morris G, Gamage E, Travica N, et al. (2021) Polyphenols as adjunctive treatments in psychiatric and neurodegenerative disorders: Efficacy, mechanisms of action, and factors influencing inter-individual response. *Free Radic Biol Med*. 172:101-122. PMID: **34062263**

17

POLYPHENOLS AND MICROBIOME CROSSTALK



Polyphenols interact with intestinal microbiota to activate SCFA production, intestinal immune function, and other protective physiological processes.

Kawabata K, Yoshioka Y, Terao J. (2019) Role of Intestinal Microbiota in the Bioavailability and Physiological Functions of Dietary Polyphenols. *Molecules*. 24(2): 370. doi: PMID: **30669635**.

The interaction between polyphenols and gut microbiota provides a credible explanation for the exceptional bioactivities of polyphenols.

Cheng H, Zhang D, Wu J, et al. (2023) Interactions between gut microbiota and polyphenols: A mechanistic and metabolomic review. *Phytomedicine*. 119: 154979. PMID: **37552899**

"*This interplay provides the central explanation as to the stupefying pleiotropic biological/clinical actions and functions of "parent" polyphenols even though their systemic bioavailability is incredibly limited*"

Koudoufio M, Desjardins Y, Feldman F, et al. (2020) Insight into Polyphenol and Gut Microbiota Crosstalk: Are Their Metabolites the Key to Understand Protective Effects against Metabolic Disorders? *Antioxidants (Basel)*. 9(10):982. PMID: **33066106**.

18

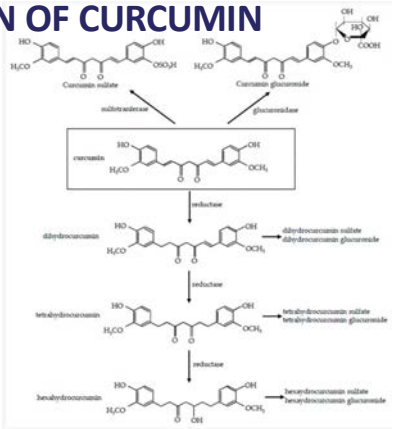
MICROBIAL CONVERSION OF CURCUMIN

E. coli metabolises curcumin initially producing dihydrocurcumin, which is then reduced to tetrahydrocurcumin.

Blautia spp. demethylate curcumin to produce two derivative molecules, demethylcurcumin and bis-demethylcurcumin.

Bifidobacteria, Lactobacillus, Enterococcus and also appear to play an important role in curcumin biotransformation and degradation.

Morris G, Gamage E, Travica N, et al. (2021) Polyphenols as adjunctive treatments in psychiatric and neurodegenerative disorders: Efficacy, mechanisms of action, and factors influencing inter-individual response. *Free Radic Biol Med*. 172:101-122. PMID: **34062263**



Scazzocchio B, Minghetti L, D'Archivio M. (2020) Interaction between Gut Microbiota and Curcumin: A New Key of Understanding for the Health Effects of Curcumin. *Nutrients*12(9): 2499. PMID: **32824993**

19

MICROBIAL CONVERSION OF ALKALOIDS

Constituent	Herb	Processes	Microbiota	Metabolites	Change:
berberine	*Berberis vulgaris*	reduction demethylation demethylenation	*Staph. aureus* *Enterococcus* *Enterobacter* *Escherichia coli,* *Pseudomonas* *Klebsiella* *Proteus mirabilis,* *Acinetobacter*	dihydroberberine thalifendine berberrubine jatrorrhizine demethyleneberberine	AUC, Cmax ↑ Bioavailability ↑ Hypoglycaemic ↑, Anti-inflammation ↑ Hepatoprotective ↑
aconitine	*Aconitum spp*	deacylation dehydration hydrolysis reduction	*Bacteroides*	lipoaconitine 14-benzoylaconine 14-benzoylmesaconine 14-benzoylhypaconine etc	Toxicity ↓

Chen Y, Lei Z, Gu D, et al. (2025) Gut microbiota: A potential enhancing factor for the therapeutic efficacy of bioactive compounds in herbal medicines. *Fitoterapia*. 183: 106570. PMID: **40288589**

20

MICROBIAL CONVERSION OF QUINONES

Constituent	Herb	Processes	Microbiota	Metabolites	Increase:
rhein	*Rheum officinale*	reduction	*Bacteroides*	rheinanthrone	Purgative effect ↑
barbaloin	*Aloe barbadensis*	deglycosylation	*Eubacterium*	aloe-emodin anthrone	Bioavailability ↑ Purgative effect ↑
sennosides	*Cassia angustifolia*	deglycosylation reduction	*Clostridium* *Bifidobacterium* *Eubacterium* *Peptostreptococnrc*	sennidin, 8-glucosylrheinanthrone rheinanthrone	AUC, Cmax↑ Bioavailability ↑ Purgative effect ↑

Chen Y, Lei Z, Gu D, et al. (2025) Gut microbiota: A potential enhancing factor for the therapeutic efficacy of bioactive compounds in herbal medicines. *Fitoterapia*. 183: 106570. PMID: **40288589**

21

MICROBIAL CONVERSION OF OTHERS

Constituent	Herb	Processes	Microbiota	Metabolites	Change:
Caffeic acid		dehydroxylation and reduction	Various	dihydrocaffeic acid, hydroxyphenylpropionic acid	Bioavailability ↑
Gallic acid		decarboxylation	Various	pyrogallol	Antioxidant ↑ Antibacterial ↑
Arctiin	*Arctium lappa*	deglycosylation, dehydroxylation, demethylation	Various	arctigenin enterolactone	Bioavailability ↑ Antioxidant ↑ Anti-inflammatory ↑
Gentiopicroside	*Gentiana lutea*	xx	*Various*	erythrocentaurin, gentiopicral	xx

Chen Y, Lei Z, Gu D, et al. (2025) Gut microbiota: A potential enhancing factor for the therapeutic efficacy of bioactive compounds in herbal medicines. *Fitoterapia*. 183: 106570. PMID: **40288589**

22

TENDING BIOMES

Our gut microbiome shares many of the properties of other complex self-organizing ecological systems of mutually interacting living organisms:

The 'WoodWideWeb' and the living soil

It is likely to benefit from the care given by a woodland ranger or organic farmer

23

GUT MICROBIOTA: THE THERAPEUTIC JOURNEY

probiotic

seed

prebiotic

soil

postbiotic

compost

24

PROBIOTICS

Be promiscuous!

We don't know what you need ...

- Supplements
- Kefirs (multiple bacterial strains)
- Yoghurts (*Lactobacillus, Streptococcus* and *Bifidobacteria*)
- Vegan equivalents (same cultures though often heat treated)
- Kimchi (*Lactobacillus* and others)
- Sauerkraut (*Leuconostoc* and *Lactobacillus*)
- Kombucha (*Lactobacillus* and others)
- Miso (fungus: koji' - *Aspergillus* and *Saccharomyces*)
- Tempeh
- Natto (*Bacillus* and others)
- Pickles
- Cheeses (semi-hard)
- Buttermilk
- Sourdough (*Lactobacillus* and others)

25

PHYTOCHEMICAL GROUPS HELP THE MICROBIOME

Polysaccharides

Mucilages and **Gums**

Flavonoids and **Anthocyanidins** = **Polyphenols**

Tannins

Acrids

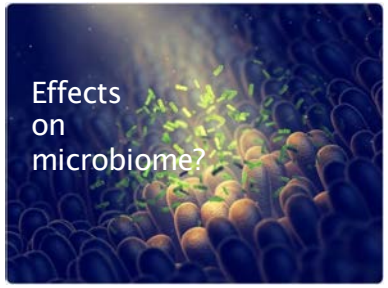
Saponins

Aromatics

Bitters

Resins

Anthraquinones



Singh A, Kaur P, Kumar M, et al. (2025) The role of phytochemicals in modulating the gut microbiota: Implications for health and disease, *Medicine in Microecology* 24: 100125 https://tinyurl.com/**2at8jpux**

Luo B, Wen Y, Ye F, et al. (2023) Bioactive phytochemicals and their potential roles in modulating gut microbiota, *Journal of Agriculture and Food Research* 12: 100583, https://tinyurl.com/**2mhdwvxz**

26

PREBIOTICS IN PRACTICE

Realistically we are looking for things we can take regularly and at food-level doses

Our work here is more dietary advice than prescriptions

27

POLYSACCHARIDES ARE THE BEST PREBIOTICS

Beta-glucan induces the growth of *Prevotella* and *Roseburia* with a concomitant increase in SCFA propionate production.

Inulin and all oligosaccharides have a strong bifidogenic effect.

All natural sugars, most notably non-digestible forms like inulin and oligosaccharides, increase SCFA levels

A high fructooligosaccharide and fibre diet led to significant increases in butyrate-producing *Bifidobacterium*

Fehlbaum S, Prudence K, Kieboom J, et al. (2018) *In Vitro* Fermentation of Selected Prebiotics and Their Effects on the Composition and Activity of the Adult Gut Microbiota. *Int J Mol Sci*. 19(10):3097. PMID: **30308944**

Whelan K, Judd PA, Preedy VR, et al.(2005) Fructooligosaccharides and fiber partially prevent the alterations in fecal microbiota and short-chain fatty acid concentrations caused by standard enteral formula in healthy humans. *J Nutr*. 135(8): 1896-902. PMID: **16046714**.

28

POLYPHENOLS ARE VERY GOOD PREBIOTICS

It has long been known that **90–95 % of polyphenols pass into the large intestine, interacting with the gut microbiota**.

Rechner AR, Smith MA, Kuhnle G, et al. (2004) Colonic metabolism of dietary polyphenols: influence of structure on microbial fermentation products. *Free Radic Biol Med*.36(2): 212-25. PMID: **14744633**

Kahle K, Kraus M, Scheppach W, et al. (2006) Studies on apple and blueberry fruit constituents: do the polyphenols reach the colon after ingestion? *Mol Nutr Food Res*. 50(4-5):418-23. PMID: **16548015**

Phenolic extracts obtained from eight berries containing anthocyanins, flavan-3-ols, B-type proanthocyanidins, and ellagitannins inhibited the growth of food-poisoning bacteria, such as *Salmonella*, *Listeri* and *Staphylococcus aureus*, but did not affect the growth of the probiotic bacterium, *Lactobacillus rhamnosus*.

Puupponen-Pimiä R, Nohynek L, Alakomi HL, Oksman-Caldentey KM. (2005) The action of berry phenolics against human intestinal pathogens. *Biofactors*. 23(4): 243-51. PMID: **16498212**

29

POLYPHENOLS ARE VERY GOOD PREBIOTICS

Cheng H, Zhang D, Wu J, et al. (2023) Interactions between gut microbiota and polyphenols: A mechanistic and metabolomic review. *Phytomedicine*. 119:154979. PMID: **37552899**

Morris G, Gamage E, Travica N, et al. (2021) Polyphenols as adjunctive treatments in psychiatric and neurodegenerative disorders: Efficacy, mechanisms of action, and factors influencing inter-individual response. *Free Radic Biol Med*. 172:101-122 PMID: **34062263**

In elderly Japanese subjects quercitin encouraged populations of *Fusobacteriaceae* and *Enterobacteriaceae* and reduced populations of *Sutterellaceae* and *Oscillospiraceae*.

Grape seed extract enriched gut microbiota diversity in human subjects toward beneficial microbes, like *Lactobacillus* and *Bifidobacterium*.

Tamura M, Hoshi C, Kobori M, et al. (2017) Quercetin metabolism by fecal microbiota from healthy elderly human subjects. *PLoS One*. 12(11): e0188271 PMID: **29176866**

Filosa S, Di Meo F, Crispi S. (2018) Polyphenols-gut microbiota interplay and brain neuromodulation. *Neural Regen Res*. 13(12): 2055-2059. PMID: **30323120**

30

TEA IS A PREBIOTIC

Camellia sinensis L

Tea polyphenols metabolized by the microbiome in turn promote the growth of beneficial species.

Tea compounds are able to correct dysbiosis associated with high-fat diets and to influence the growth of some bacterial species involved in lipid or bile salts metabolism and to correct the microbial dysbiosis associated with inflammatory diseases

Green tea reduces the production of pro-inflammatory substances such as LPS.

Tea polyphenols are also able to hinder the growth of some pathogenic bacteria, especially gram-positive.

Cheng H, Zhang D, Wu J, et al. (2023) Interactions between gut microbiota and polyphenols: A mechanistic and metabolomic review. *Phytomedicine*. 119: 154979. PMID: **37552899**

Pérez-Burillo S, Navajas-Porras B, López-Maldonado A, et al. (2021) Green Tea and Its Relation to Human Gut Microbiome. *Molecules*. 26(13): 3907. PMID: **34206736**

31

TURMERIC IS A PREBIOTIC

Curcuma longa L

An RCT investigating the effect of curcumin supplementation on the composition of the microbiota in human volunteers reported relatively uniform increases in the majority of *Clostridium*, *Bacteroides*, *Cronobacter*, *Citrobacter*, *Enterococcus*, *Klebsiella*, *Enterobacter*, *Parabacteroides*, and *Pseudomonas and* decreases in *Ruminococcus*, *Prevotella* and *Coriobacterales*.

Peterson CT, Vaughn AR, Sharma V, et al. (2018) Effects of Turmeric and Curcumin Dietary Supplementation on Human Gut Microbiota: A Double-Blind, Randomized, Placebo-Controlled Pilot Study. *J Evid Based Integr Med*. 23: 2515690X18790725. PMID: **30088420**

32

TURMERIC IS A PREBIOTIC

Curcuma longa L

- it increases butyrate-producing bacteria and faecal butyrate levels and especially anti-inflammatory *Bifidobacteria* and *Lactobacilli*
- it reduces proinflammatory *Enterobacteria, Enterococci* and *Coriobacterales*

Breath hydrogen increases when turmeric is added to meal indicating increased colonic carbohydrate metabolism

Zam W. (2018) Gut Microbiota as a Prospective Therapeutic Target for Curcumin: A Review of Mutual Influence. *J Nutr Metab.* 2018:1367984. PMID: **30647970**.

McFadden RM, Larmonier CB, Shehab KW, et al. (2015) The role of curcumin in modulating colonic microbiota during colitis and colon cancer prevention. *Inflamm Bowel Dis.* 21, 2483–94 PMID: **26218141**

Shimouchi A, Nose K, Takaoka M, et al. (2009) Effect of dietary turmeric on breath hydrogen. *Dig Dis Sci.* 54, 8, 1725-9 PMID: **19034660**

33

CHILLI IS A PREBIOTIC

Capsicum spp.

A short-term and high-dose capsaicin-enriched diet (10 mg/day, for two weeks) has been proven to increase *Faecalibacterium prausnitzii* levels in healthy humans; these are inversely associated with IBD, immunity, obesity, diabetes, asthma, major depressive disorder, and colorectal cancer.

Both low and high concentrations of dietary capsaicin (respectively 5 and 10 mg/day) administered for each one for 2 weeks in healthy subjects led to an increase in the ratio of the overall intestinal flora balance.

Rosca AE, Iesanu MI, Zahiu CDM, et al. (2020) Capsaicin and Gut Microbiota in Health and Disease. *Molecules*. 25(23):5681. PMID: **33276488.**

Kang C, Zhang Y, Zhu X, et al. (2016) Healthy Subjects Differentially Respond to Dietary Capsaicin Correlating with Specific Gut Enterotypes. *J Clin Endocrinol Metab.* 101(12): 4681-4689. PMID: **27676396**.

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GARLIC IS A PREBIOTIC

Patients with arterial hypertension who received aged garlic extract increased the composition and diversity of gut bacteria, with an increase in *Lactobacillus* and *Clostridium* species and modification in *Firmicutes*/ *Bacteroidetes* ratio associated with improved health.

Ried K, Travica N, Sali A. (2018) The Effect of Kyolic Aged Garlic Extract on Gut Microbiota, Inflammation, and Cardiovascular Markers in Hypertensives: The GarGIC Trial. *Front Nutr.* 5:122. PMID: **30619868**.

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POSTBIOTICS?

A new way for herbs to interact with the microbiome?

The commercial definition of a postbiotic is as a “preparation of inanimate microorganisms and/or their components that confers a health benefit on the host”.

Salminen S, Collado MC, Endo A, et al. (2021) The International Scientific Association of Probiotics and Prebiotics (ISAPP) consensus statement on the definition and scope of postbiotics. *Nat Rev Gastroenterol Hepatol*. 18(9):649-667. PMID: **33948025**

More widely postbiotics refer to soluble factors (products or metabolic byproducts), secreted by live gut bacteria, or released after bacterial lysis.

Aguilar-Toalá JE, Garcia-Varela R, Garcia HS, et al, (2016) Postbiotics: An evolving term within the functional foods field, *Trends in Food Science & Technology*, 75, 105-114. https://tinyurl.com/**ynjk59bu**

All the microbial conversion of herbal constituents we have seen qualifies these metabolites as postbiotics.

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CHOCOLATE CREATES POSTBIOTICS!

Cocoa polyphenols interact bidirectionally with the gut microbiota.

They modulate the composition: enhance beneficial gut bacteria, such as *Lactobacillus* and *Bifidobacterium;* reduce the number of pathogens such as *Clostridium perfringens*.

Microbial cocoa metabolites are bioactive: enhance gut health, display anti-inflammatory activities, positively affect immunity, and reduce the risk of various diseases.

Sorrenti V, Ali S, Mancin L, et al. (2020) Cocoa Polyphenols and Gut Microbiota Interplay: Bioavailability, Prebiotic Effect, and Impact on Human Health. *Nutrients*. 27;12(7):1908. PMID: **32605083**

Tzounis X, Rodriguez-Mateos A, Vulevic J, et al. (2011) Prebiotic evaluation of cocoa-derived flavanols in healthy humans by using a randomized, controlled, double-blind, crossover intervention study. Am *J Clin Nutr*. 93(1): 62-72. PMID: **21068351**

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TANNINS CREATE POSTBIOTICS

Camellia sinensis L

Hydrolysable tannins, such as gallotannins and ellagitannins, are metabolised by the microbiome to generate gallic acid, ellagic acid, and their catabolites, including bioavailable human gut microbiota metabolites urolithin A, B and C.

Significant inhibition of TNF-α production was determined for all urolithins. Urolithin C also inhibited IL-6 production.

Kawabata K, Yoshioka Y, Terao J. (2019) Role of Intestinal Microbiota in the Bioavailability and Physiological Functions of Dietary Polyphenols. *Molecules*. 24(2): 370. PMID: **30669635**.

Piwowarski JP, Granica S, Zwierzyńska M, et al (2014) Role of human gut microbiota metabolism in the anti-inflammatory effect of traditionally used ellagitannin-rich plant materials. *Journal of Ethnopharmacology*. 155 (1): 801-809. PMID: **24969824**

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SOYA CREATES A POSTBIOTIC

Soya isoflavone daidzein is metabolised by gut microbiota to S-equol.

This is the most antiatherogenic of isoflavones. Several short-duration RCTs document that soy isoflavones improve arterial stiffness. The evidence associates both atherosclerosis and arterial stiffness with cognitive decline and dementia and points to the benefit of S-equol especially in preventing these.

Sekikawa A, et al. Effect of S-equol and Soy Isoflavones on Heart and Brain. *Curr Cardiol Rev*. 2019; 15(2): 114-135. PMID: **30516108**

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TURMERIC CREATE POSTBIOTICS

Curcuma longa L

Turmeric's bidirectional relationship with the microbiome

- Curcumin transformed into more active metabolites
- Curcumin metabolites have postbiotic effects

Turmeric metabolites increase microbiomic diversity, reduce absorption of inflammatory bacterial lipopolysaccharides (LPS) with quantifiable benefits for IBD, hepatic stenosis, tumorogenesis and neurological disease.

Shen L, Ji HF. (2018) Bidirectional interactions between dietary curcumin and gut microbiota. *Crit Rev Food Sci Nutr*. 59(18):2896-2902. PMID: **29781709**

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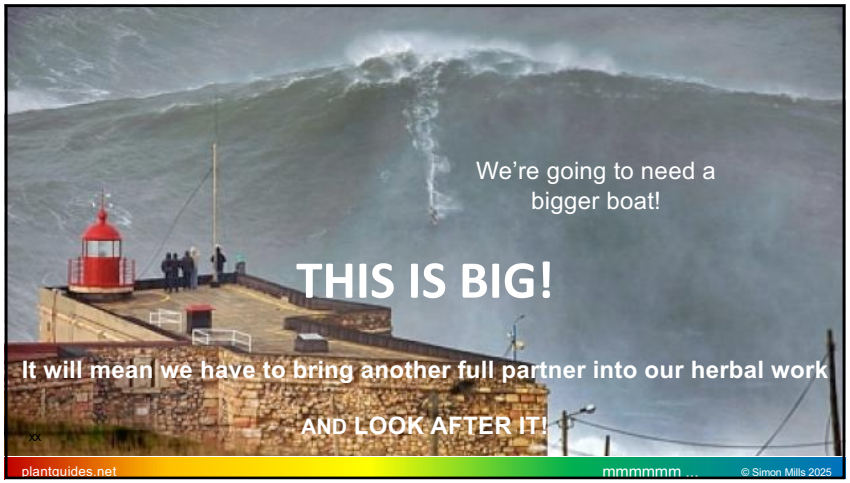

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FORTUNATELY WE CAN BOTH TEND THE MICROBIOME AND WORK WITH IT TO POWER UP OUR REMEDIES.

An afterthought: all this confirms we and our microbiomes are all different and will respond differently to our remedies.

DISCUSS .....

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THANK YOU – QUESTIONS .... MMMMMM?

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Thumann TA, Pferschy-Wenzig EM, Moissl-Eichinger C, Bauer R. (2019) The role of gut microbiota for the activity of medicinal plants traditionally used in the European Union for gastrointestinal disorders. *J Ethnopharmacol*. 245: 112153. PMID: **31408679**.

Effect of plants on the gut microbiome

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Luo B, Wen Y, Ye F, et al. (2023) Bioactive phytochemicals and their potential roles in modulating gut microbiota, *Journal of Agriculture and Food Research* 12: 100583, https://tinyurl.com/**2mhdwvxz**

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