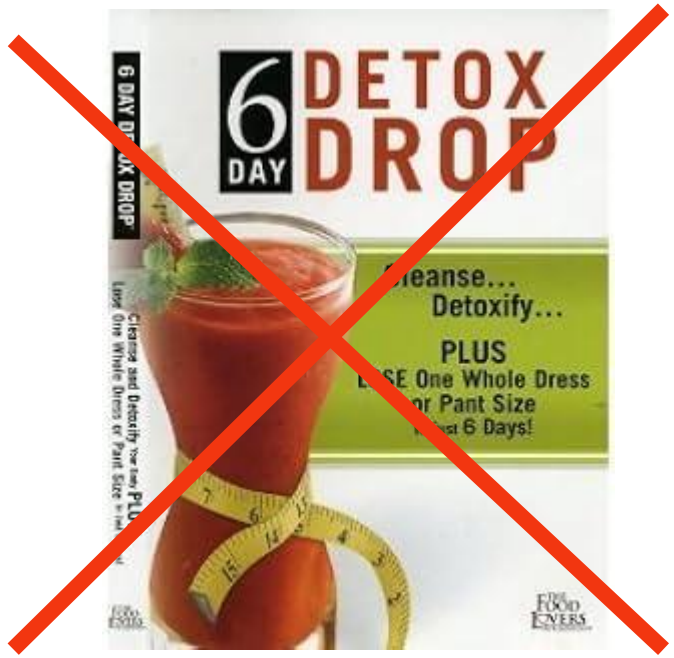
Detoxification for PD

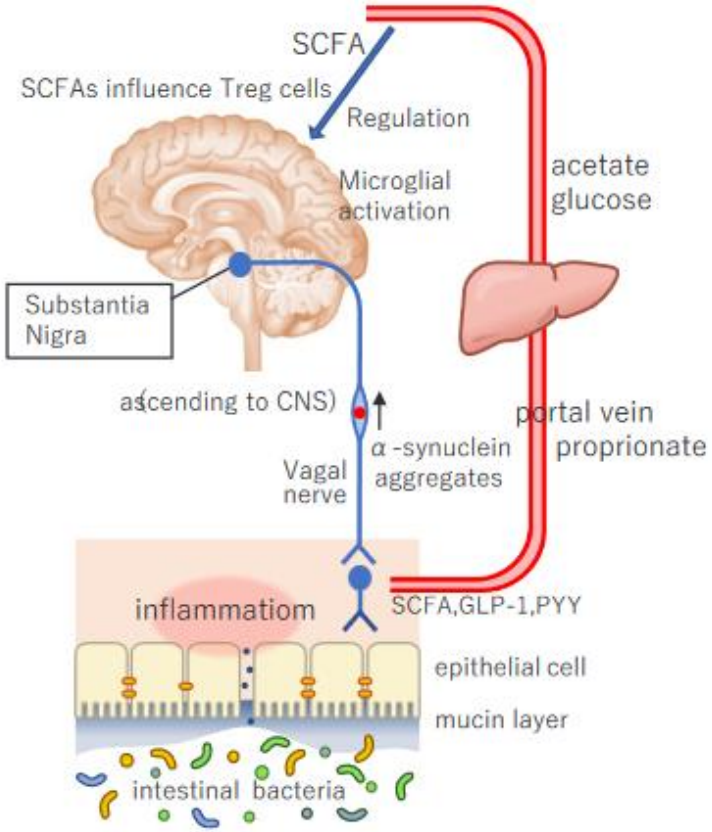
The liver/gut/brain axis

Detoxification (Metabolic) Definition

Not something that comes in a box



Your natural detoxification system



Hirayama & Ohno. PD and gut microbiota 2021 Annals of Nutrition and Metabolism

JMD
https://doi.org/10.14802/jmd.20006 / J Mov Disord 2020;13(2):97-104
pISSN 2005-940X / eISSN 2093-4939

REVIEW ARTICLE

Nutrition and Lifestyle Interventions for Managing Parkinson's Disease: A Narrative Review

Tracy Lister

Maryland University of Integrative Health, Laurel, MD, USA

Academy of Nutrition and Dietetics

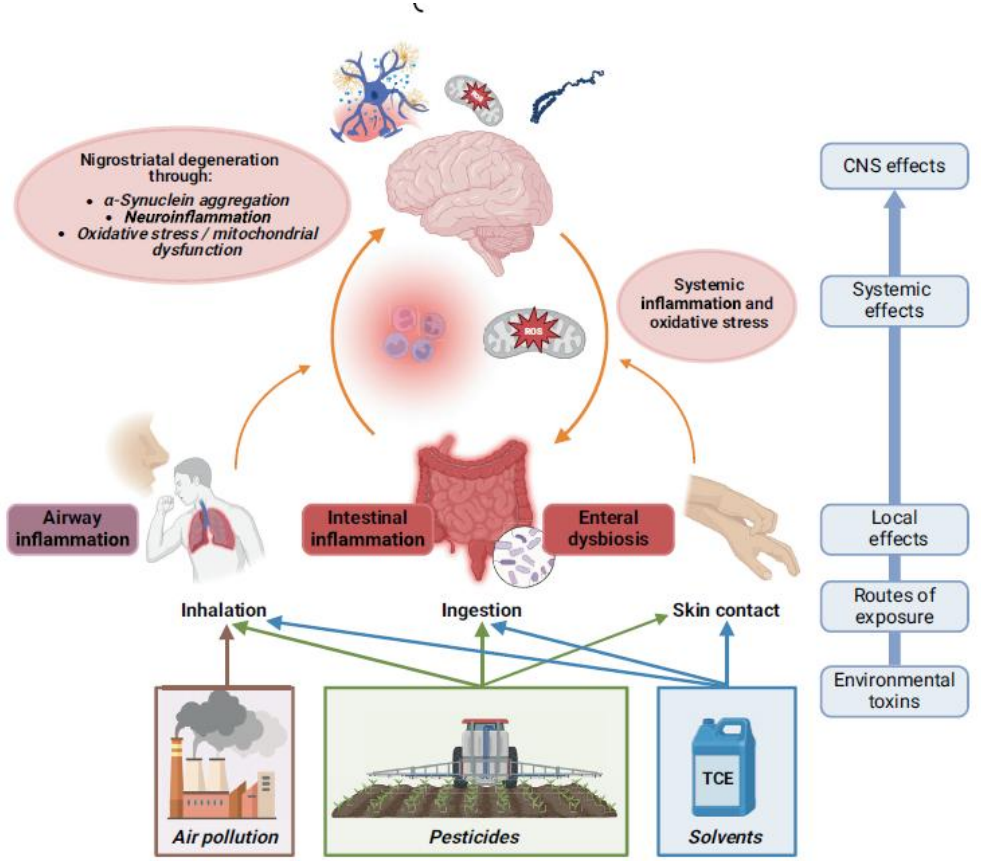
Evidence Analysis Manual:

Steps in the Academy Evidence Analysis Process

Research and Strategic Business Development
Academy of Nutrition and Dietetics
August 2012

World Health Organization Statement

- PD is the fastest growing neurological disease
- Need to reduce modifiable risk factors:
  - Ban pesticides, herbicides, chemicals and reduce air pollution.



Brolin et al. Environmental risk factors for PD: A critical review and policy implications. Movement Disorders 2024.

Cause of PD

- Genetics -10%.
- Toxicity
  - environmental toxins, in which food is the number one source
  - medications
  - disorders of the brain
  - infections, particularly in the gut.
- Mediators
  - poor functioning detoxification system
  - abnormalities of the gut that lead to chronic inflammation.

Dietary Habits of People with PD

- 60% are malnourished
  - inadequate intake of vitamins/minerals and protein
  - malnourished people can be normal weight or obese.
- consume less protein, fiber, fat, vitamin/minerals antioxidants,
  - vitamin C, E and copper

Toxicity may the cause, but malnutrition can be a contributor.

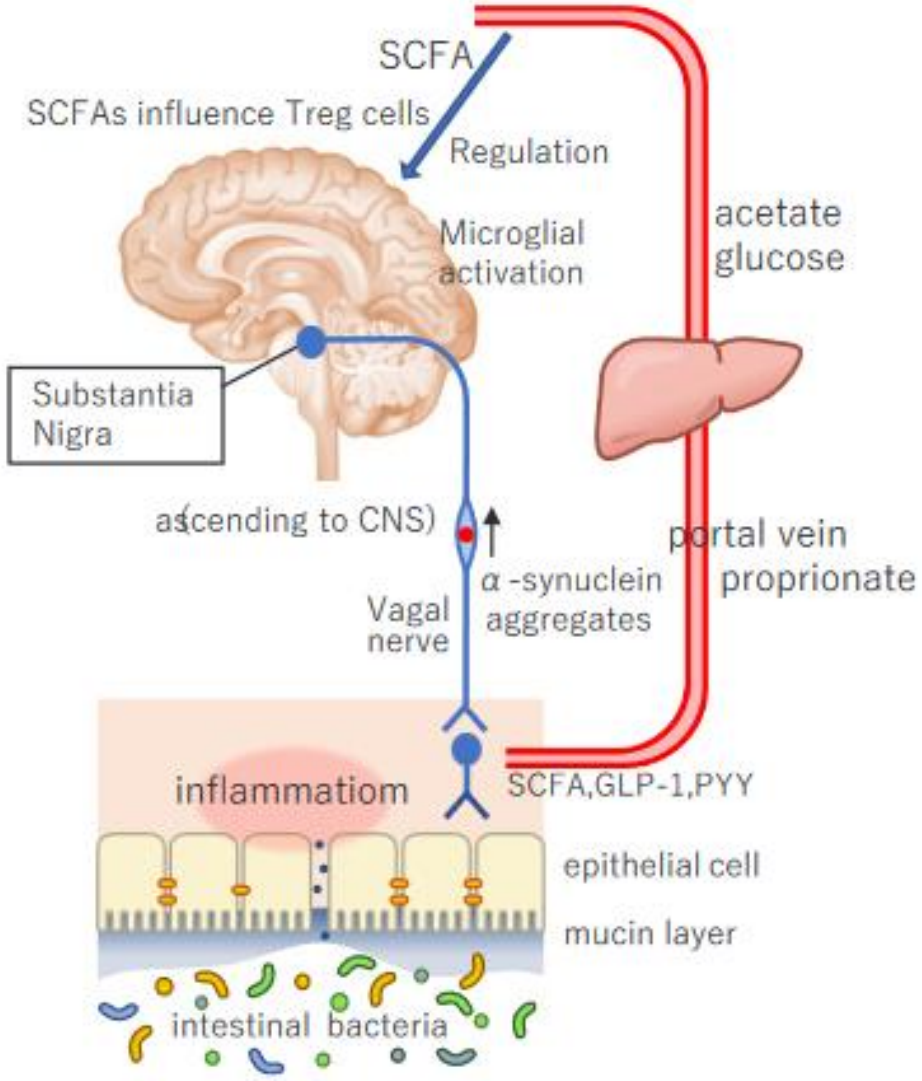
Zeng et al. 2024. Associations of dietary intakes with PD: Findings from a cross-sectional study. International Journal for Vitamins and Mineral Research. https://doi.org/10.31083/IJVNR36422

Does what we eat make a difference?

YES!

Meta-analysis of systematic reviews shows that diet interventions have a positive effect on motor and non-motor symptoms in PD.

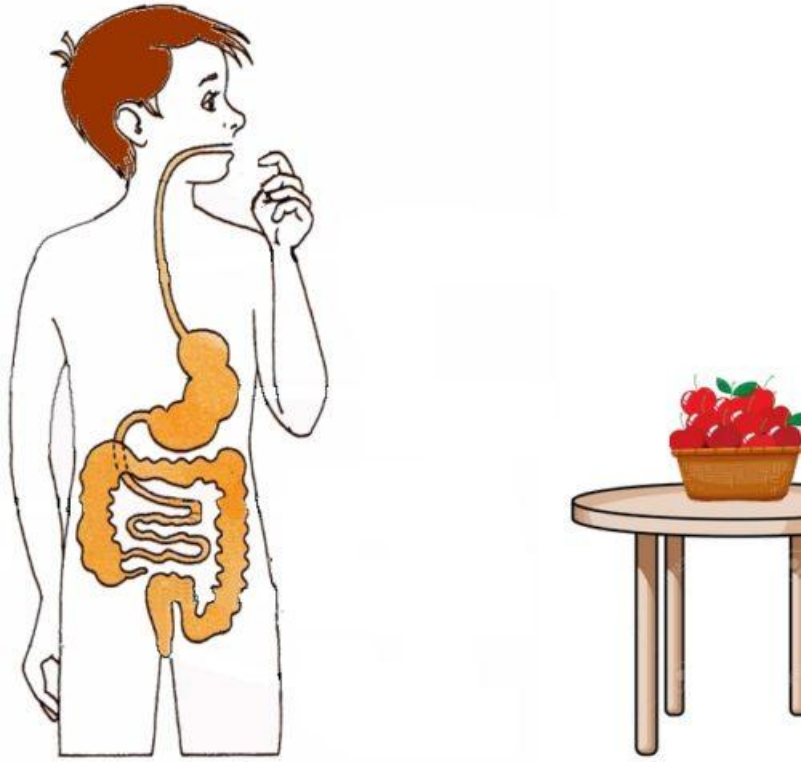
Wu et al. Effects of dietary supplements, foods, and dietary patterns in PD: Meta-analysis and systematic review of the randomized cross over studies. European Journal of Clinical Nutrition. 2024. https://doi.org/10.1038/s41430-024-01411-1



Hirayama & Ohno. PD and gut microbiota 2021 Annals of Nutrition and Metabolism

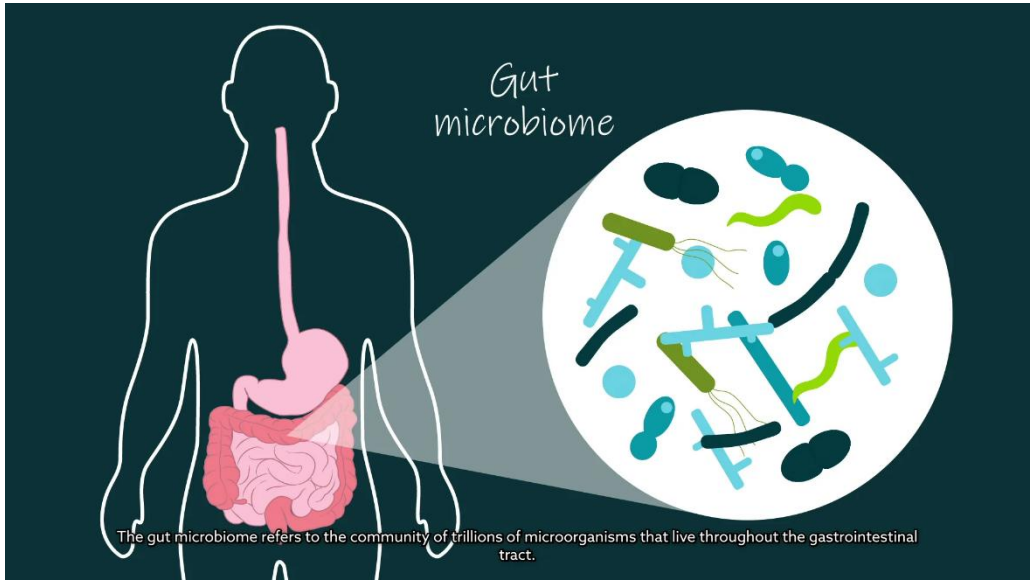
The Gut

- Tube that runs from your gums to your bum.
- Part of the detoxification.
- It is very susceptible to disruptions.
- Gut disruption may be the root cause of many diseases.
- Constipation is a disruption of the gut.
- Many sources of research say constipation starts 15-20 years before we notice other s/s of PD.



Yemula et al. PD & the gut: Symptoms, nutrition and microbiota. *Review, 2021*

Gut Microbiome



Lifestyle factors disrupt the microbiome, changing the colonies which has a negative impact on health and disease.

- Specific microbes like specific foods. Undesirable microbes feed on processed foods, SUGAR, toxins, medications, toxins, pesticides/herbicides.

You are what you eat

- The bacteria is also influenced by stress, lack of sleep, inactivity.

Hughes RL, Holscher HD. Fueling Gut Microbes: A Review of the Interaction between Diet, Exercise, and the Gut Microbiota in Athletes. Adv Nutr. 2021 Dec 1;12(6):2190-2215. doi: 10.1093/advances/nmab077. PMID: 34229348; PMCID: PMC8634498.
Soni, D. Crosstalk between gut-brain axis: Unveiling the mysteries of gut ROS in progression of PD. 2024. Inflammopharmacology https://doi.org/10.1007/s10787-024-01510-2

Key Messages

What affects the microbiome?

Everything!

What affects the gut affects the brain!

Disrupted Microbiome

Most consistent microbiota alterations measured in PD patients with respect to healthy individuals (from [15,17,18,19,20]).

Microbiota Alterations in PD Patients	Downstream Metabolites	Local Impact in PD Patients	Impact on Brain in PD Patients
↑ *Akkermansia*	Mucin-degrading enzymes	Immune gut homeostasis	
↑ *Bifidobacterium*, ↑ *Lactobacillus*	Tight junction proteins	Infection in immune-compromised individuals	
↑ Enterobacteriaceae family	LPS	↑ Inflammation	↑ BBB permeability ↑ Neuroinflammation
↓ *Blautia* ↓ *Faecalibacterium* ↓ *Roseburia*	SCFAs	↓ Gut permeability (mucus formation) ↓ Inflammation (via the NF-κB pathway)	↑ BBB permeability ↓ Microglia-mediated protection
↓ Prevotellaceae family	Mucins synthesis	↓ Gut permeability (mucus formation)	↑ BBB permeability ↑ Neuroinflammation

- Too much of some species and not enough of others.
- Lipopolysaccharides are a toxin that damages the gut lining, & blood brain barrier causing inflammation.
- Short chain fatty acids protect the gut and the blood brain barrier.

Bedarf et al. Functional implications of microbial and viral gut metagenome changes in early stage L-DOPA naïve PD patients. Genome Medicine 2017; Mirayama et al. PD and gut microbiota. Annals of Nutrition and Metabolism. 2021; Suzuki et al. Quantification of hydrogen production by intestinal bacteria that are specifically dysregularted in PD. PLoS one. 2018; Gazerani Probiotics for PD. Int J Mol Sci 2019

Probiotics? Maybe one day

Probiotics are usually Bifidobacterium & Lactobacillus - don't want more

↑ *Akkermansia*

↑ *Bifidobacterium,*

↑ *Lactobacillus*

↑ Enterobacteriaceae family

The key is a balanced, individualized microbiome

These are hard to find as a probiotic

↓ *Blautia*

↓ *Faecalibacterium*

↓ *Roseburia*

↓ Prevotellaceae family

If these become overgrown, they cause disruptions

Create a balanced microbiome with food

Processed foods decrease more

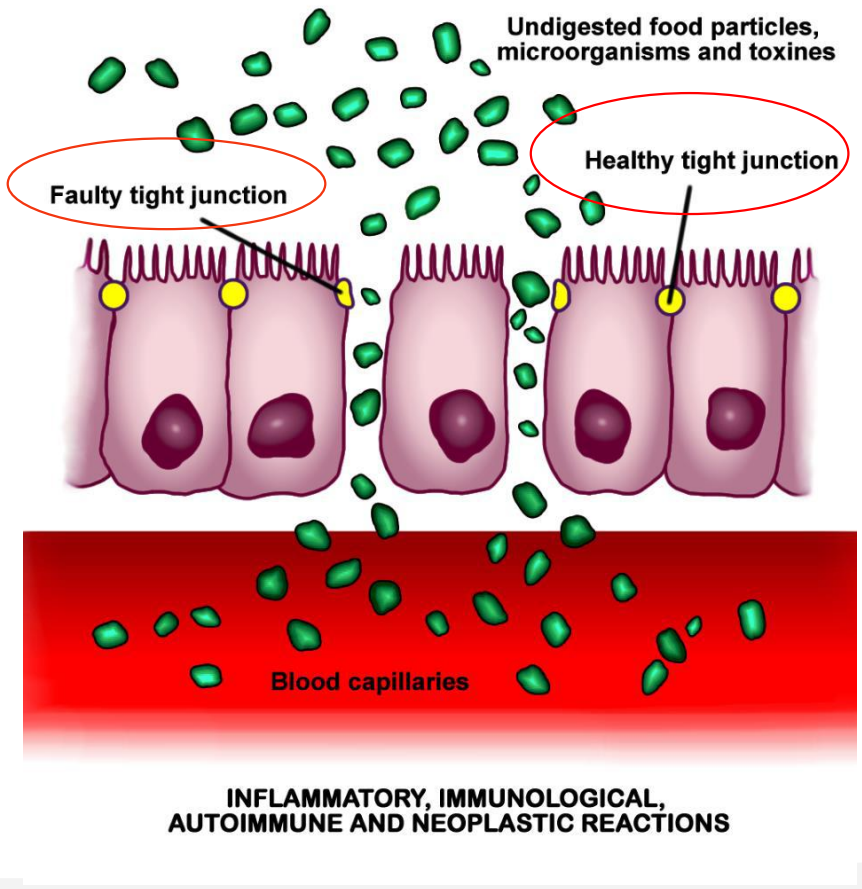
Gazerani Probiotics for PD. Int J Mol Sci 2019; Bevilacuqa et al. Ultra-processed food and gut microbiota: Do additives affect Eubiosis? A Narrative Review. Nutrients 2025

Disrupted Microbiome - infections

- A study published this year also shows that helicobacter pylori also known as H-pylori overgrowth increases the severity of PD symptoms, when irradicated leva-dopa absorption was improved.
- Small intestinal bacterial overgrowth (SIBO) was also commonly found in people with PD.

Gabrielli et al. The role of gastrointestinal Microbiota in PD. Biomolecules. 2025. https://doi.org/10.3390/biom15010026

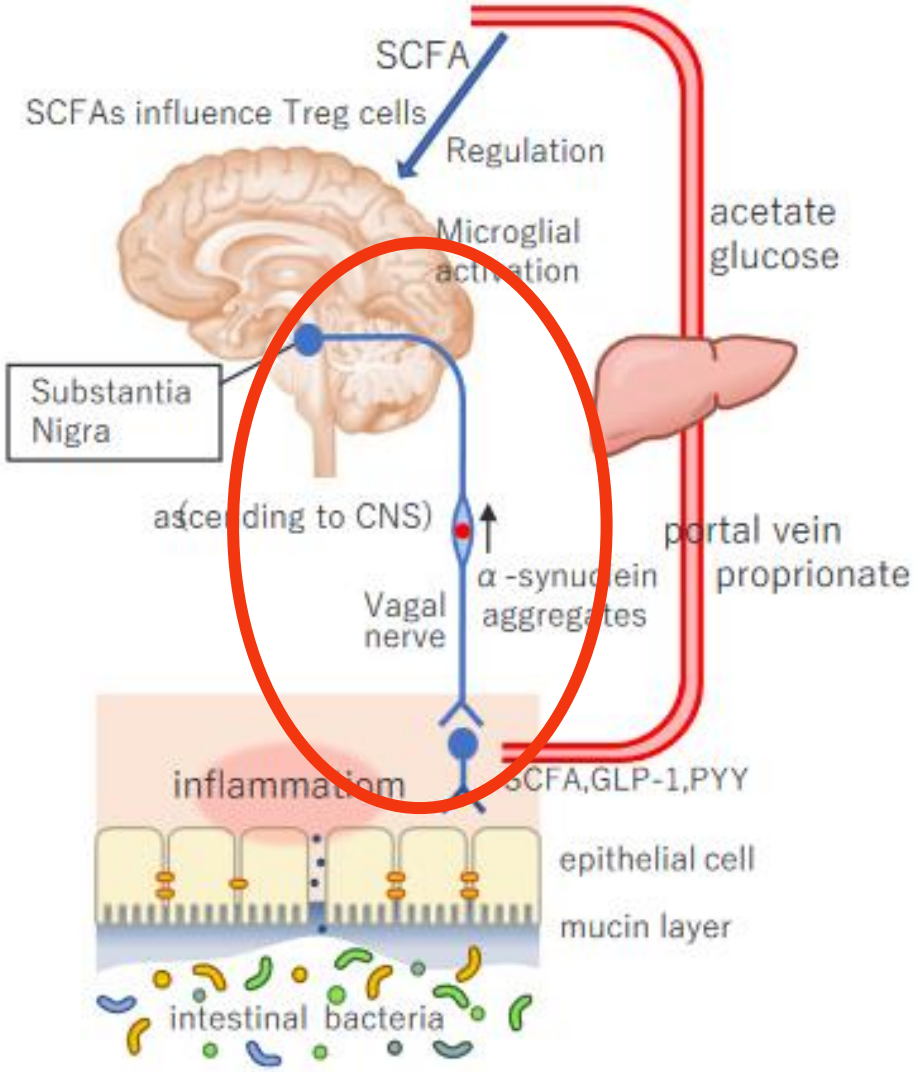
Increased Intestinal Permeability aka Leaky Gut



- The cells in the gut lining are normally tight with receptors that regulate what goes to the blood from the gut.
- When it is damaged it leaks letting toxins, viruses, bacteria, fungi, waste products pass through to the blood stream.
- Immune system is activated.
- Once in the blood toxins can travel to the brain and cross the damaged blood brain barrier.

The Vagus (vagal) Nerve

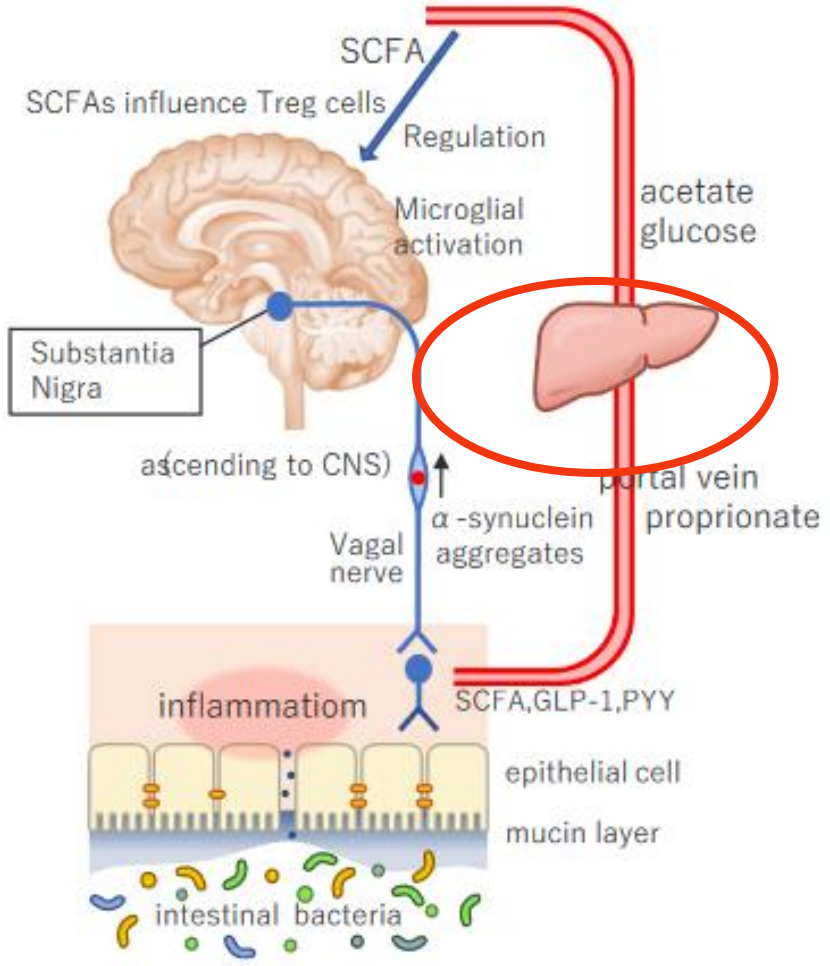
- The connection between the gut and the brain.
- Bacteria in the gut create neurotransmitters that travel to the brain via the vagus nerve.
- Bad bacteria send nasty messages to the brain that may cause depression, anxiety and damage the blood/brain barrier
- Bacteria produce inflammatory cytokines



Chan et al. Exploring the connection between the gut and microbiome and PD symptom progression and pathology: Implications for supplementary treatment options. Journal of Parkinson's Disease. 2022

Liver

- The function of the liver is to clean the blood.
- Leaky gut causes an excess of toxins to enter the blood stream.
- Excess toxins burdens the liver and detoxification is slowed.
- Liver detoxification is complicated and requires many nutrients.



Reinke et al. Reviews in basic and clinical gastroenterology and hepatology. *Gastroenterology 2016*.

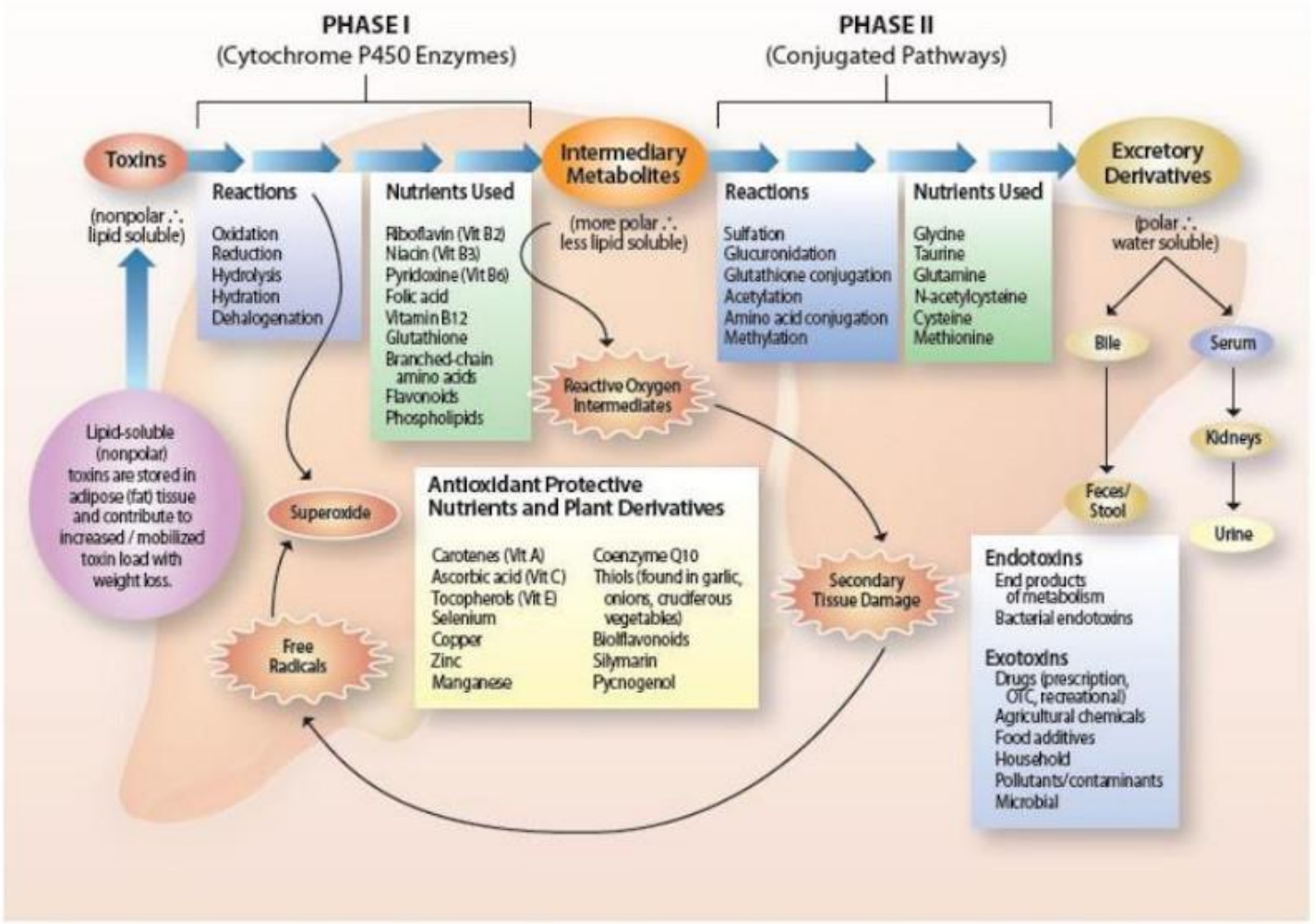


Figure 3.5 Liver detoxification pathways, activities, influences, and effects. (c) 2005 The Institute for Functional Medicine. Used with permission granted by The Institute for Functional Medicine, www.functionalmedicine.org. No part of this content may be reproduced or transmitted in any form or by any means without the express written consent of The Institute for Functional Medicine, except as permitted by applicable law.

Merrill et al. Toxicological function of adipose tissue: Focus on POP. *Environmental Health Perspectives. 2023*

Detoxification – Phase 1

- Phase one uses nutrients to convert the fat-soluble toxins into water soluble forms.
  - B-vitamins
    - Beef liver, beef, chicken, seafood, soy, nuts/seeds, vegetables
    - Microbiome, if healthy
  - Flavonoids
    - Soy, berries, lychee, orange peel, apples, onion, garlic, chia seeds, green/chamomile/milk thistle/bergamot tea, herbs (fresh, dried), cocoa
  - Branch chain amino acids
    - Meat, fish, poultry, eggs

Hodges et al. Modulation of metabolic detoxification pathways using foods and food-derived components: A scientific review of clinical applications. *Journal of Nutrition and Metabolism 2015*

Detoxification – Intermediate Phase

- Now that the toxins are water soluble, they are free to roam the body.
- We need antioxidants to quench them to prevent damage.
  - Colorful vegetables and fruit

Eat the rainbow

RED

Foods

Apples	Pomegranate	Sweet red bell peppers
Applesauce	Radishes	Tomato
Cherries	Strawberries	
Kidney beans		

ORANGE

Foods

Apricots	Cantaloupe	Nectarine
Bell peppers	Carrots	Orange
Butternut squash	Mango	Sweet potato

YELLOW

Foods

Bell peppers	Popcorn	Succotash
Corn	Spaghetti squash	Yellow squash
Lemon	Starfruit	

GREEN

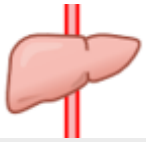
Foods

Asparagus	Cabbage	Greens *(beet, dandelion, collard, mustard, turnip)*
Avocado	Celery	Kale
Bean sprouts	Chard	Lettuce
Bell peppers	Cucumbers	Olives
Broccoli	Green beans	Snow peas
Brussels sprouts	Green peas	

BLUE/PURPLE

Foods

Blackberries	Eggplant	Potatoes *(purple)*
Blueberries	Grapes *(purple)*	Raisins
Cabbage *(purple)*	Kale *(purple)*	Rice *(black or purple)*
Carrots *(purple)*	Plums	
Dates		



Panda et al. Guided metabolic detoxification program supports phase 2 detoxification enzymes and antioxidant balance in healthy participants. Nutrients. 2023

Detoxification – Phase 2

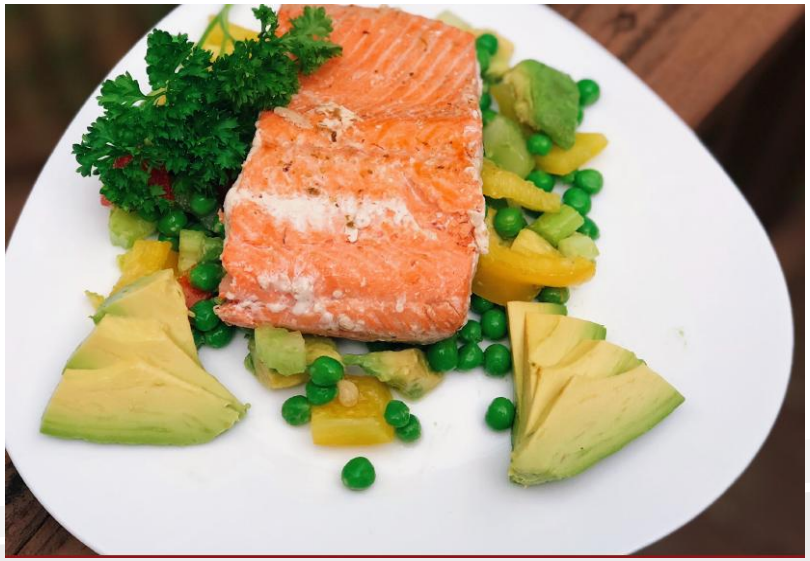
- Phase two converts the water-soluble toxins into a form that can be excrete.
  - Glutamine
    - Animal protein, spinach, parsley, cabbage
  - Sulfur compounds
    - Cruciferous vegetables
      - Arugula, bok choy, broccoli, Brussel sprouts, cabbage, kale, horseradish, cauliflower, kohlrabi, mustard, radish, rutabaga, watercress, wasabi, turnip

What does a detox diet look like?





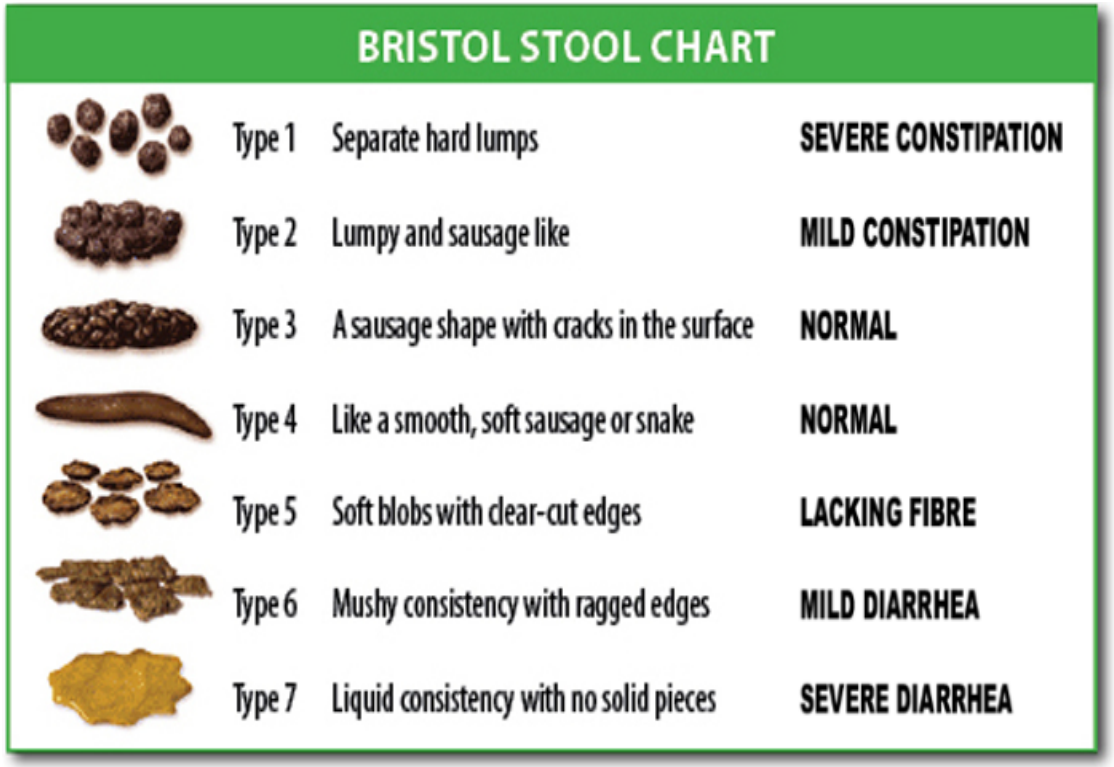


Detoxification – Phase 3

- Gut
  - Need a healthy gut and microbiome
  - Regular bowel movements (1-2 days)
  - Aim for type 4

Treat constipation



Yuan et al. Microbes and PD related constipation. *World Journal of Gastroenterology. 2024.*

Treating Constipation

- Diet high in prebiotics
  - Vegetables
  - Psyllium husks
- Physical activity
- Stress reduction
- Good sleep
- Water

Yan et al. Relationship among PD, constipation, microbes and microbiological therapy. World Journal of *Gastroenterology, 2024*

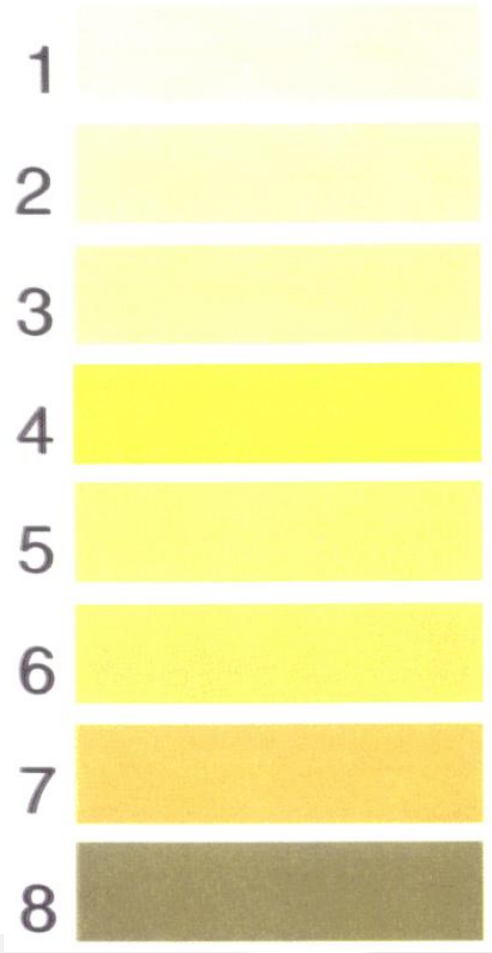
Detoxification – Phase 3

Kidney

- Adequate water (2-3 L daily)
- Pale color urine (aim for 1-3)

Skin

- Sweating
  - Sauna, exercise



Other Fluids

Caffeine studied since 1990's

- Tea, coffee, chocolate
- Increases natural dopamine
- Neuroprotective, antioxidant (tanins)
- 3-4 8oz servings daily (400 mg) may improve motor skills
- Consumed prior to L-Dopa may enhance drug effect

Deleu D, Jacob P, Chand P, Sarre S, Colwell A. Effects of caffeine on levodopa pharmacokinetics and pharmacodynamics in Parkinson disease. Neurology. 2006
Schepici, G.; Silvestro, S.; Bramanti, P.; Mazzon, E. Caffeine: An Overview of Its Beneficial Effects in Experimental Models and Clinical Trials of Parkinson's Disease. *Int. J. Mol. Sci.* **2020**, *21*, 4766. https://doi.org/10.3390/ijms21134766

Green Tea

- EGCG is the active ingredient
- Reduces cognitive impairment
- Prevents dopamine breakdown
- 3 cups daily (550 mg EGCG)
- Antioxidant
  - Postmortem PD brains show oxidative stress which degrades brain tissues

Hibiscus Tea

- Hibiscetin From the hibiscus plant
- Antioxidant
- Reduces blood pressure
- Reduces Catalepsy Akinesia (slowness to start movement)
- 10 mg/kg
- Can be consumed as a tea.

Brain

- Once we have corrected the microbiome, healed the gut, enhanced detoxification we can start working on the brain.
- Neuroplasticity & Neuro-regeneration
  - The blood brain barrier can be repaired
  - The brain can be rebuilt
  - We can influence neurotransmitters

Palasz et al. BNF as a promising therapeutic agent in PD. *International journal of Molecular Science 2020; Xiromerisiou et al. PF, it takes guts: The correlation between intestinal microbiome and cytokine network with neurodegeneration. Biology 2023*

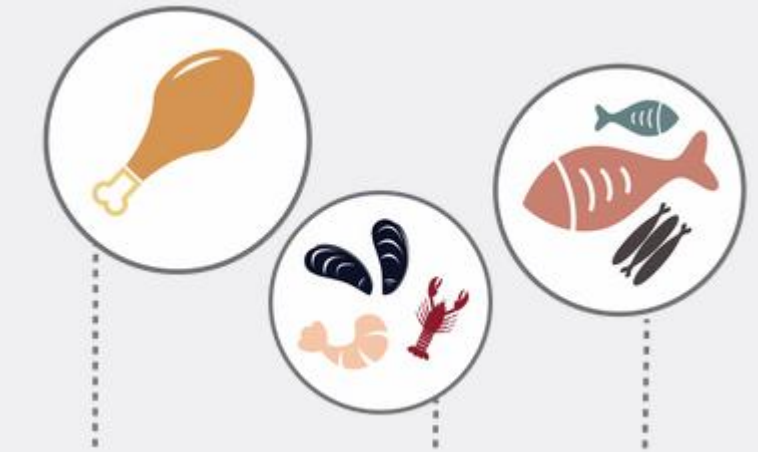
Brain Food - Fats

- Fats are the building blocks for the brain
- Need: omega-3 fatty acids, olive oil, flaxseed oil, saturated fats (coconut, animal), magnesium, curcumin, B6 and B12 to produce dopamine.
- Avoid: processed fats such as margarine, salad dressings, commercial baked goods.

Van der Berg et al. Clinical trial highlights. Dietary Interventions in PD. *Journal of Parkinson's. 2024;* Bisaglia. Mediterranean diet and PD. *In J Mol Sci* 2023; Boulos, et al. Nutritional risk factors, microbiota, and PD. What is the current evidence? *Nutrients. 2019.;* Terenzi et al. Nutrition and gut-brain pathways impacting the onset of PD. *Nutrients. 2022*

Brain Food - Protein

- Protein is essential for all cells
- B-vitamins: meats
- Choline: eggs, soy, beef, chicken
- Iron: meat, poultry



Brain Food -Vitamins

- Vitamin D: 2000-4000 IU daily
  - Our skin loses the ability to produce vitamin D ~ age 65
- Vitamin E: asparagus, avocado, olives, seeds, spinach
- Vitamin C: peppers, citrus, tomato, strawberries, spinach

Brain Food - Minerals

- Zinc: oysters, beef, crab, pumpkin seeds, shrimp, fish
- Magnesium: seeds, nuts, legumes, spinach
- Selenium: Brazil nuts
- Copper: Brazil nuts, beef, cocoa, black pepper

Brain Food -Antioxidants

- Antioxidants: colorful vegetables and fruit
- Spices: Curcumin/Turmeric
- Flavonoids: cocoa, tea, and citrus

Intermittent Fasting

- Gives the body a rest from digesting/metabolizing nutrients.
- Resets the immune system.
- Strengthens the microbiome.
- Allows the body time to repair, including the brain.

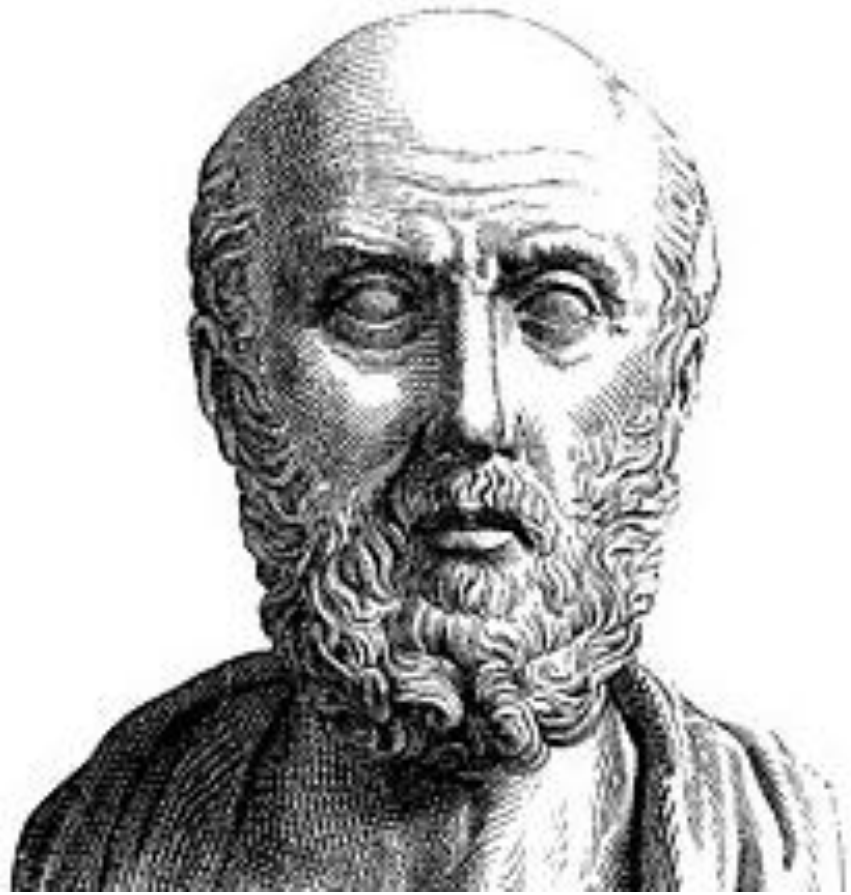
Avoid eating before you go to bed

Perez-Gerdel et al. Impact of intermittent fasting on the gut microbiota: A systematic review. *Adv Biol. 2023*

Mediterranean Diet

- Hippocrates lived on the Greek Island of Kos in the Mediterranean ~400 BC
- He started the first nutrition trend – the Mediterranean diet.
- Today the Mediterranean diet is the most researched diet.
- Currently recommend for good health.

We don't live in the Mediterranean



Let Food be thy Medicine
All Disease Begins in the Gut

Mediterranean vs Canadian Diet

- Preserved many of their traditional ways.
- Does not allow genetically modified foods, pesticides, herbicides.
- Most food consumed is locally grown/in season.
- Animals are allowed to live their natural lives grazing in fields. Chickens roam the garden eating bugs and weeds.
- Very few processed foods.
- Eat from the land and home gardens. Some weeds are edible. Herbs have curative properties

- We eat ultra- processed foods and fast foods.
- We genetically modify foods and use pesticides/herbicides increase the yield of crops. Particularly wheat.
- We import/transport most food that we eat out of season.
- We mass produce livestock keeping them in small spaces, so they need antibiotics.
- We consume processed foods are part of our regular diet.
- Home gardens are not norm.

Mediterranean Lifestyle

- Mediterranean's live longer without disease not only because of diet but also lifestyle (lower stress).
  - They have nice weather most days and spend time outside.
  - Their lifestyle is more active, just doing day to day activities (tending the garden, goats, chickens, walking to the market).
  - They protect “down time” and engage in leisure activity every day.
  - Television is not a past time; being outside, with people socializing.
  - Keeping traditional ways results in less stress related to daily living.

Cryan et al. The microbiota-gut-brain axis. Physiological Reviews. 2019

Canadian Mediterranean Diet

- Whole food diet limiting processed food (box, package, can)
- Focuses on vegetables.
  - Colorful with lots of variety
- Not too much fruit
  - Fructose is hard on the liver
  - Source of sugar
- High quality proteins (but not too much beef/chicken)
  - Variety of red meat, chicken, fish, seafood, organic soy
  - No processed meats (bacon, salami, bologna)
- High quality fats
  - Omega-3, olive oil, some animal fat, coconut oil
  - Not processed fats (margarine, miracle whip, salad dressings)
- Limits grains
  - In North American grains are genetically modified so they can be sprayed with round up
- Limits dairy
  - How cows are raised influences their milk
  - When raised in tight quarters they are given antibiotics and "feed" instead of being allowed to graze
  - Mammals concentrate toxins in their milk/fat
    - 17% ↑ PD risk/200 g/d milk
- Omits sugar
  - Feeds "bad" bacteria
  - Damages the gut
  - Increases inflammation

Yemula et al. PD and the gut: symptoms, nutrition, microbiota. Journal of PD. 2021

Additives

1. Emulsifiers/thickeners

- Used to stabilize and improve the texture of process foods.
- Locust bean, guar gum, carrageenan, maltodextrin, polysorbate
- Change the microbiome, cause intestinal inflammation and tumors.

2. Glutamate

- Changes the microbiome, inflammation, high blood pressure, increases body fat.
- Monosodium glutamate (MSG)
- Meat tenderizer, flavor enhancer, condiments, soups, chips, spices, restaurants/fast foods

Bevilacgua et al. Ultra-processed food and gut microbiota: Do additives affect Eubiosis: A narrative review. Nutrients 2025.

Additives

3. Food colors

- Affects the microbiome, affects the brain (ADHD)
- Margarine, processed foods (Jello, jams, baked goods, cheese dips, dried fruit, condiments, salad dressings/marinades

4. Sulfites

- Has negative effect on the microbiome, causes inflammation.
- Dried fruit, bacon, beer, cider, wine, apple cider, canned fruit, vegetables, condiments, deli meats, snack foods.
- Found naturally in food has no negative effectives.

Additives

5. Essential oils
   - Antibacterial, improve the microbiome
   - Thyme, cinnamon, citric acid
6. Polydextrose
   - Acts like a prebiotic and therefore has a positive effect on the gut
   - Increasing the absorption of calcium and iron.
   - Reduces constipation

Lifestyle

- Get outside most days. Forest Bathing
- Be active as much as possible
  - Proven to improve PD symptoms
- Be social. It is good for your heart
- Have protected down time
  - Learn to say “no” to commitments that do no bring you joy.

Li. Effects of forest environment (Shinrin-yoku/forest bathing on health promotion and disease prevention _the Establishment of “Forest Medicine”. Environmental Health and Preventative Medicine. 2022

Sleep

- Sleep is vital for healing the brain, it also allows for dopamine to build up.
- Melatonin is a very effective sleep aide. It is also an antioxidant.
- Reduces rotational behavior- tendency to lean or favor one side but high dosages 10-30 mg/kg for 19 days is needed to see this effect.
- Regardless sleep is important, and melatonin can help.

Soni, D. Crosstalk between gut-brain axis. Unveiling the mysteries of gut ROS in Progression of PD. Inflammopharmacology. 2024

Glucose- Enemy of Brain

- North America we consume too much carbohydrates (sugar, dairy, grains, fruit, potato, corn)
  - Potato, corn some fruit are genetically modified
  - Consumed in excess cause a high glucose load
  - Crosses the blood brain barrier
  - Damages the body tissues and brain
  - Should diabetes medications be prescribed for PD?

Not keto, but less than 100 g CHO daily

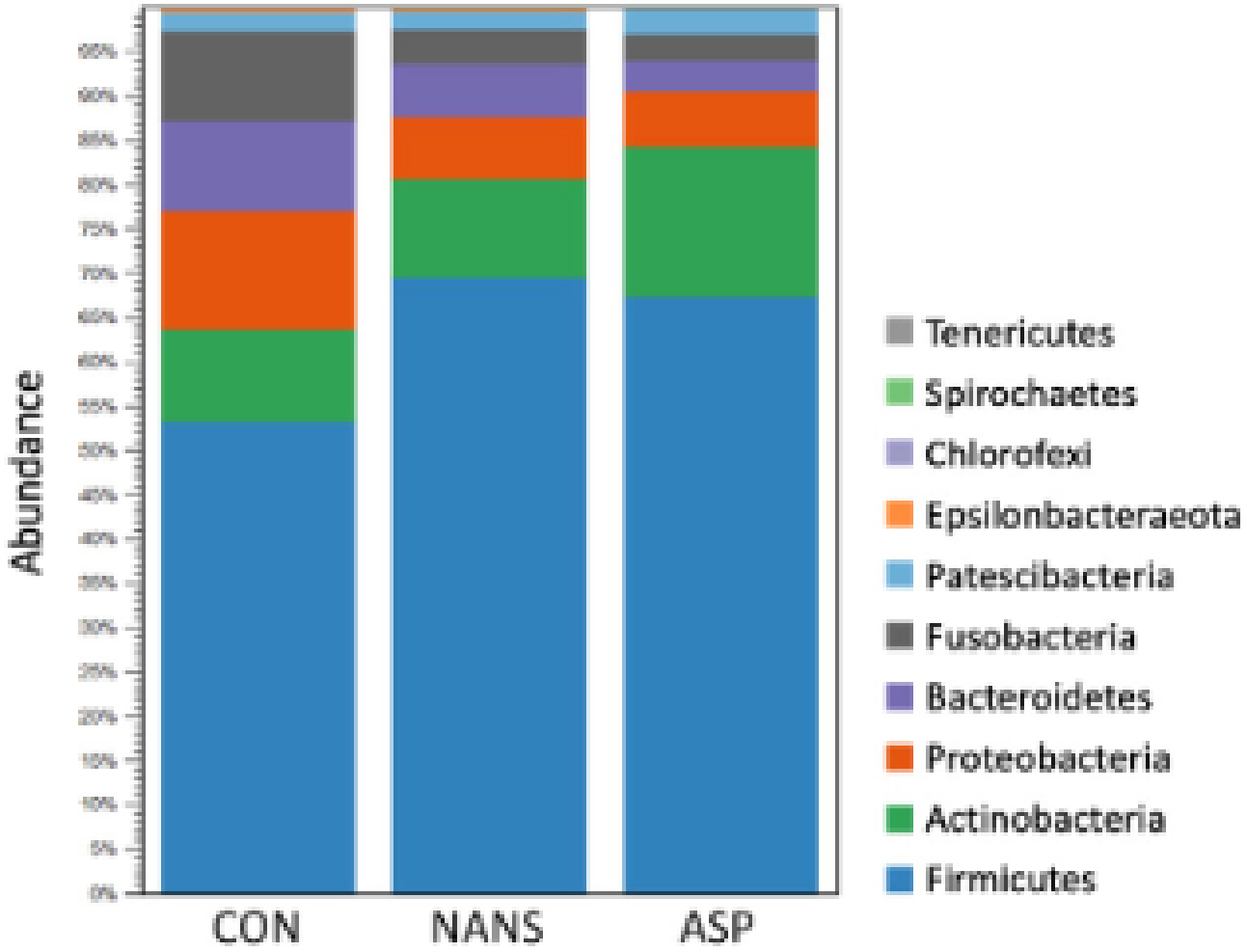
Dai et al. Glucose metabolism impairment in PD. *Brain Research Bulletin. 2023; Tingting et al. Molecular insights into PD and type 2 diabetes: Metformin's role and genetic pathways explored. Experimental Neurology 2025*

Less than 100 g carbohydrate meal plan

Sugar Substitutes

- Alter the microbiome.

Con = don't consume sugar substitutes
Nans= consume non-nutrient sweeteners
ASP = consume aspartame



Hosseini et al. Consuming artistical sweeteners may alter the structure and function of duodenal microbial communities. Cell Press. 2023

What about Stevia?

Increases Lactobacillus, Bifidobacterium and Akkermansia

↑ *Akkermansia*

↑ *Bifidobacterium,*

↑ *Lactobacillus*

↑ Enterobacteriaceae family

Stevia may be beneficial for some but not with PD

Gazerani Probiotics for PD. Int J Mol Sci 2019; Bevilacuqa et al. Ultra-processed food and gut microbiota: Do additives affect Eubiosis? A Narrative Review. Nutrients 2025

Levodopa & Nutrition

- Constipation
  - Disrupts the microbiome
- Protein → amino acids
  - Amino acids compete with Levodopa for absorption in the gut
  - Protein reduces stomach emptying also affecting when Levodopa is absorbed
  - Recommendation is to consume protein outside of taking Levodopa
  - Leads to insufficient protein intake → muscle wasting

Leta et al. Gastrointestinal barriers to levodopa and absorption in Parkinson's disease. *European Journal of Neurology. 2023;*
Menozzi, et al. The Gut Microbiota in Parkinson Disease: Interactions with Drugs and Potential for Therapeutic Applications. *CNS Drugs* (2024).

ADVANCED THERAPIES FOR PARKINSON'S DISEASE

July 6, 2024

JONATHAN SQUIRES, MD, FRCPC
CLINICAL ASSISTANT PROFESSOR
UBC

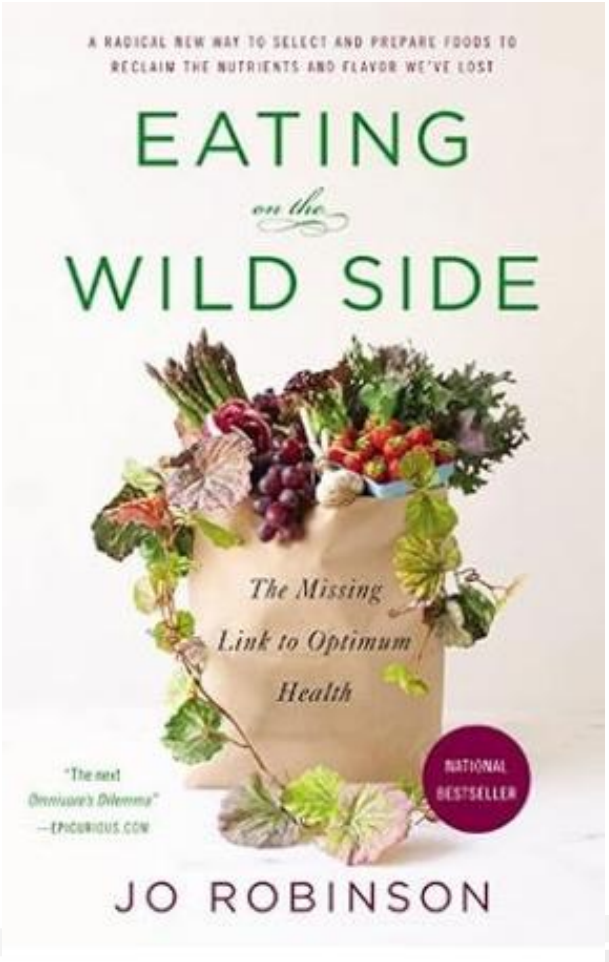
Parkinson's Foundation
CENTER OF EXCELLENCE

Djavad Mowafaghian
CENTRE FOR BRAIN HEALTH

Organic – is it worth it?

- Lu et al 2006 conducted a study with 23 children living at a private school in Washington State.
- Measured toxins in urine while consuming their usual diet.
  - Found pesticides/herbicides which damage the nervous system (brain).
- For a week they consumed organic food, which was tested to ensure it was toxic free. Also removed all toxic cleaning supplies and personal care products.
  - Urine testing did not detect pesticides/herbicides ($p<0.01$)

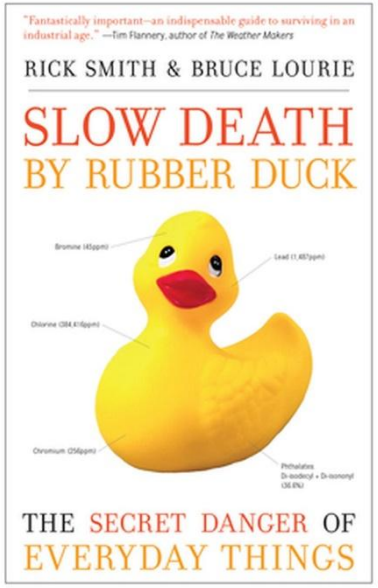
Good Read

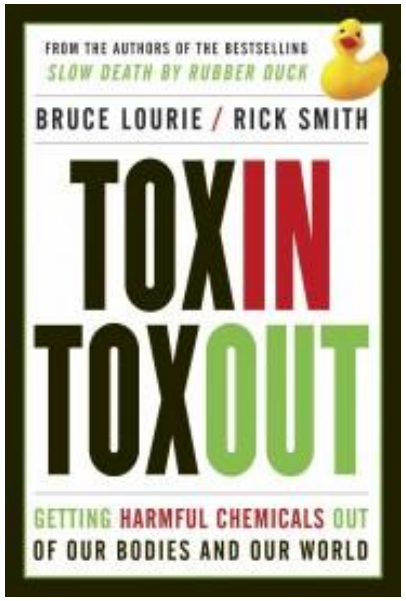


- Scours food science journals for the most nutrient dense variety of foods, tests growing them in this zone
- Blueberries have more nutrients after freezing
- Garlic has more nutrients when crushed and let to sit for 15 minutes before cooking

Reducing Exposures

It's not just food - cleaning supplies, personal care products





Two Canadian Environmental researchers have written about our toxic exposures and how to avoid them.

We will never be able to be fully toxic free but if we support the liver and reduce toxic exposures, we will be able to detoxify and eliminate those toxins that we can't avoid.

Dr. Tracy Lister RD DCN

nutrition.endeavors@gmail.com

250-954-7908