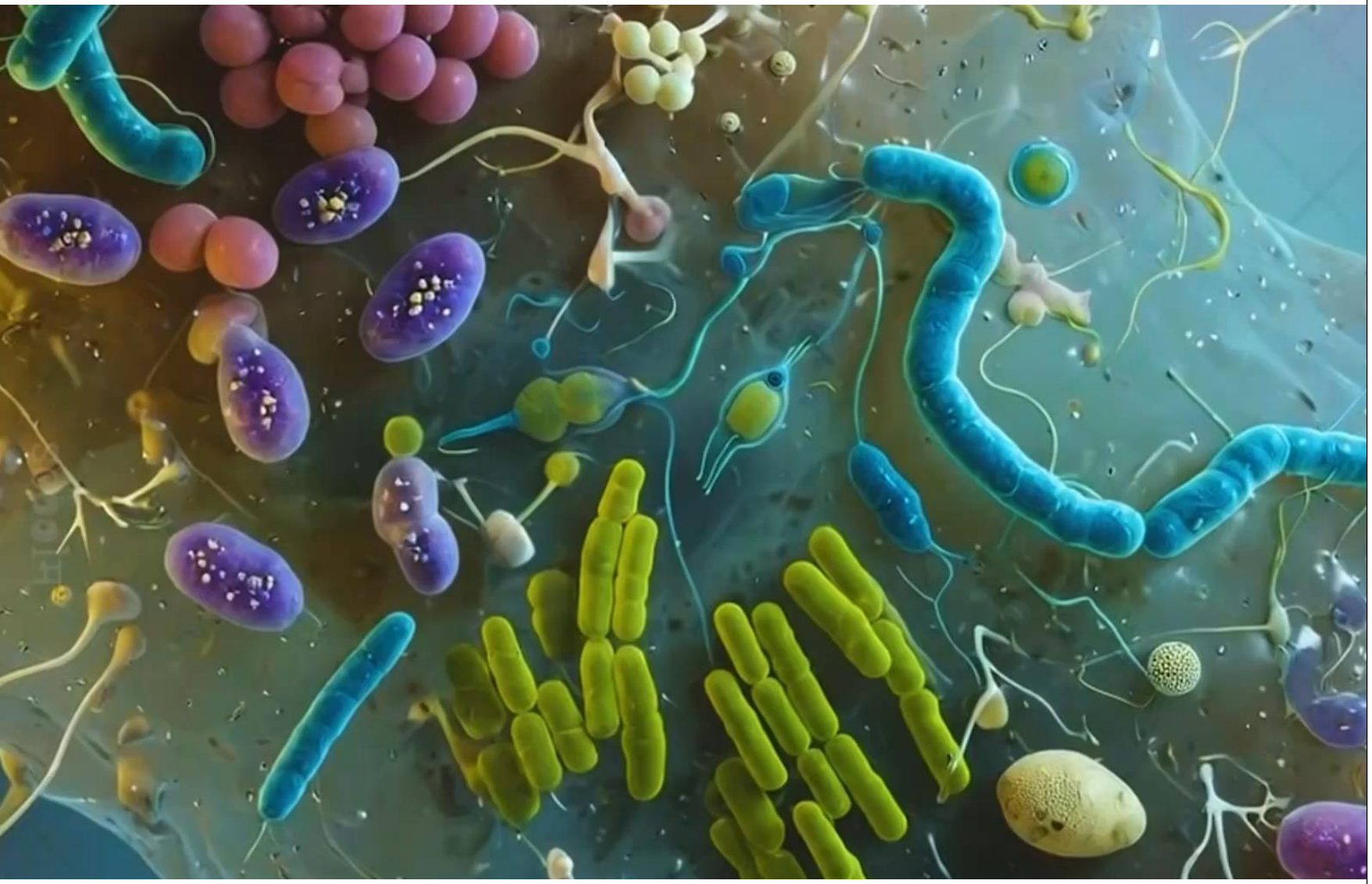


ZOOMING IN TO ZOOM OUT

Gut Health,

Parkinson's

& the

Whole-Person

Perspective

Karin Duncan, NMD

AFFILIATIONS | DISCLOSURES

INTEGRATIVE NEUROLOGY
WELLNESS CENTER
CONNECT • RESTORE • EMPOWER • THRIVE

NORTHWEST PARKINSON'S FOUNDATION

PARKINSON'S SCHOOL
An Online Course for Patients and Providers

MEET DR. KARIN

I love metaphors and analogies

I can sing the alphabet backwards

I didn't start drinking coffee until medical school – not even in the military!

I use Legos with my son as an excuse to do my nerdy hobby

My fastest mini crossword score is ~~26~~ 13 seconds

I began studying the brain at age 14

DOPAMINE

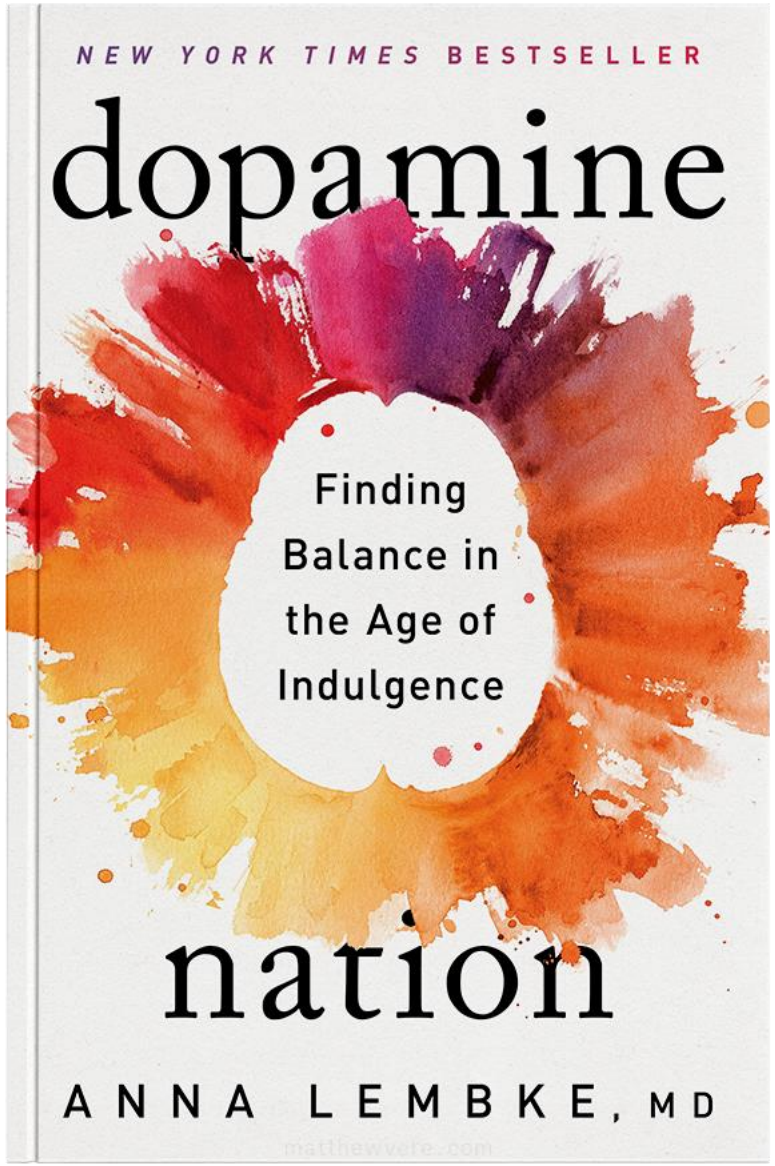
Pre-reward dopamine spike with conditioned cue

Dopamine decrease below baseline

Craving -> Motivation

Curiosity drives midbrain activity = dopaminergic neurons and hippocampus

It should make SENSE



WHAT IS A NATUROPATHIC MEDICAL DOCTOR?

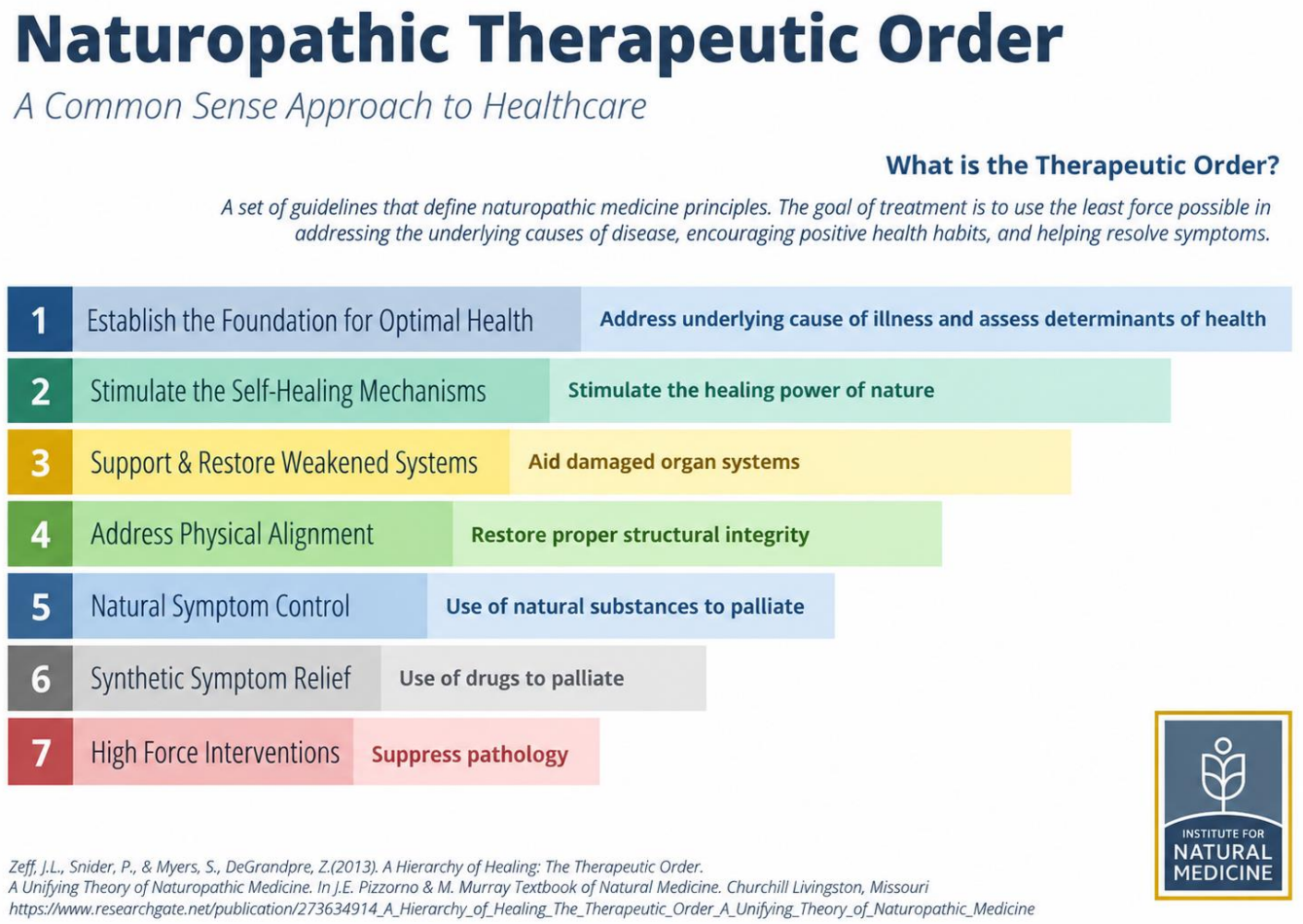
Licensed primary care providers (DO, ARNP, MD, NMD/ND)

Able to diagnose, treat, manage parkinsonism

Order and interpret laboratory tests and imaging

Prescribe pharmaceutical drugs used in the management of parkinsonism

Provide guidance on diet, lifestyle, health care promotion, etc.



INTEGRATIVE CARE: WHAT YOU NEED TO KNOW

Many fields consider themselves "integrative" which provides MANY options

- *Naturopathic Medicine*
- *Functional Medicine*
- *Chiropractic Medicine*
- *Acupuncture*
- *Chinese Medicine*
- *Ayurvedic Medicine*
- *Botanical Medicine*

APPROACH TO A PD PATIENT

PRO-PD

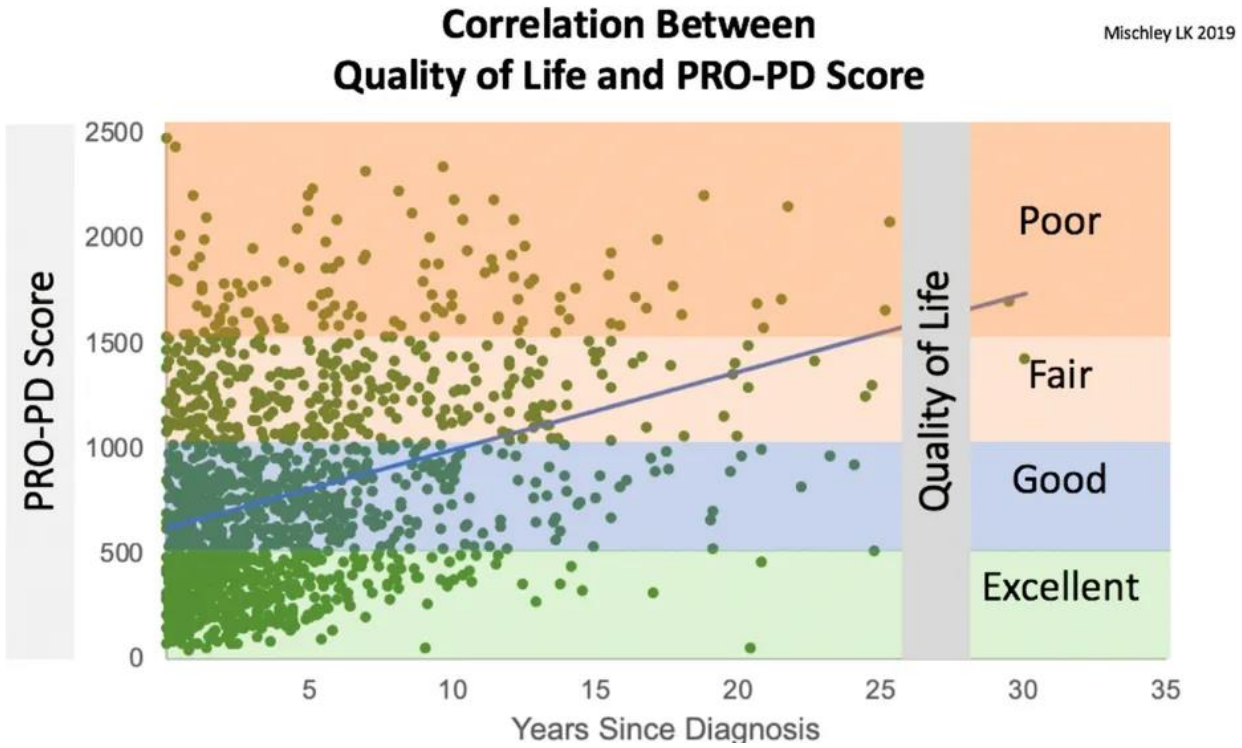
Measuring the burden of disease

Validated tool for progression (or regression!)

Continuous measure of disease severity

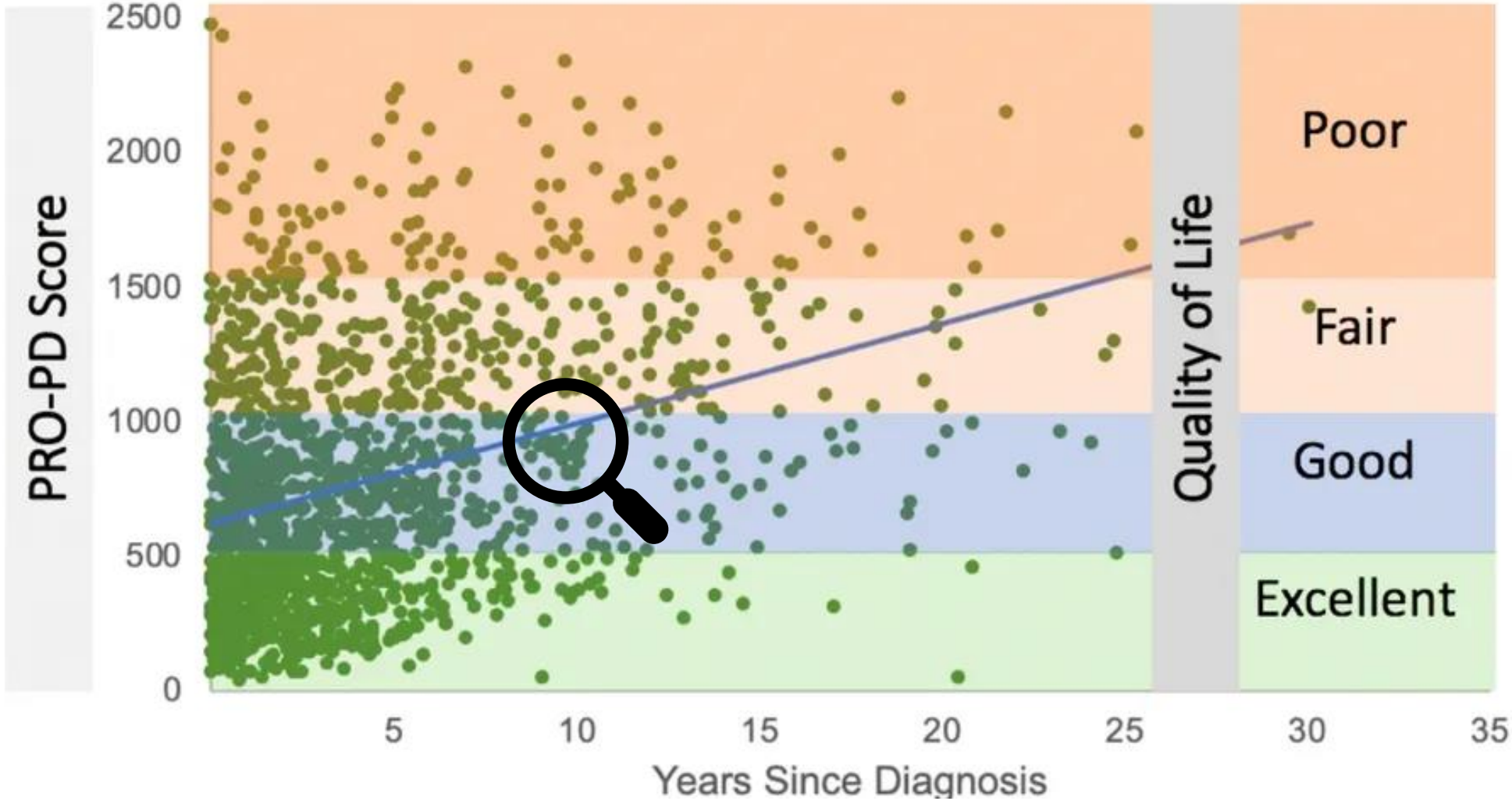
Stratifiable by symptom

Lower scores are better



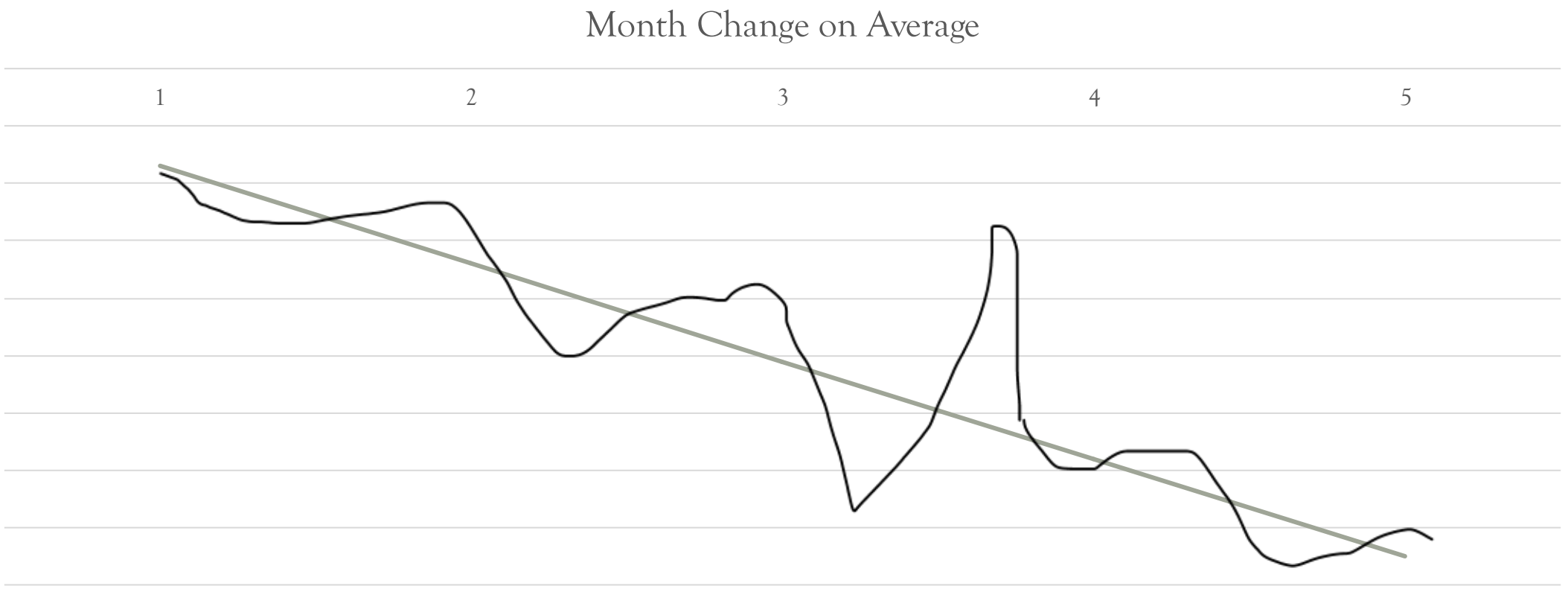
Correlation Between Quality of Life and PRO-PD Score

Mischley LK 2019



OUTCOMES

OUTCOMES

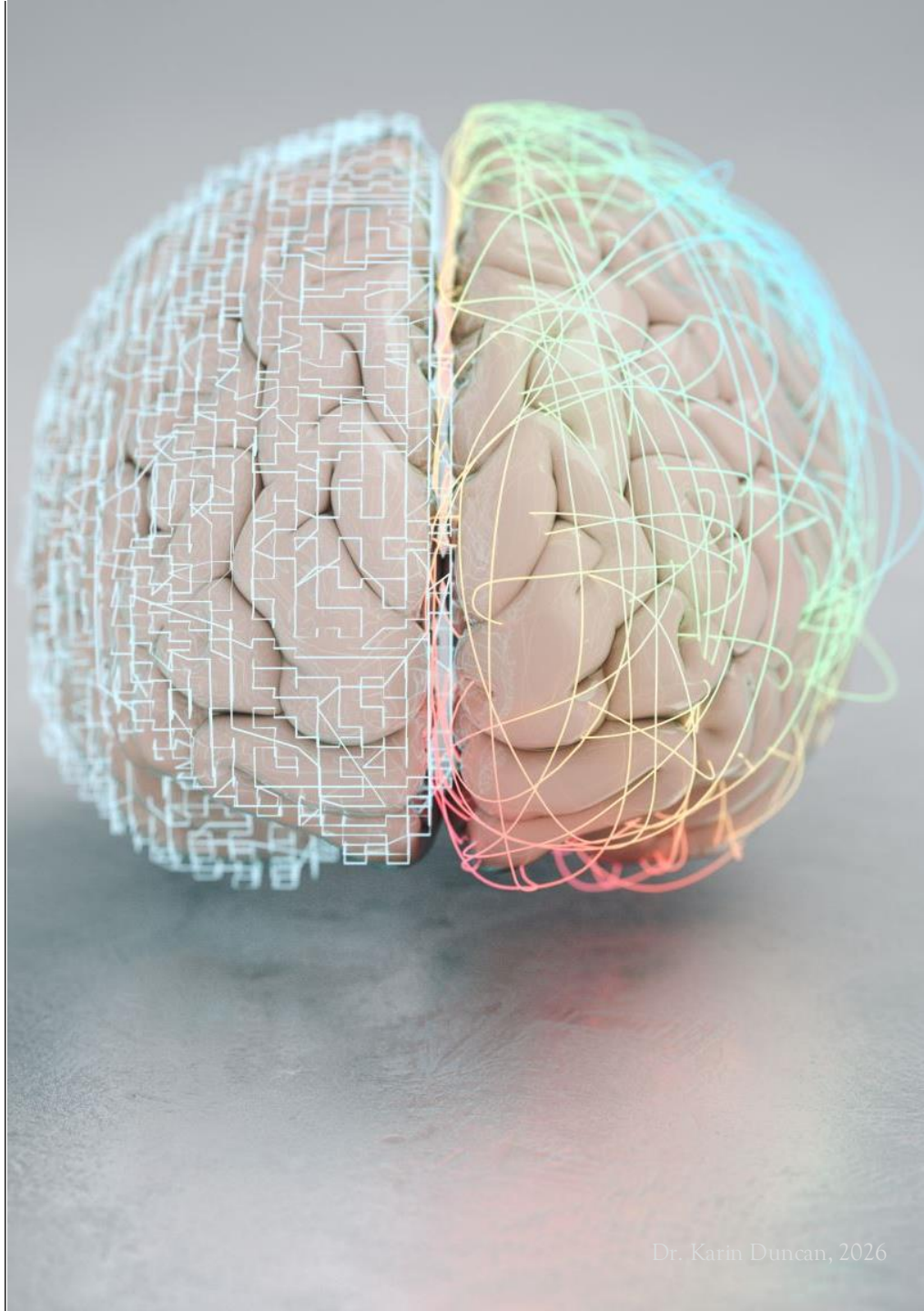


GOALS FOR TODAY

- You leave this talk realizing there are many more therapeutic options available to you than you realized or have been told
- You learn more about your body, health, and disease to create a strategy to address the whole of you
- There are providers that will work with your established team to enhance your overall health – with expertise on your condition(s)
- PD is only a portion of your overall health picture
- Your emotional health and nervous system play an essential role in your health picture
- Your quality of life is considered in your health management

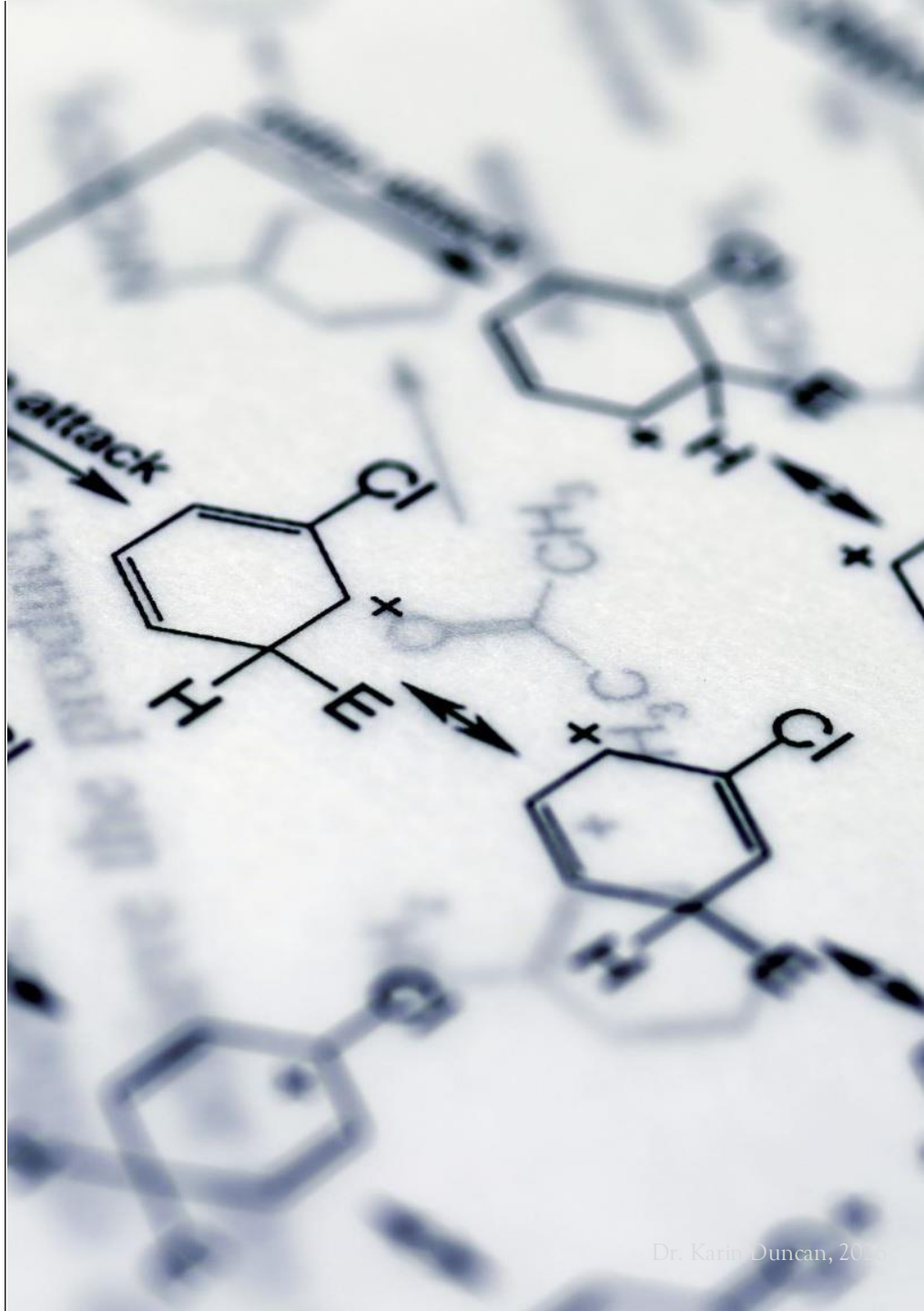
PARKINSON'S DISEASE

Among all neurological disorders, PD is experiencing the most significant growth in terms of deaths, prevalence, and disability-compromised life



PARKINSON'S DISEASE

- Symptoms of PD are characterized by a deficit of dopamine.
- This occurs when the build-up of α-syn aggregates in dopaminergic neurons and exert cytotoxic effects, impairing synaptic plasticity, and contributes to neuronal dysfunction, degeneration and, thus, the loss of dopamine production.



PARKINSON'S DISEASE

Loss of dopamine cells is NOT the only degenerative process driving PD

- Serotonin
- Glutamate
- Norepinephrine
- Acetylcholine

Found in basal ganglia, cortical and brainstem regions

PARKINSON'S DISEASE: NON- MODIFIABLE RISK FACTORS

HERE'S WHERE WE ZOOM IN

PARKINSON'S DISEASE: MODIFIABLE RISK FACTORS

- Misfolded proteins and accumulation
- Oxidative stress
- Mitochondrial dysfunction
- Energy deficiency
- Excitotoxicity
- Propagation of α-synuclein
- Protein clearance pathway malfunction
- Corticostriatal circuit dysfunction

PARKINSON'S DISEASE: MODIFIABLE RISK FACTORS

Misfolded proteins and accumulation	Oxidative stress	Mitochondrial dysfunction	Energy deficiency
Excitotoxicity	Propagation of α-synuclein	Protein clearance pathway malfunction	Corticostriatal circuit dysfunction

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ZOOMING BACK OUT

HOW DO YOU FIX A LEAK?

PRODROMAL SYMPTOMS

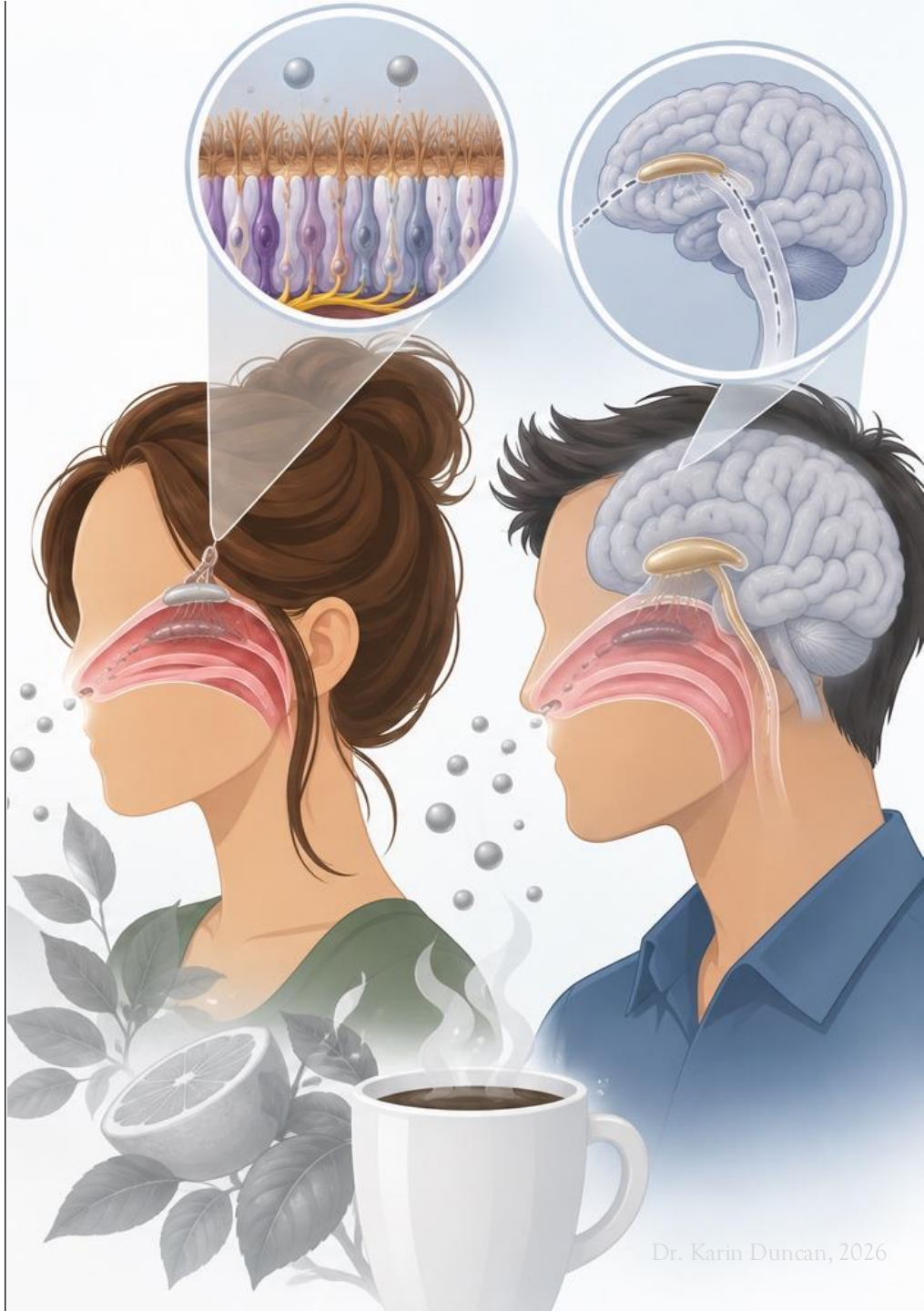
Hypo/Anosmia (sense of smell)

Constipation

REM Sleep Behavior Disorder

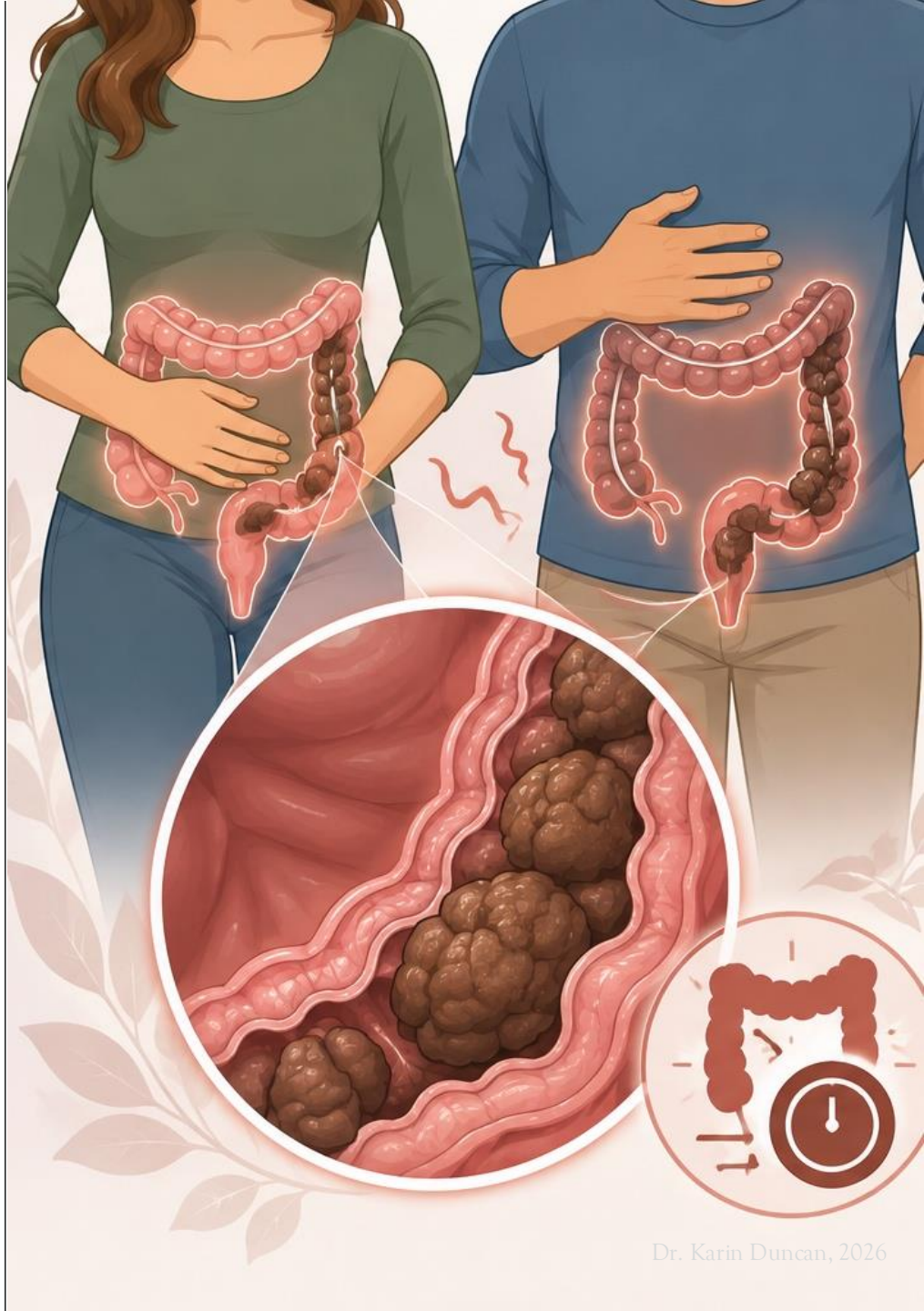
PRODROMAL SYMPTOMS: SMELL

- Loss of sense of smell is strongly linked to the early development of PD
  - *Olfactory system is one of the first brain regions affected*
    - Early α-syn deposition in olfactory structures
      - *5-15 years prior to diagnosis*



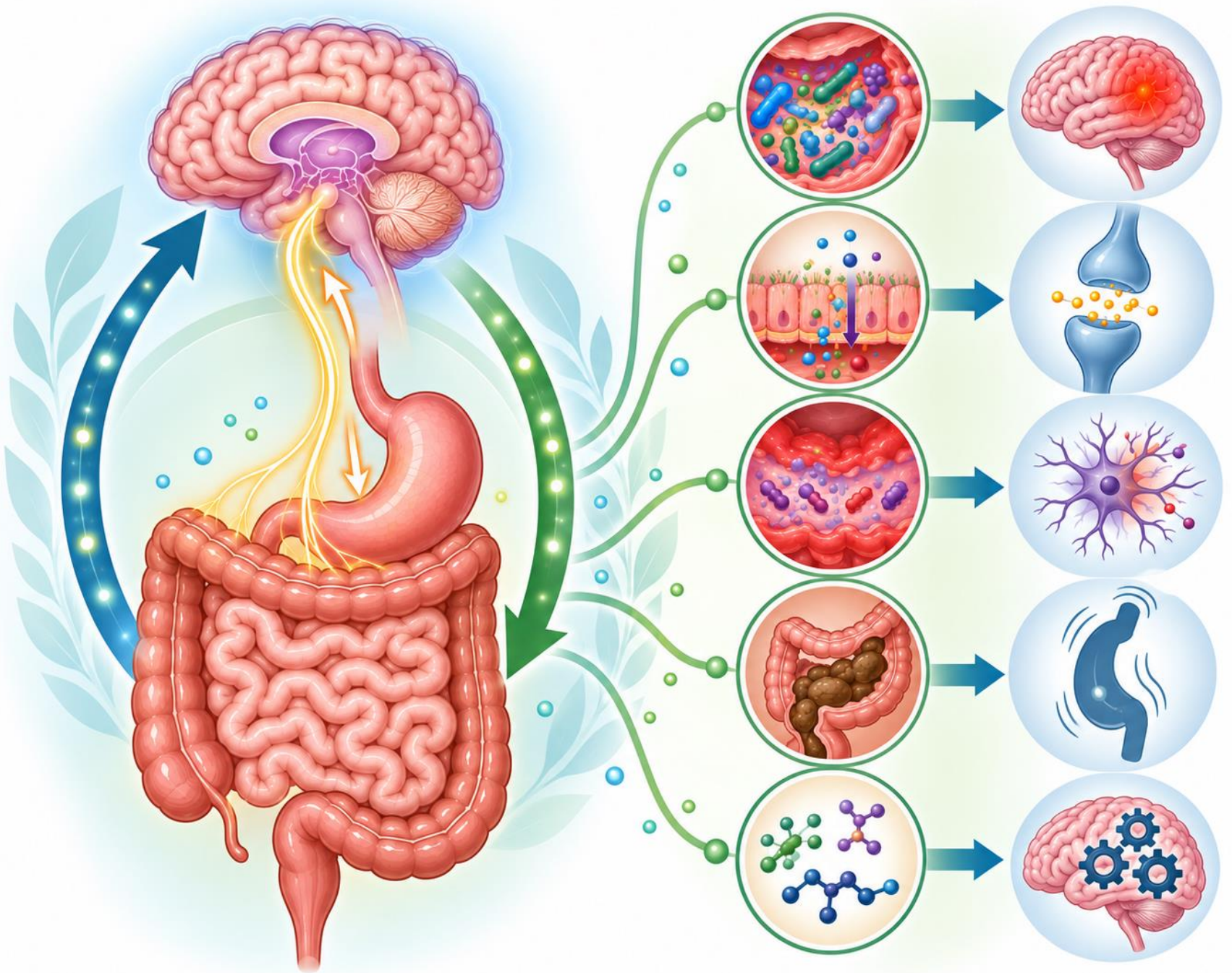
PRODROMAL SYMPTOMS: CONSTIPATION

- Anosmia and constipation
- Early involvement of ENS and autonomic circuits shifts motility
- Alters microbiome metabolites, nutrient absorption, mucosal immunity
- Impaired detoxification
  - *Creates or exacerbates intestinal permeability (“leaky gut”)*



PRODROMAL SYMPTOMS: RBD

- Sleep disorders are closely connected to PD because the brain regions that regulate sleep are affected very early in the disease process
  - *α-synuclein affects sleep-regulation centers that normally paralyze the body during dreaming*
- One of the strongest known prodromal predictors of PD and related synuclein disorders



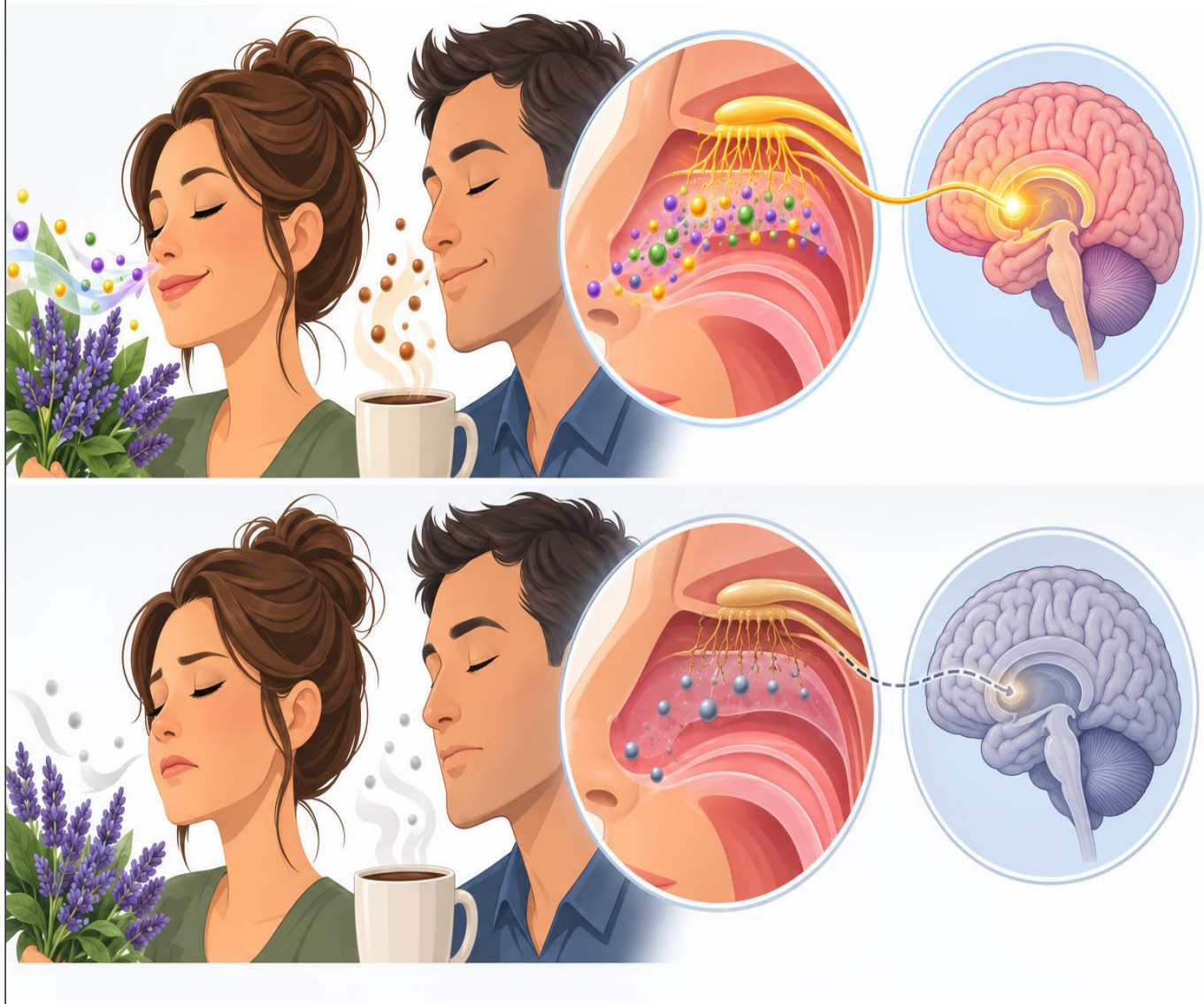
GUT FUNCTION AND PD

CEPHALIC PHASE – GET READY TO EAT

- Digestion begins BEFORE food reaches the stomach
- Sight, smell, taste, though, anticipation
- Stimulate Vagus nerve
- COORDINATION

CEPHALIC PHASE – PWP

- Loss of or diminished sense of smell
- Disrupted autonomic nervous system
  - *Disordered eating habits*
    - Lack of access
    - Loss of ability/motivation to prepare
    - Loss of community

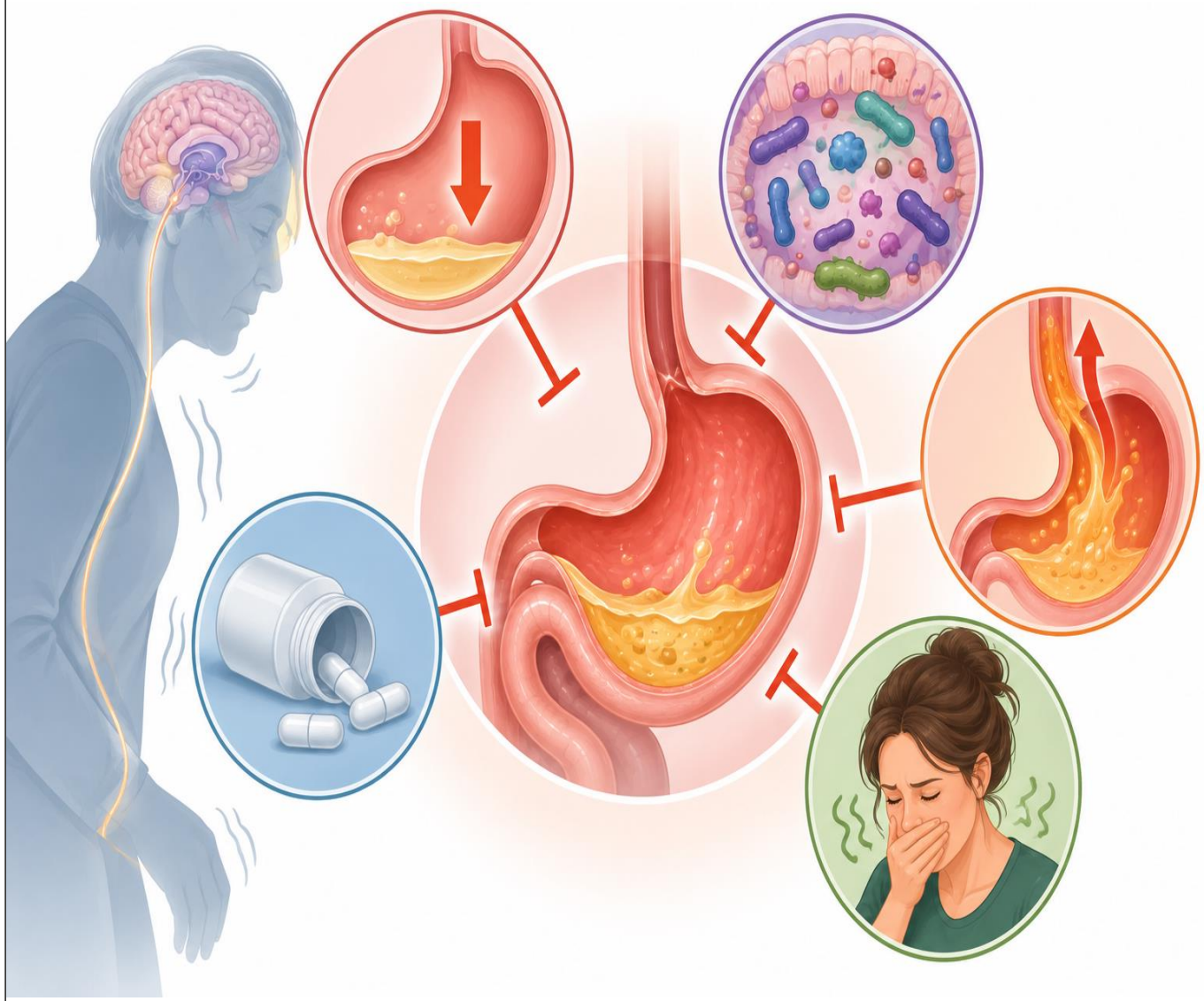


GASTRIC PHASE – FOOD HAS ARRIVED

- Acidify chyme
- Triggers:
  - *Stomach distension*
  - *Protein in stomach*
  - *Rising gastric pH*
- Major players:
  - G *cells, ECL, Parietal, Chief cells*
- Mix it up
- Built-in brake with low pH
- 3-4 hours

GASTRIC PHASE – PWP

- HyPOchlorhydria
- Dysbiosis
- Acid reflux
- Treatment for acid reflux
- Stomach pain
- Nausea

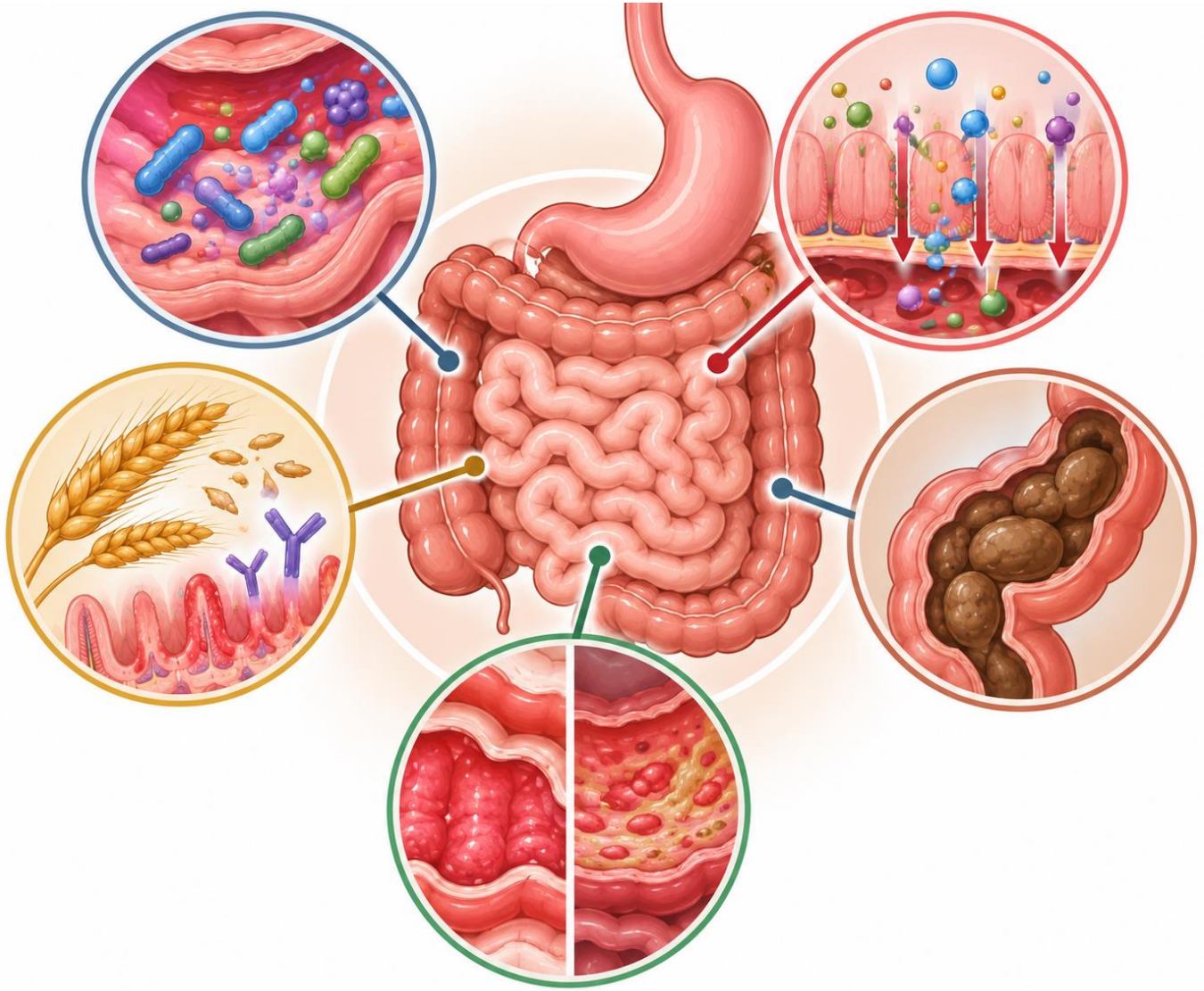


INTESTINAL PHASE – ABSORB, NOURISH, REGULATE

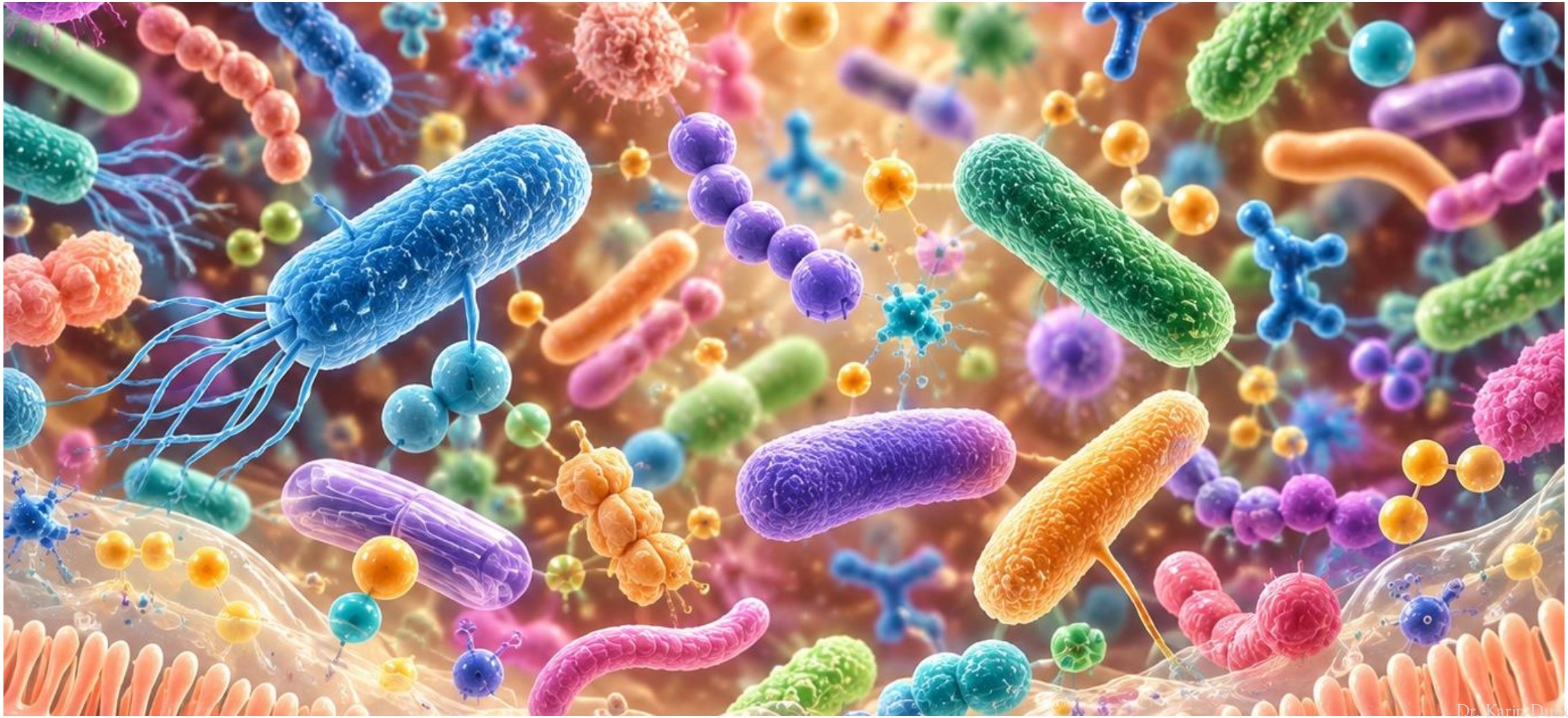
- Finish digestion
- Absorb nutrients
- Regulation/pacing
- Triggers: chyme
- Identification: acidity, fat, protein, carbs, [], amount
- Neural reflexes & intestinal hormones
- Duration: hours

INTESTINAL PHASE – PWP

- SIBO/dysbiosis
- Leaky gut/permeability
- Constipation
- IBD/IBS
- Celiac disease
- Candidiasis
- Dehydration

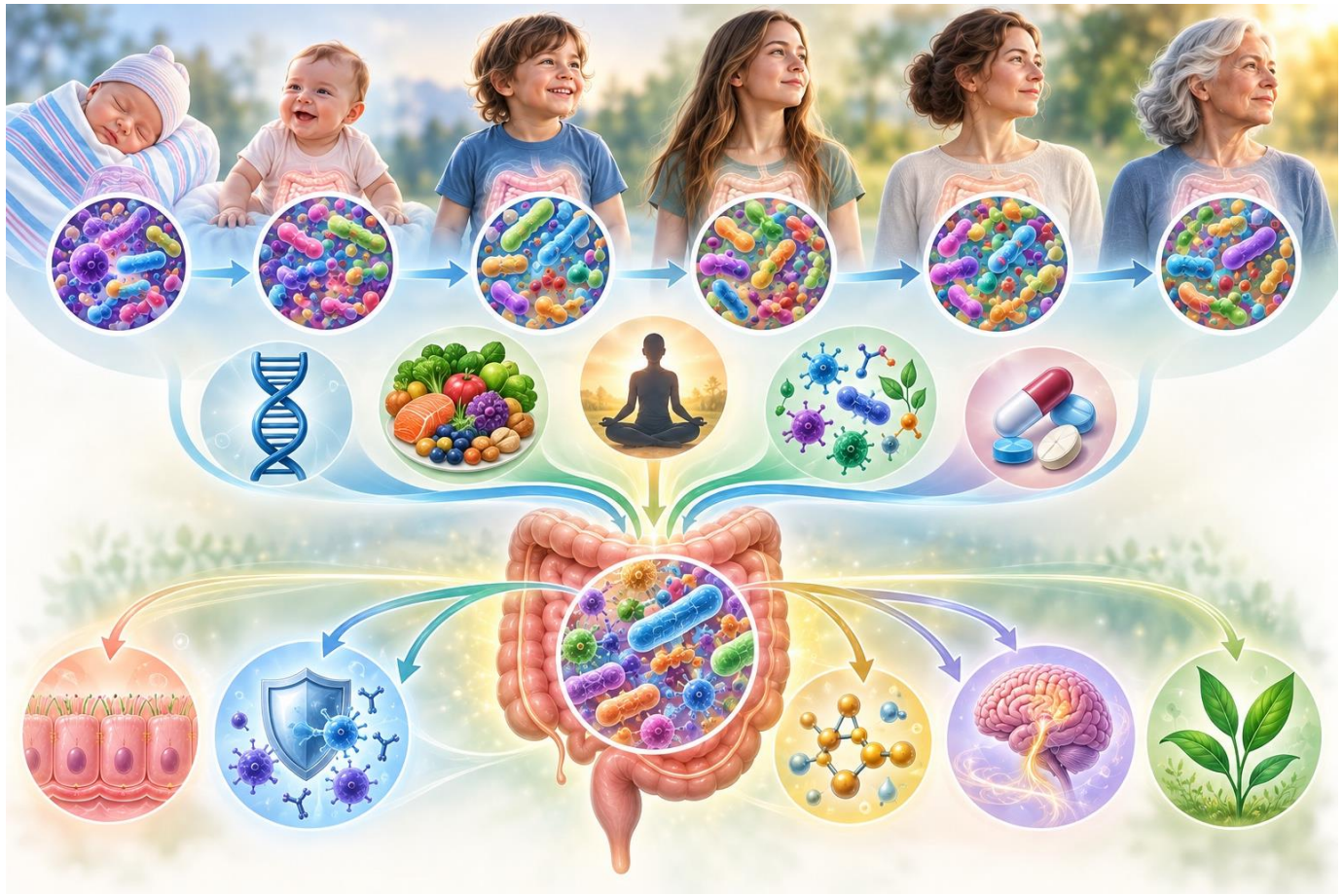


MICROBIOME AND PD



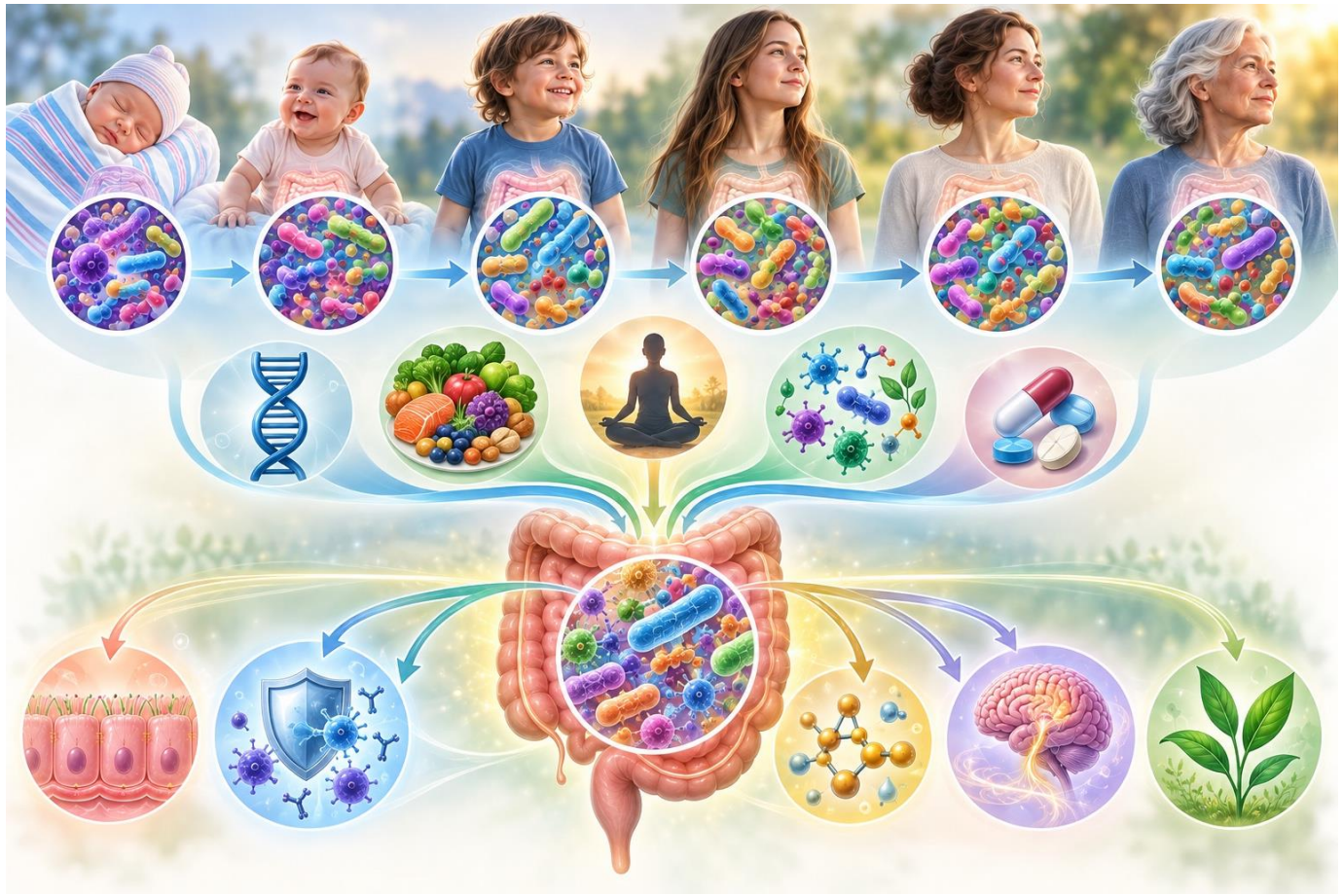
ZOOMING IN…A LOT.

MICROBIOME - DEFINITION



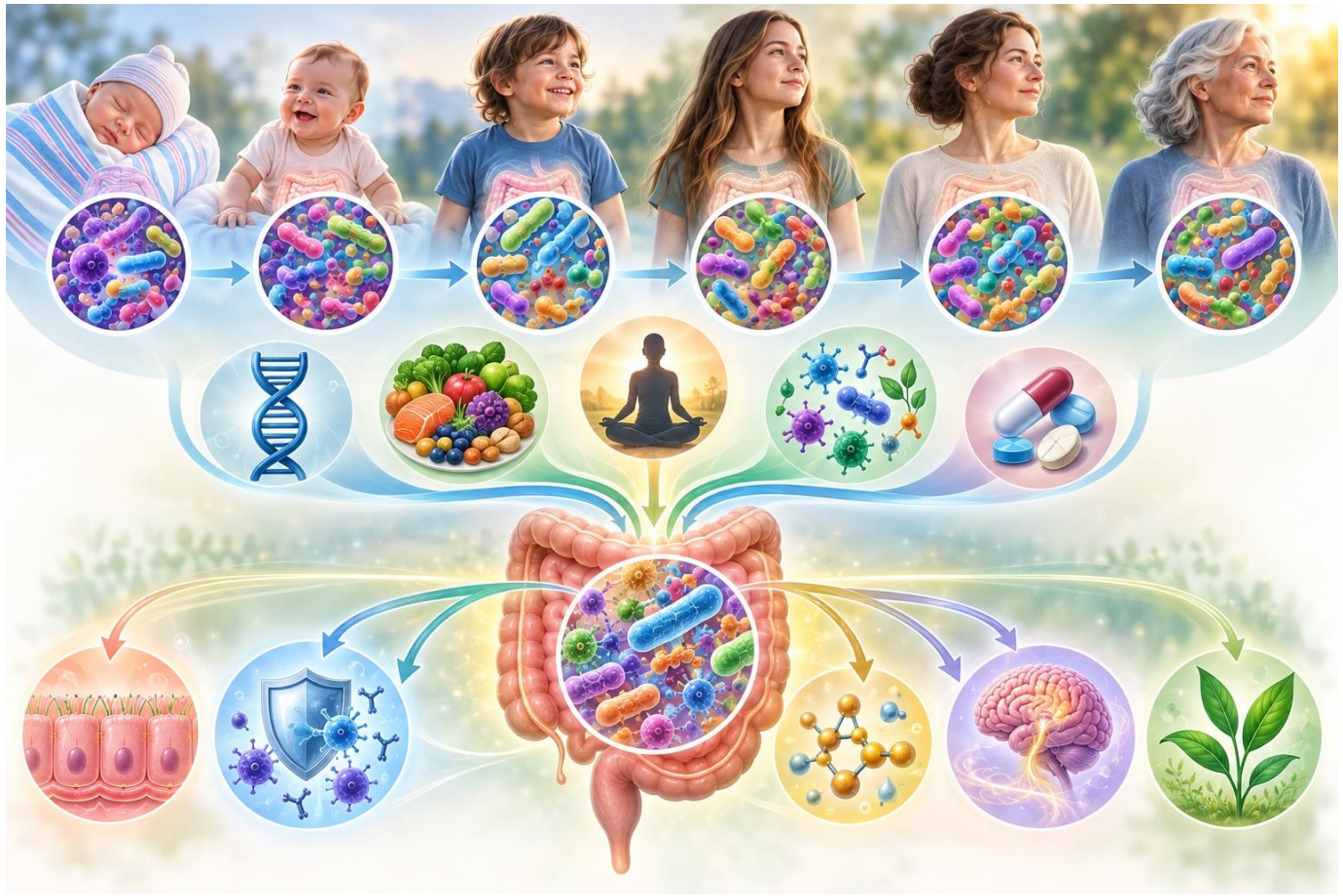
- Consortium of different microbes in our skin, lungs, UG, and GI
- "hidden organ"
- Connected to multiple illnesses
  - *Obesity*
  - *Diabetes*
  - *IBD*
  - *CVD*
  - *NDD (AD and PD)*

MICROBIOME - DEFINITION



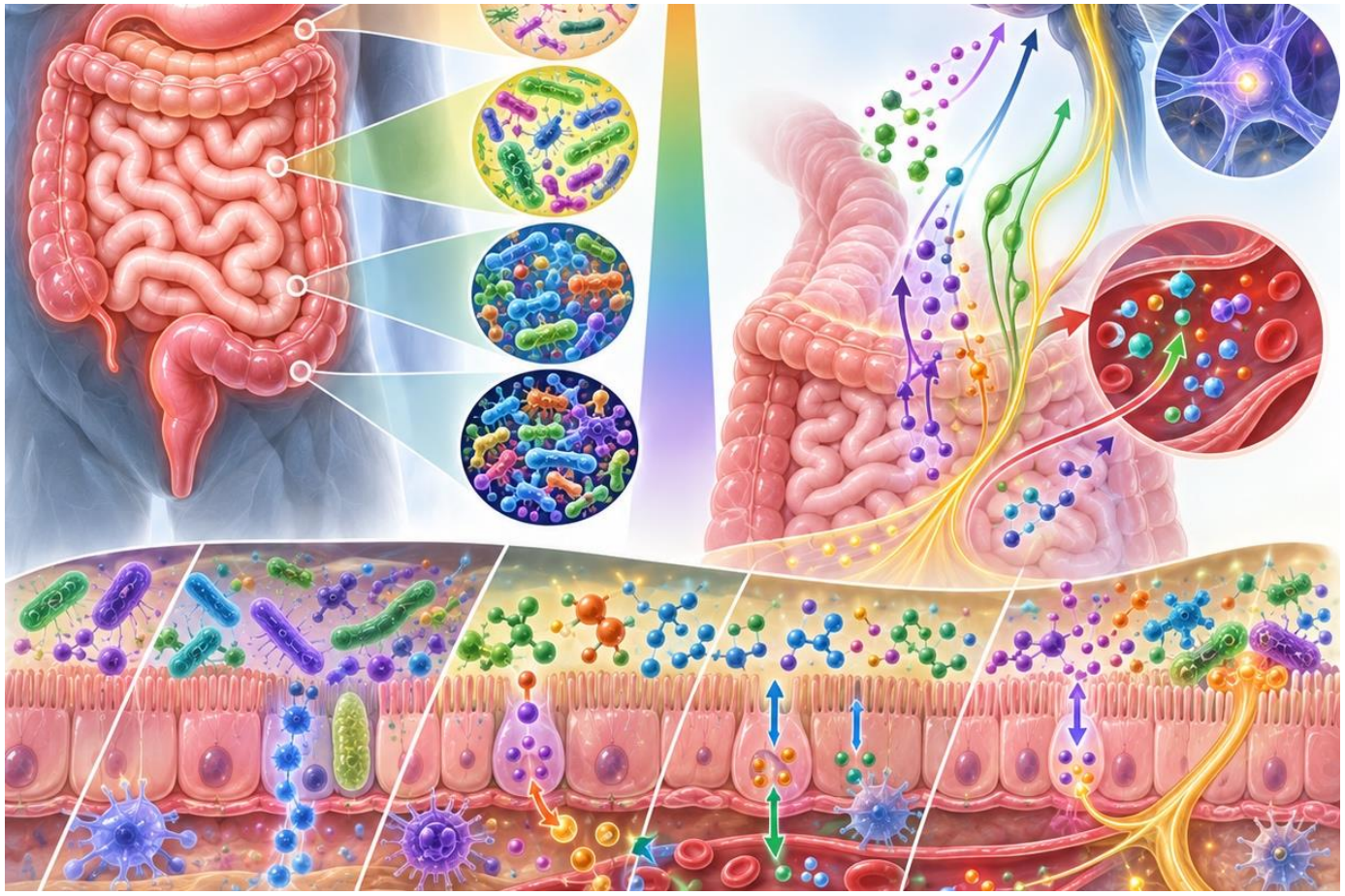
- We are more bug than human
- Microbiome's collective genetic repertoire > ours

MICROBIOME - COMPOSITION



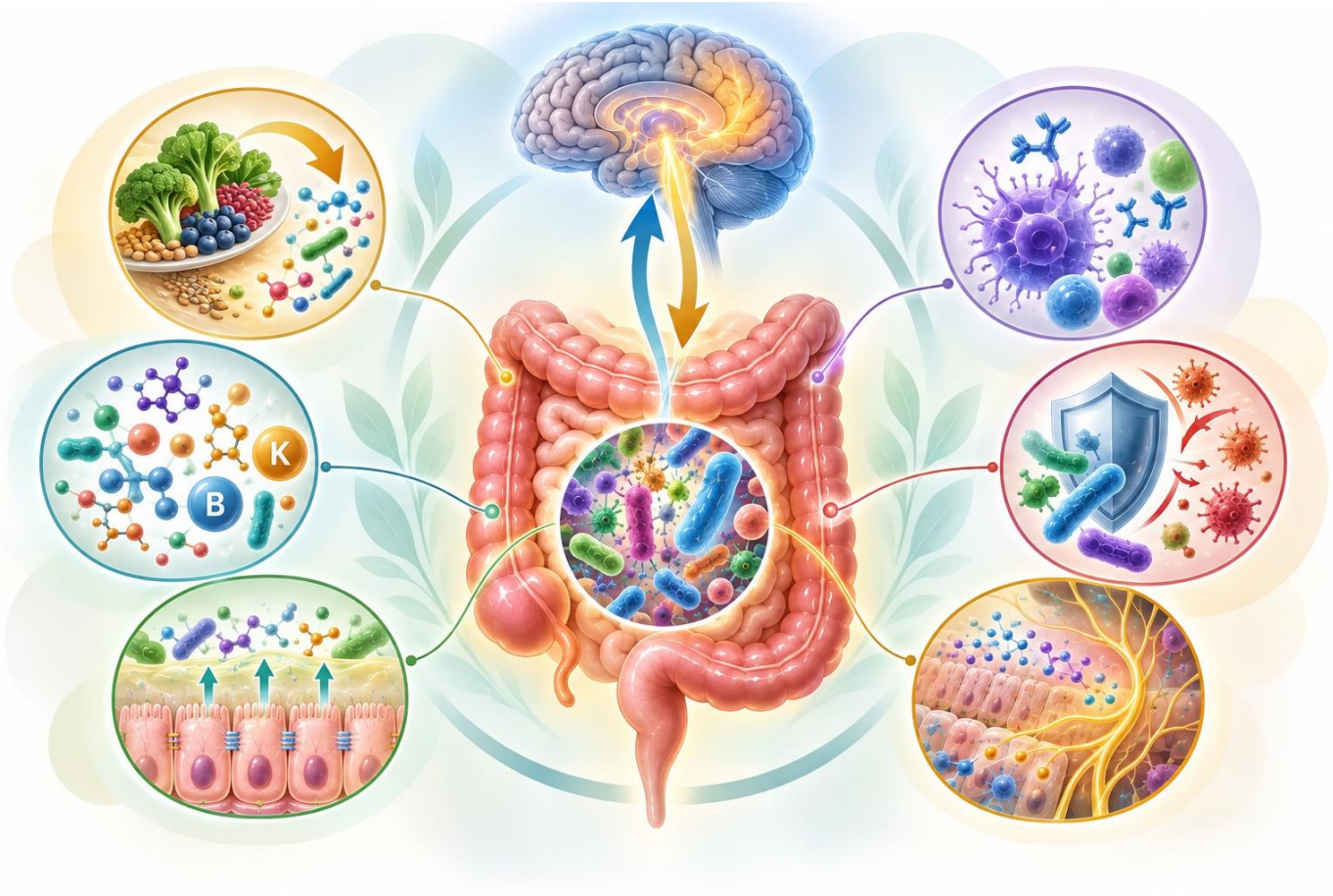
- Initially acquired at birth
- Regulated by a combination of factors
  - *Host genetics*
  - *Environmental: diet, stress, exposure, antibiotics*
- Diverse
- Flexible/adaptable

MICROBIOME - FUNCTION



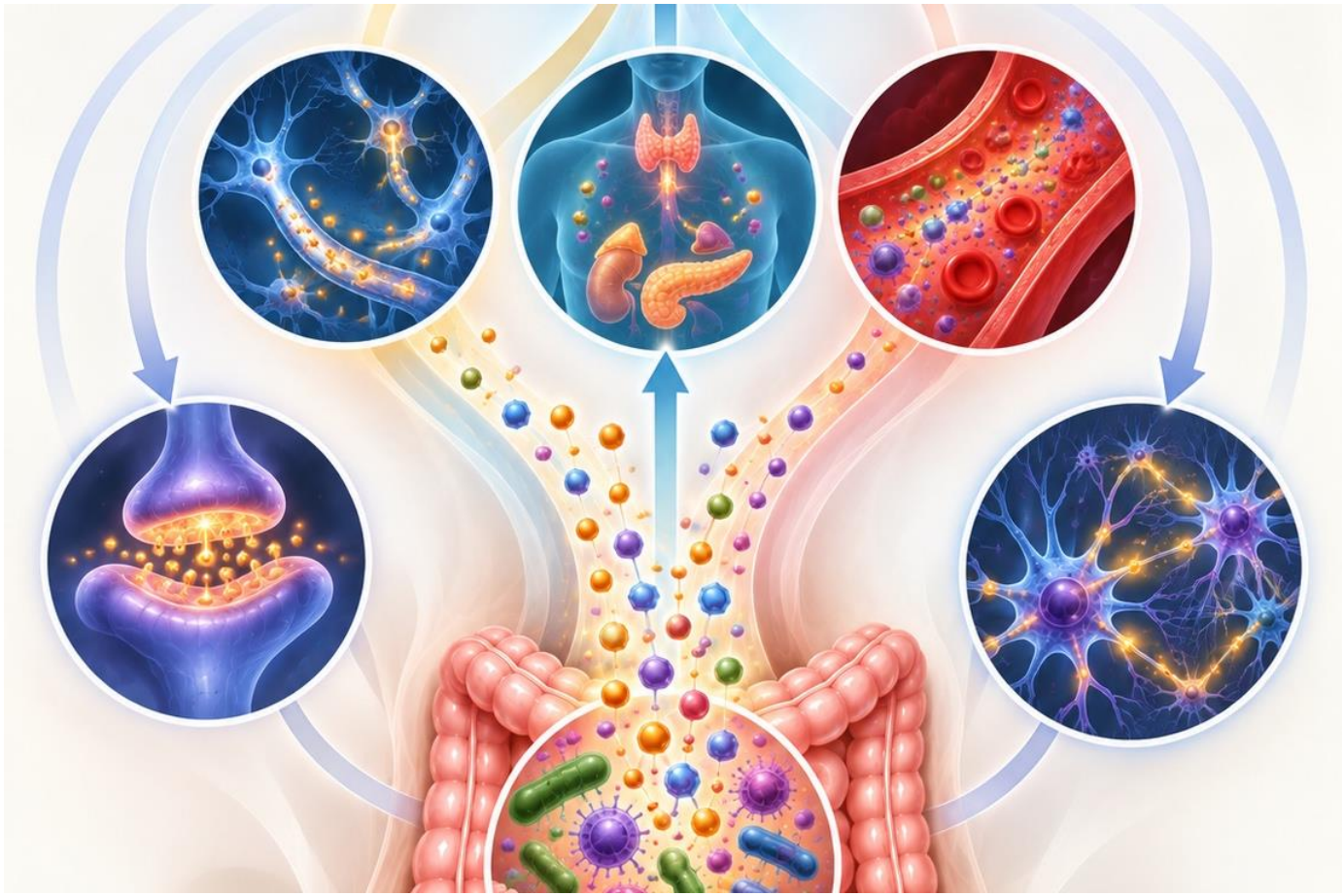
- Aids digestion
- Production of metabolites
- Maintains intestinal barrier
- Drug metabolism
- Regulates immune system
- Protects against pathogens
- Communicates with brain

MICROBIOME - FUNCTION



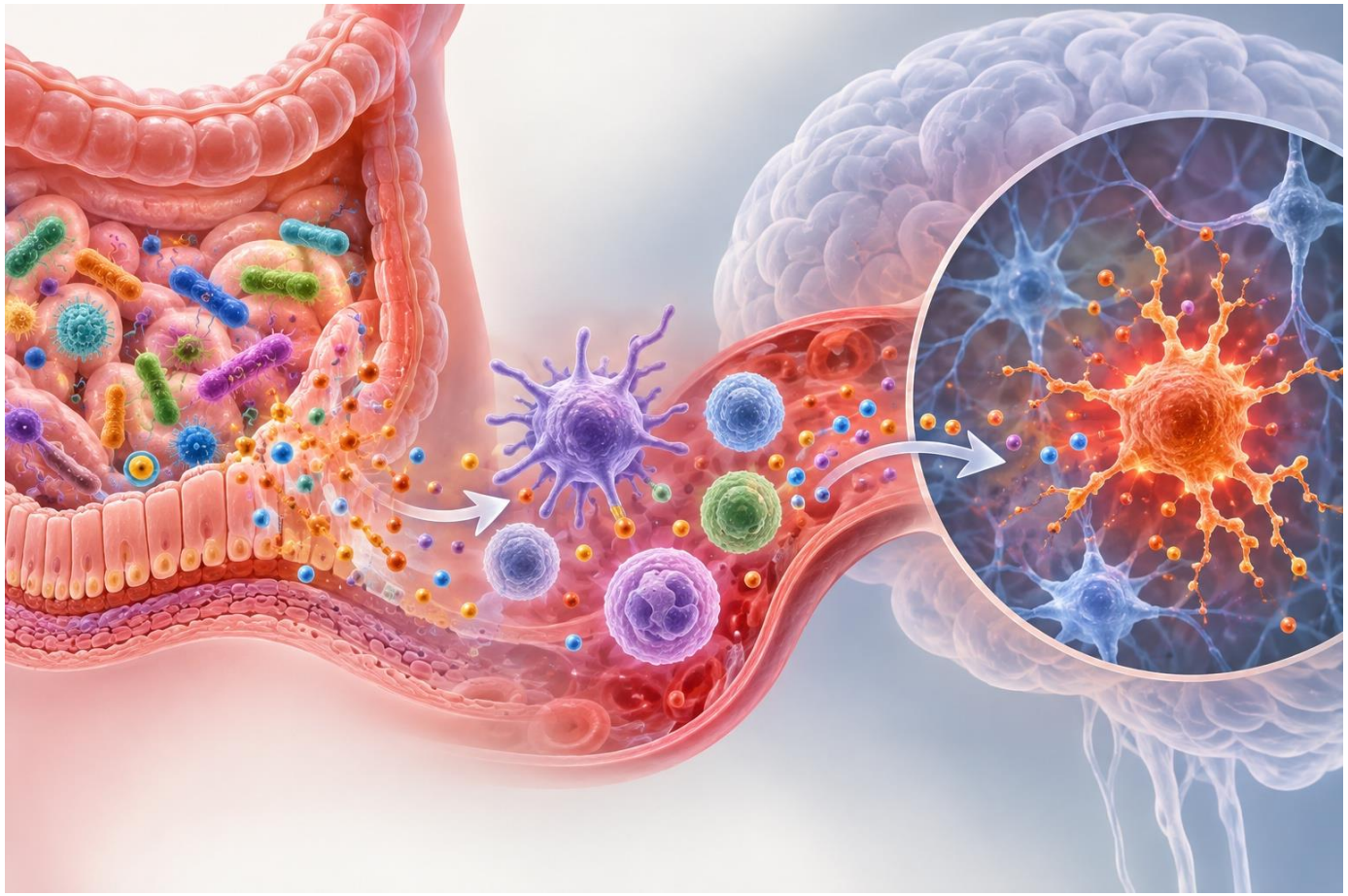
The microbiome isn't simply a collection of bacteria helping us digest food. It's metabolically active, interacts with our immune system and intestinal barrier, and participates in a two-way communication network with the brain.

MICROBIOME – CNS FUNCTION



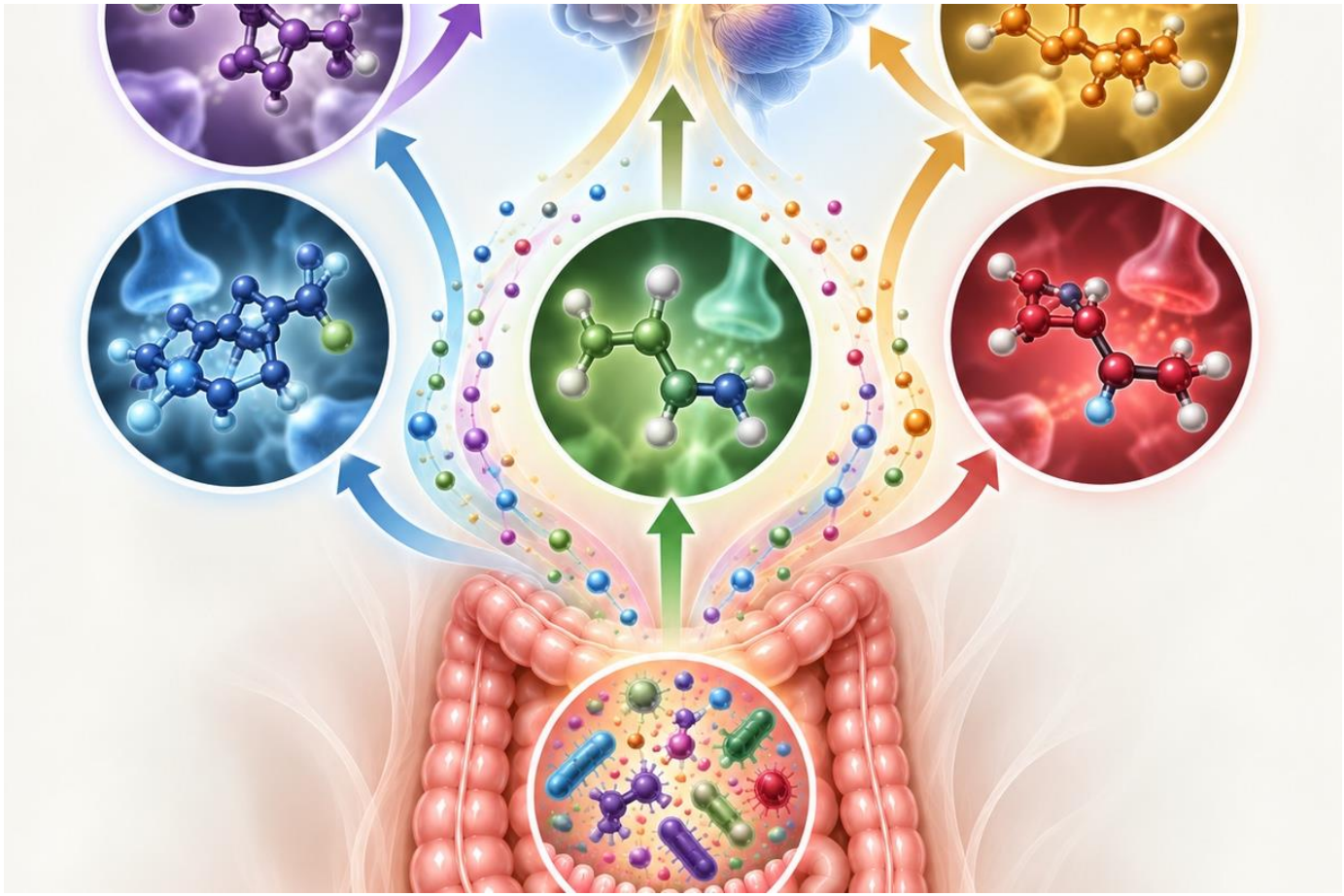
- Synthesizes and modulates chemical messengers that influence CNS function
- Signaling plays a role in:
  - *Neurotransmission*
  - *Dendritic development*
  - *Synaptic plasticity*

MICROBIOME – CNS FUNCTION



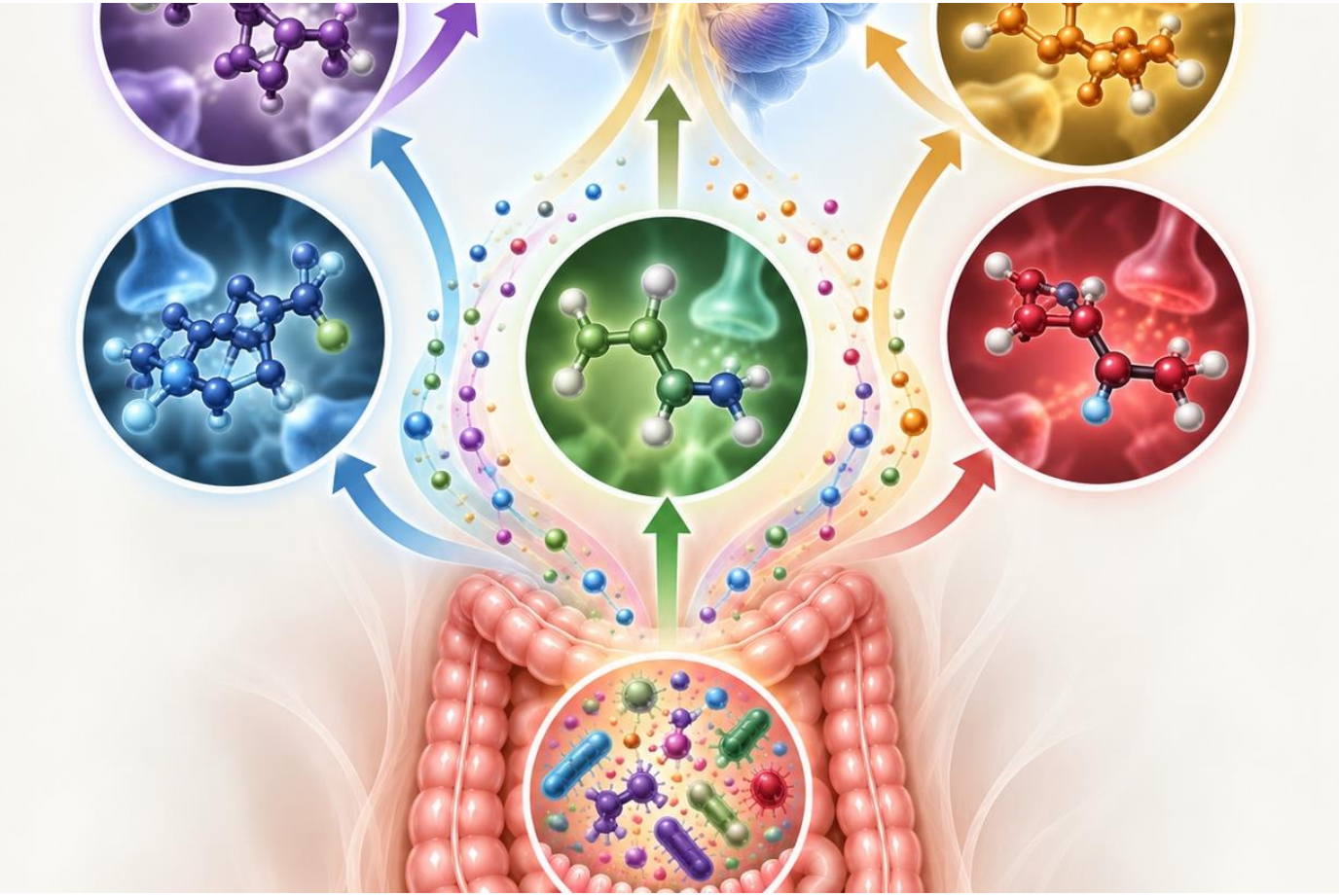
- Contribute to microglial maturation and activity
- Facilitates clearance of neurotoxic protein aggregates
- Influences the expression of BDNF *(more later)*

MICROBIOME – CNS FUNCTION



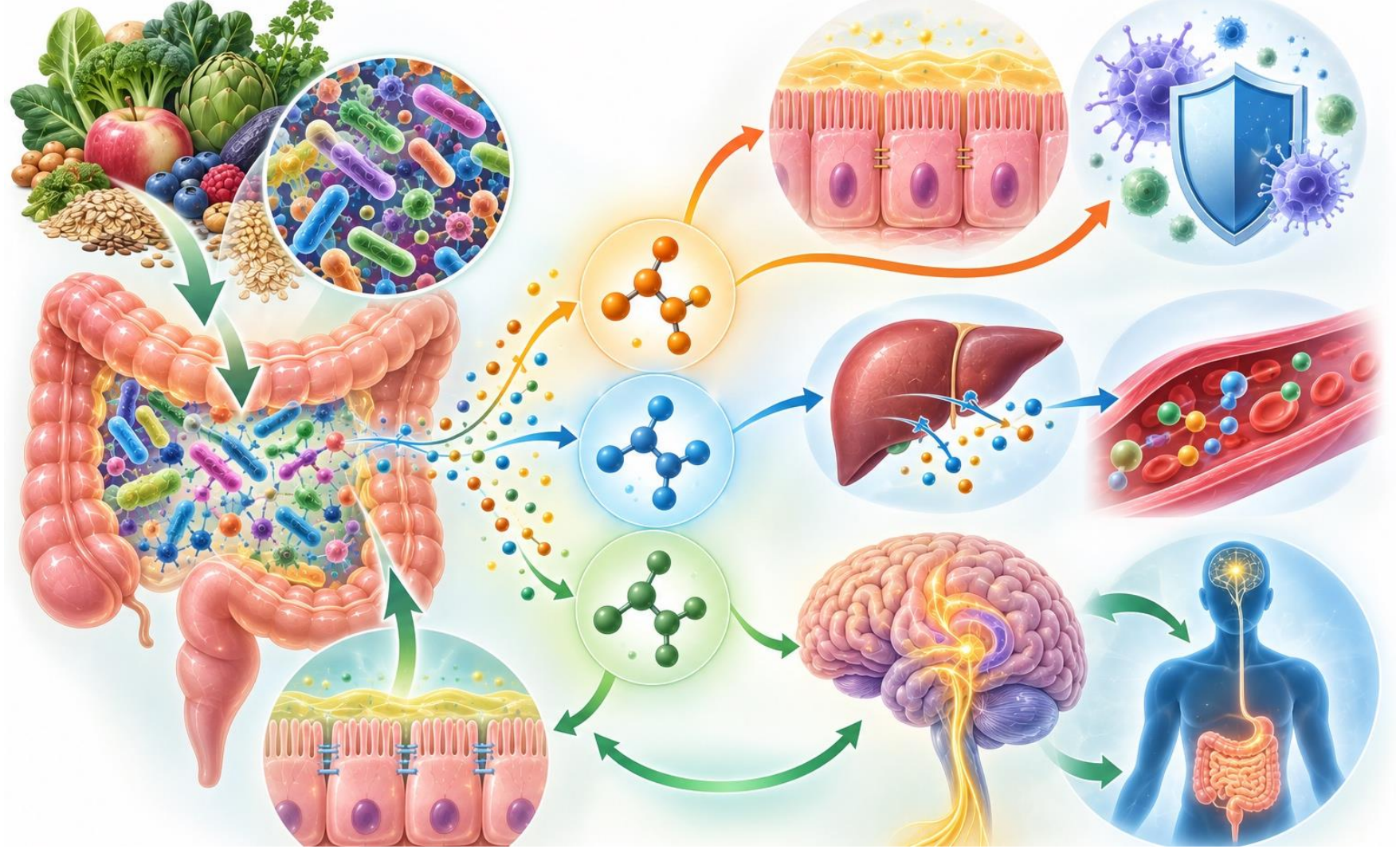
- Produce, regulate, metabolize key neurotransmitters
  - *5-HT*
  - *Dopamine*
  - *Glutamate*
  - *Norepinephrine*
  - *GABA*

MICROBIOME – CNS FUNCTION



- Serotonin dysregulation and PD
- 90-95% of serotonin made in GI
- Certain microorganisms promote synthesis/enterochromaffin cells
- Impacts:
  - *Motility, secretion, sensation, gut-nerve signaling*

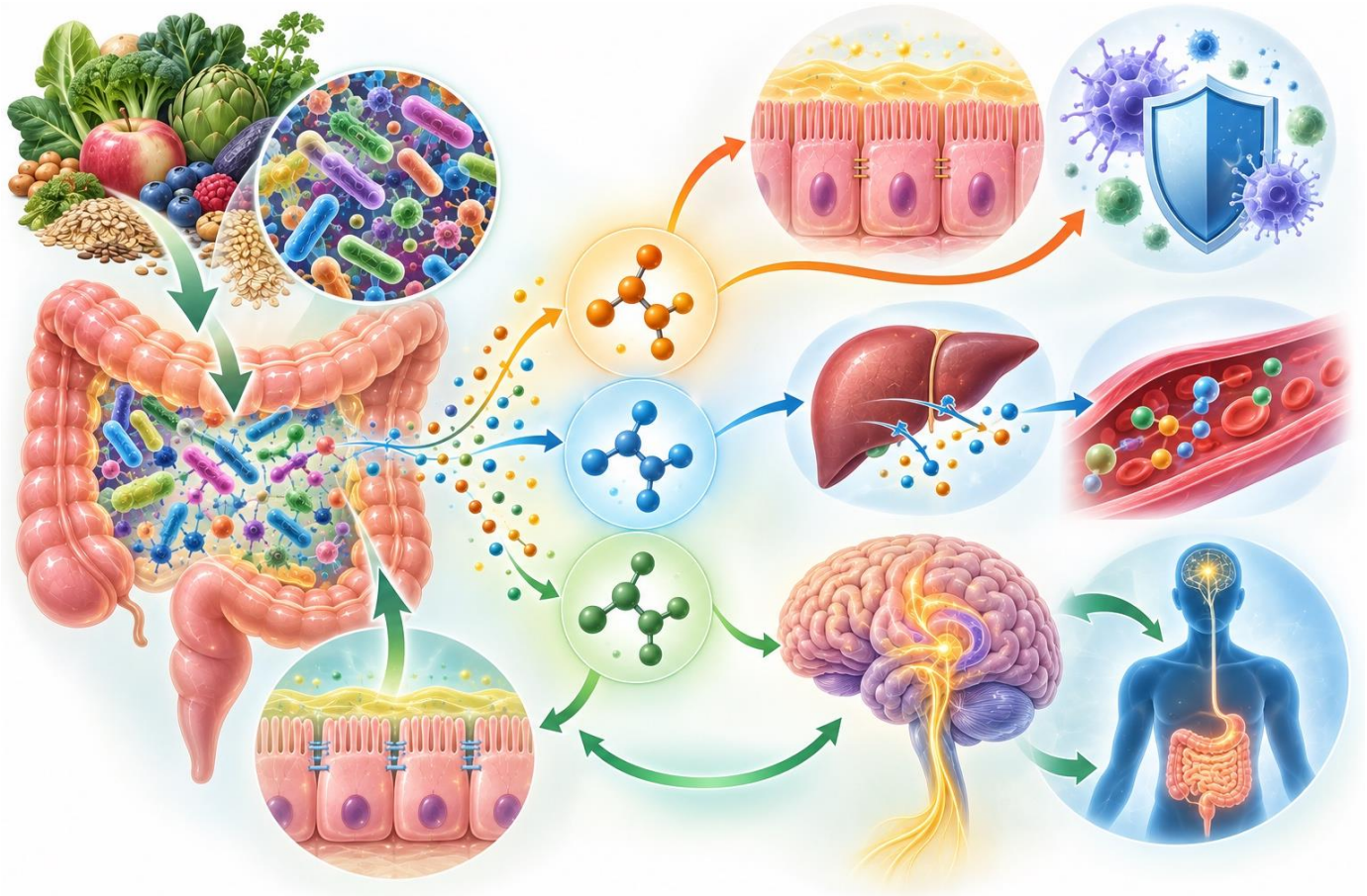
THREE IMPORTANT FACTORS



MICROBIOME - SCFAS

SHORT CHAIN FATTY ACIDS

MICROBIOME - SCFAS



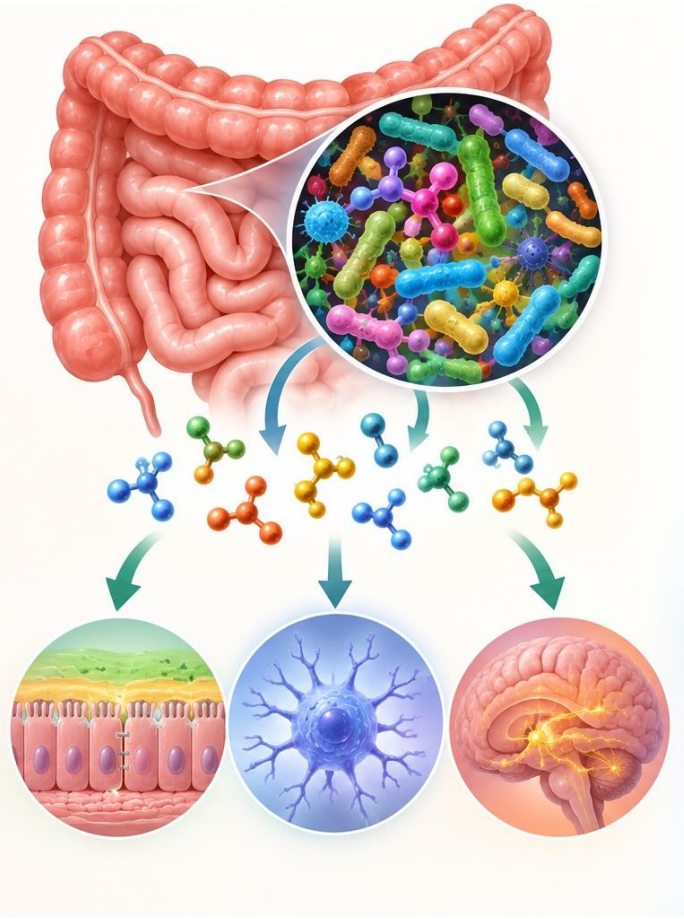
- Short Chain Fatty Acids
  - *Ferment dietary fiber and resistant starches*
- Butyrate, propionate, acetate
- Determinants:
  - *Sleep quality*
  - *Exercise*
  - *Avoidance of high sugar diet*

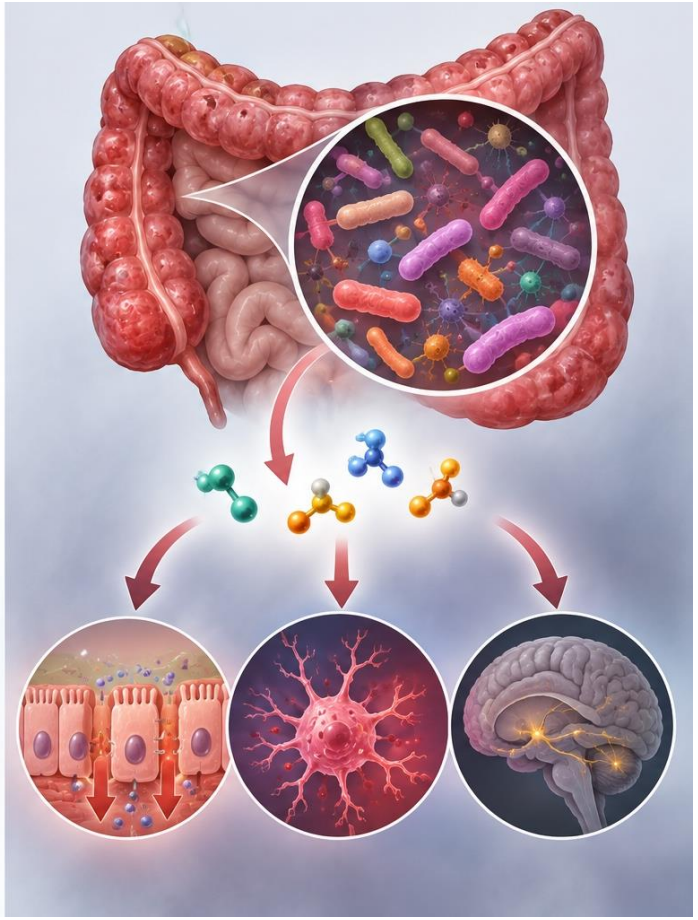
Decrease	• inflammation in body
Increase	• nerve formation
Improve	• memory
Reduce	• “leaky” blood brain barrier
Fuel	• for GI cells
Decrease	• growth of harmful bacteria

MICROBIOME - SCFAS

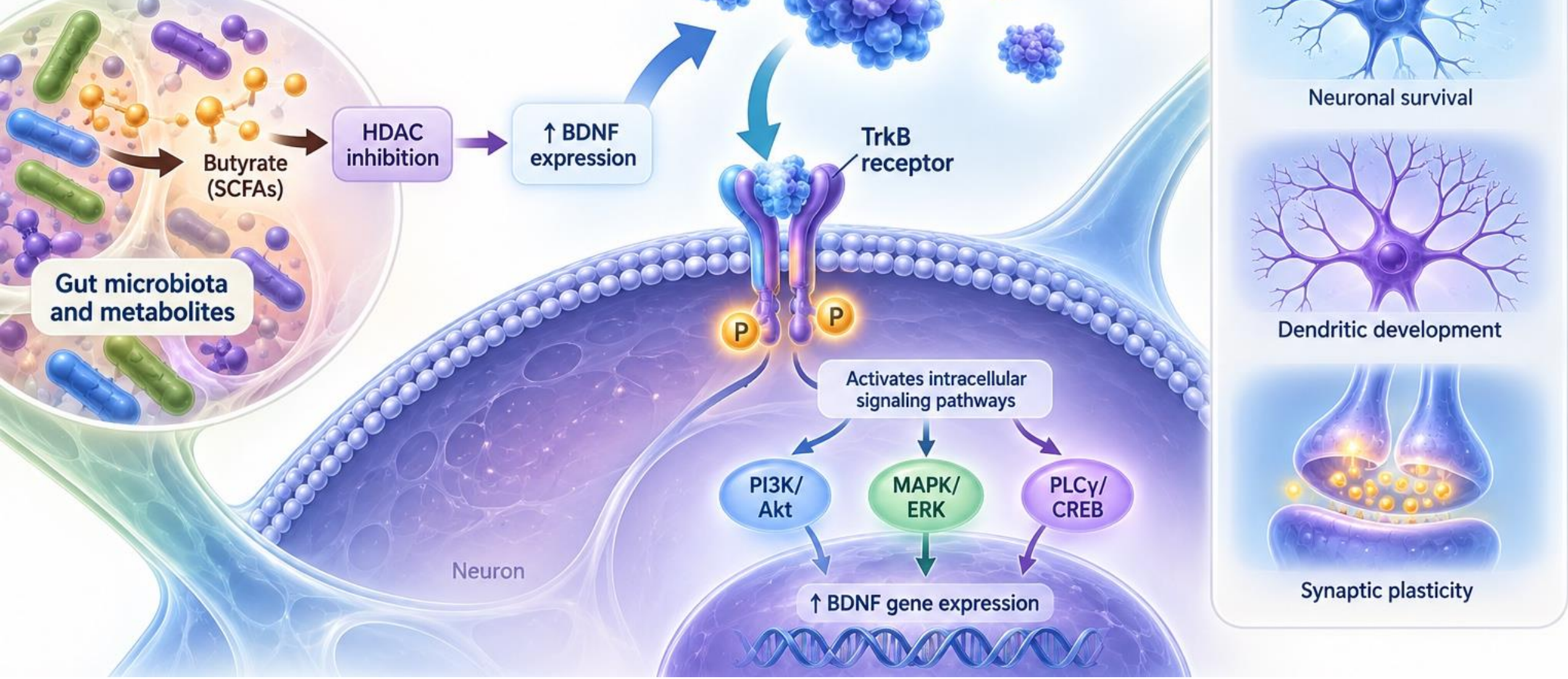
SHORT CHAIN FATTY ACIDS

MICROBIOME – SCFAS + PWP





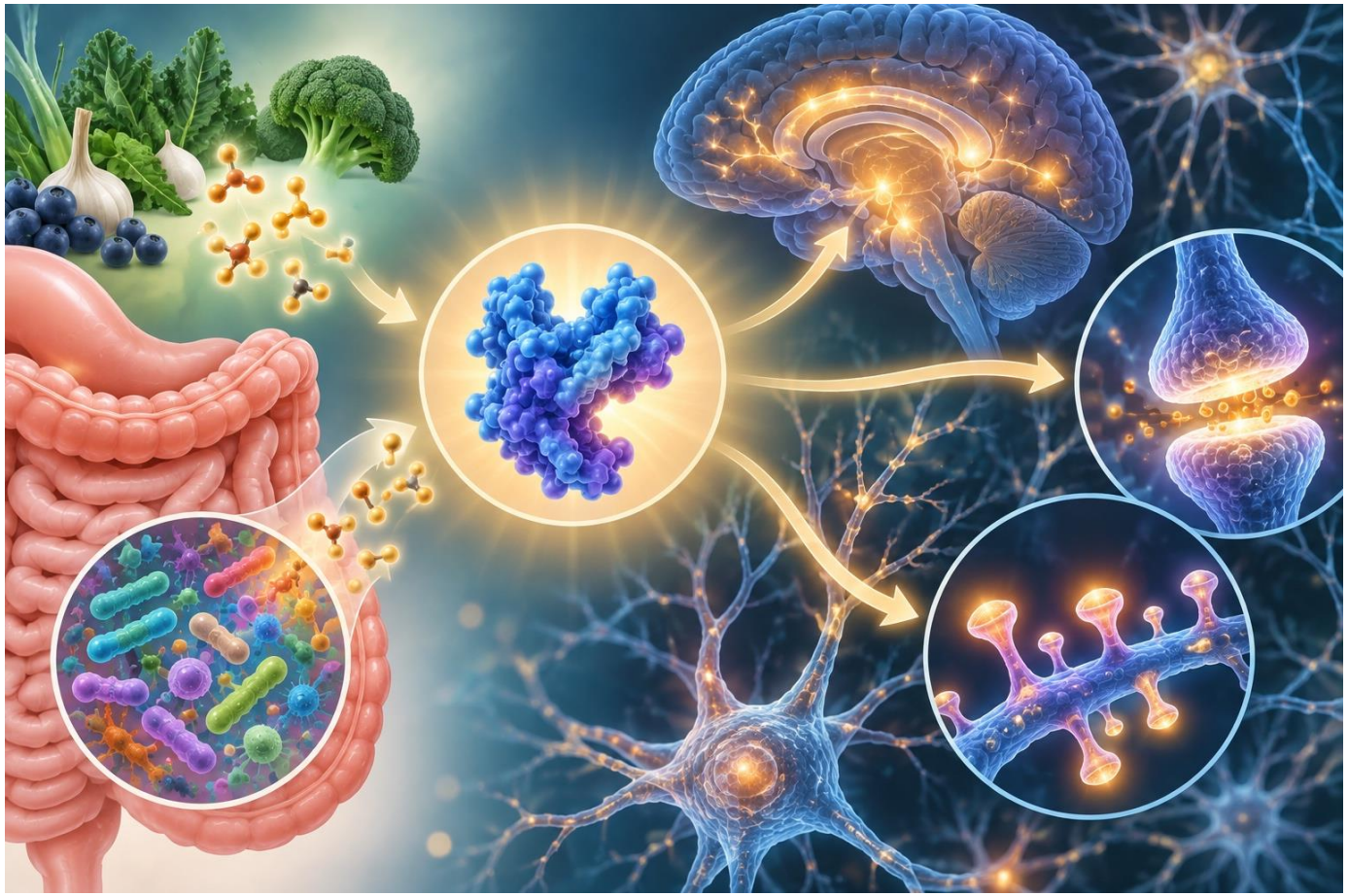
- Your microbiome has lower levels of SCFAs
- These changes have been observed in early-stage and drug-naïve PD patients
- Not merely consequence of disease or Rx use



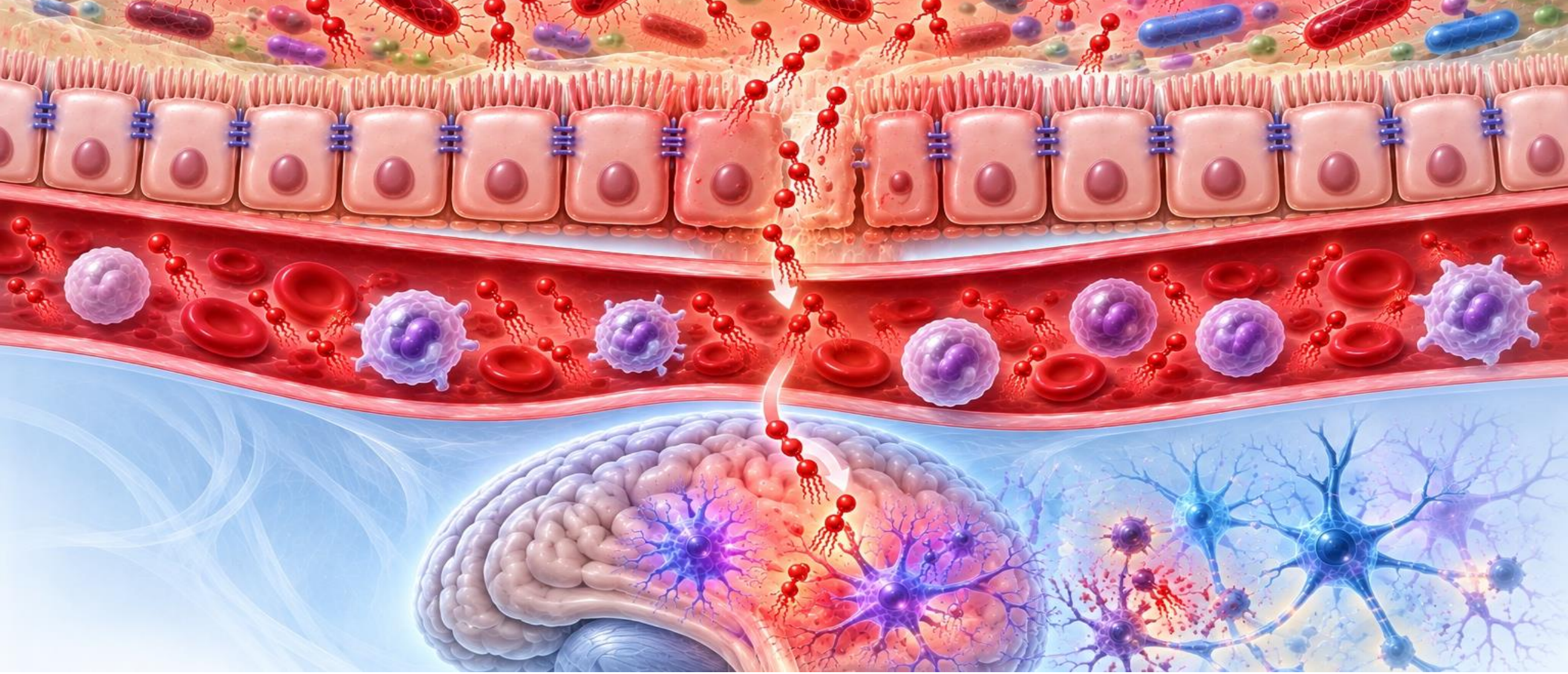
MICROBIOME - BDNF

BRAIN-DERIVED NEUROTROPHIC FACTOR

MICROBIOME – BDNF



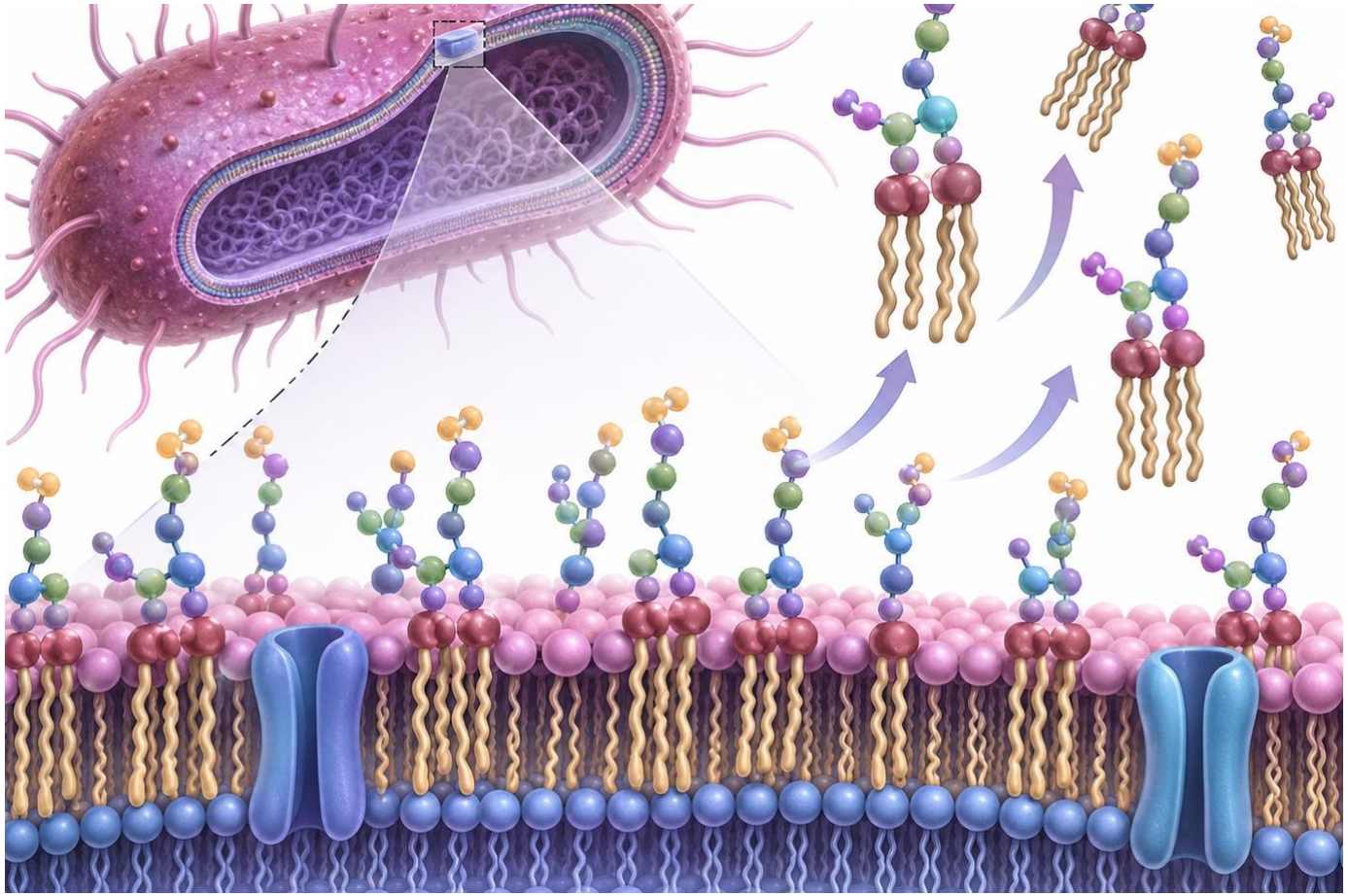
- Member of the neurotrophin family of growth factors
- Plays a critical role in:
  - *Neuronal survival*
  - *Differentiation*
  - *Synaptic plasticity in CNS*
- Reduction in neuroinflammation
- Depletion found in PD
- Butyrate enhances BDNF signaling



MICROBIOME - LPS

LIPOPOLYSACCHARIDE

MICROBIOME – LPS



- Endotoxin in bacteria membrane
- Restricted in gut lumen
- Decline in SCFA ->
- Overgrowth of bacteria ->
- ^ LPS
- Drives pro-inflammation

From Gut Dysbiosis to a Leaky Blood–Brain Barrier

A Connected Pathway of Inflammation

The gut and brain are in constant conversation.

1. Dysbiosis

Imbalance in gut microbiota with overgrowth of LPS-producing bacteria

2. ↑ LPS

Increased production of lipopolysaccharide (LPS) from Gram-negative bacteria

3. Leaky Gut

Disrupted tight junctions allow LPS to cross into the bloodstream

4. LPS Enters Circulation

LPS binds to LBP and activates immune cells

5. Systemic Inflammation

Activation of TLR4/NF-κB and release of pro-inflammatory cytokines (e.g., TNF-α, IL-1β, IL-6)

TNF-α

IL-1β

IL-6

6. Weakened Blood–Brain Barrier

Inflammatory signals disrupt BBB tight-junction proteins, increasing permeability

7. Neuroinflammation

Activation of microglia and astrocytes, increased oxidative stress

8. Neuronal Stress and Vulnerability

Chronic inflammation may promote α-synuclein pathology and vulnerability of dopaminergic neurons

α-synuclein aggregation

Dopaminergic neuron

Healthy Blood–Brain Barrier

Blood

Tight junction proteins (claudin, occludin, ZO-1)

Endothelial cell

Astrocyte endfoot

Brain

Inflamed / Leaky Blood–Brain Barrier

LPS and inflammatory cytokines in circulation

Disrupted tight junctions (increased permeability)

Inflammatory signaling into the brain

Brain Cellular Response

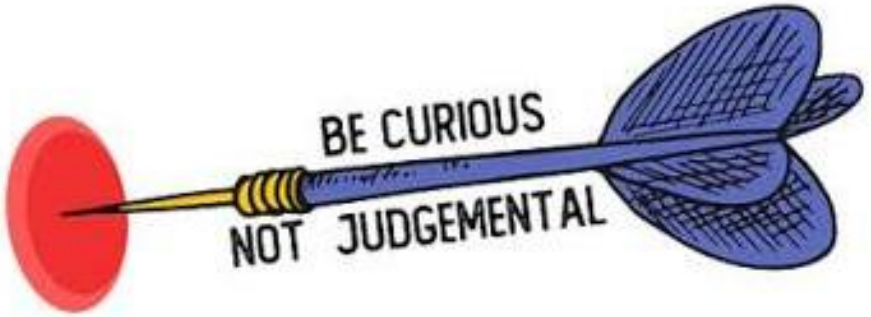
Activated microglia

Activated astrocyte

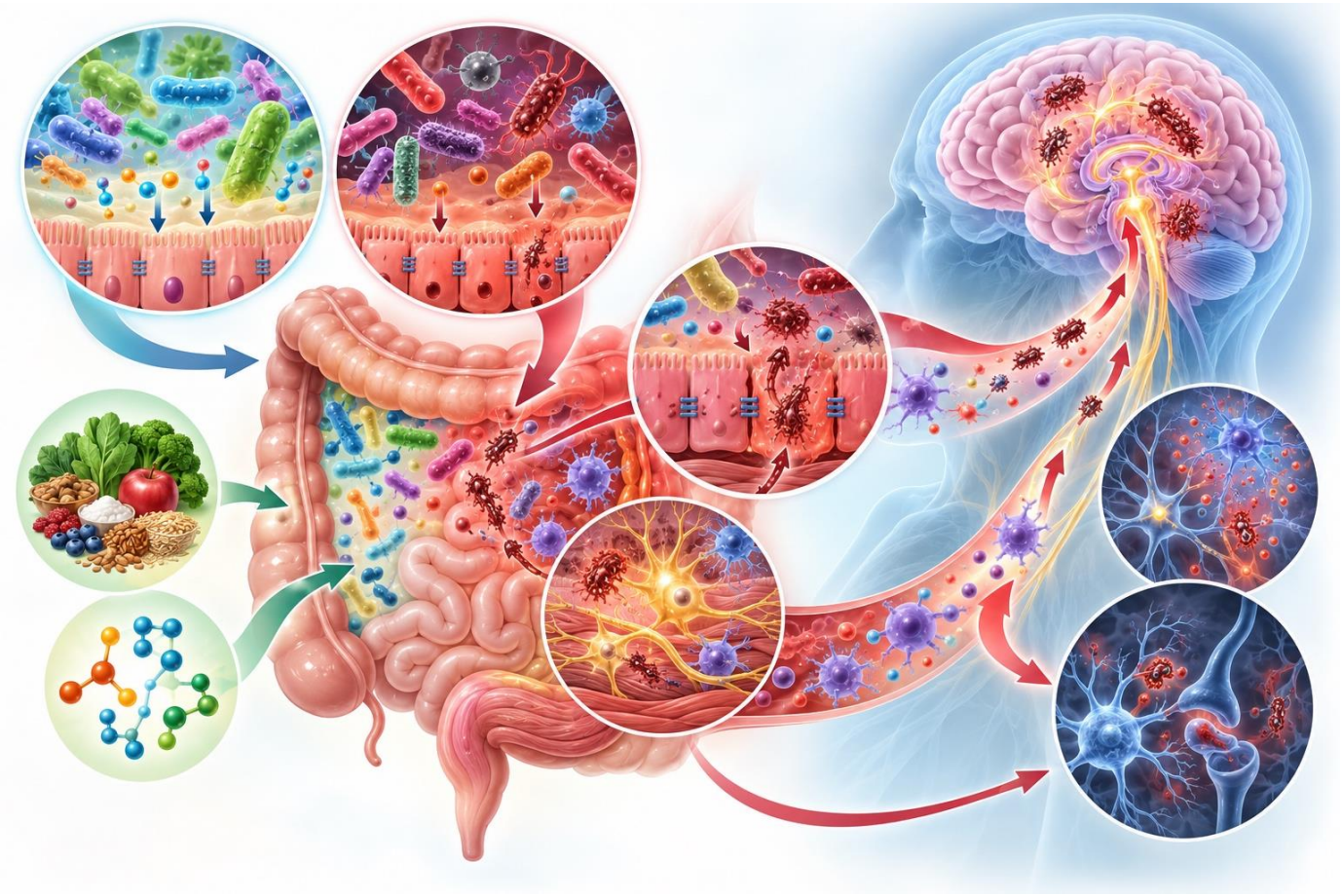
Downstream Effects

- Neuroinflammation
- Oxidative stress
- Neuronal dysfunction
- Environment that may favor α-synuclein pathology (PD)

TAKE A DEEP BREATH…BE CURIOUS

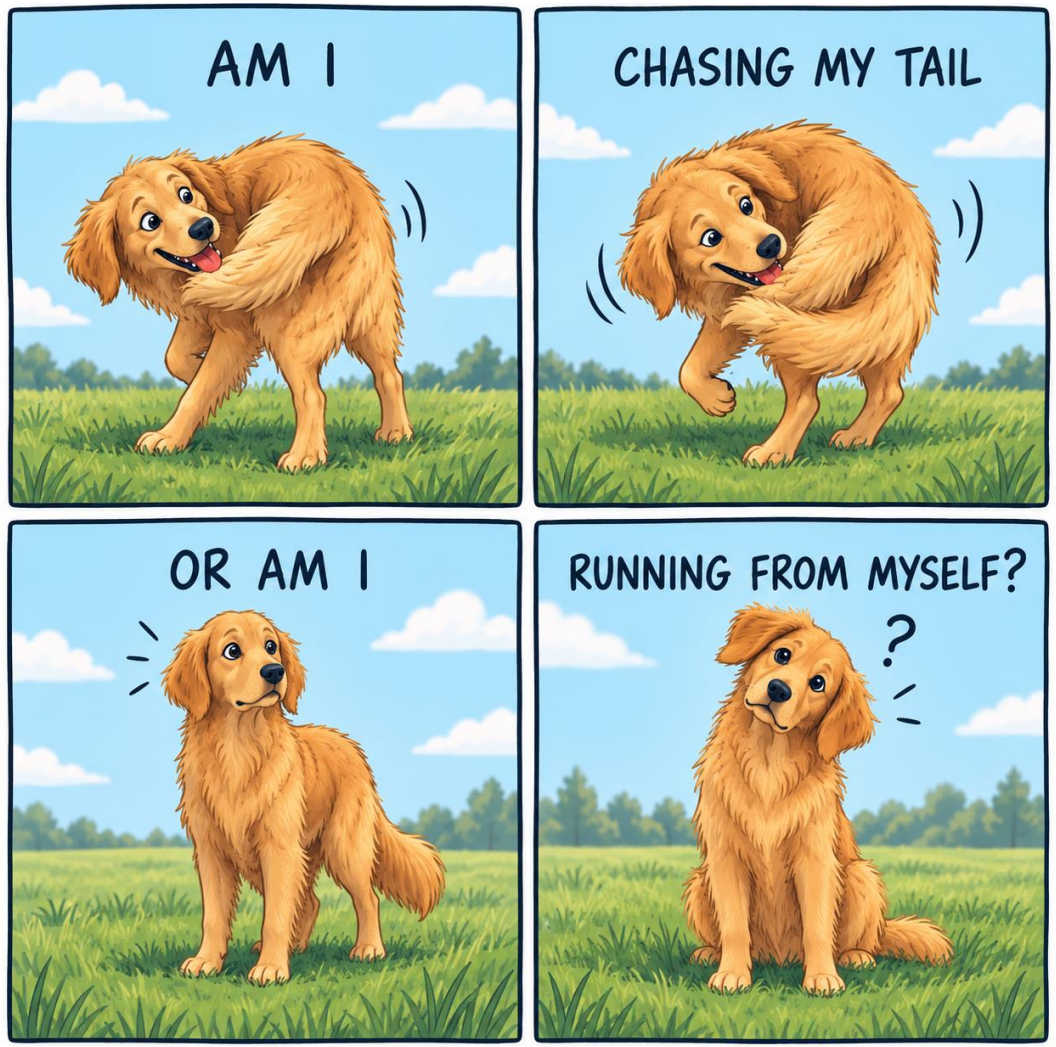


MICROBIOME - PWP



- Changes in bacteria that produce lower levels of SCFAs
  - *Lower BDNF*
  - *Elevated LPS*
- Increase in pathobionts
- ENS dysfunction
- Dysregulation of microbiota
- GI dysfunction
  - *Precedes motor sx by several years*

MICROBIOME AND PD MEDS



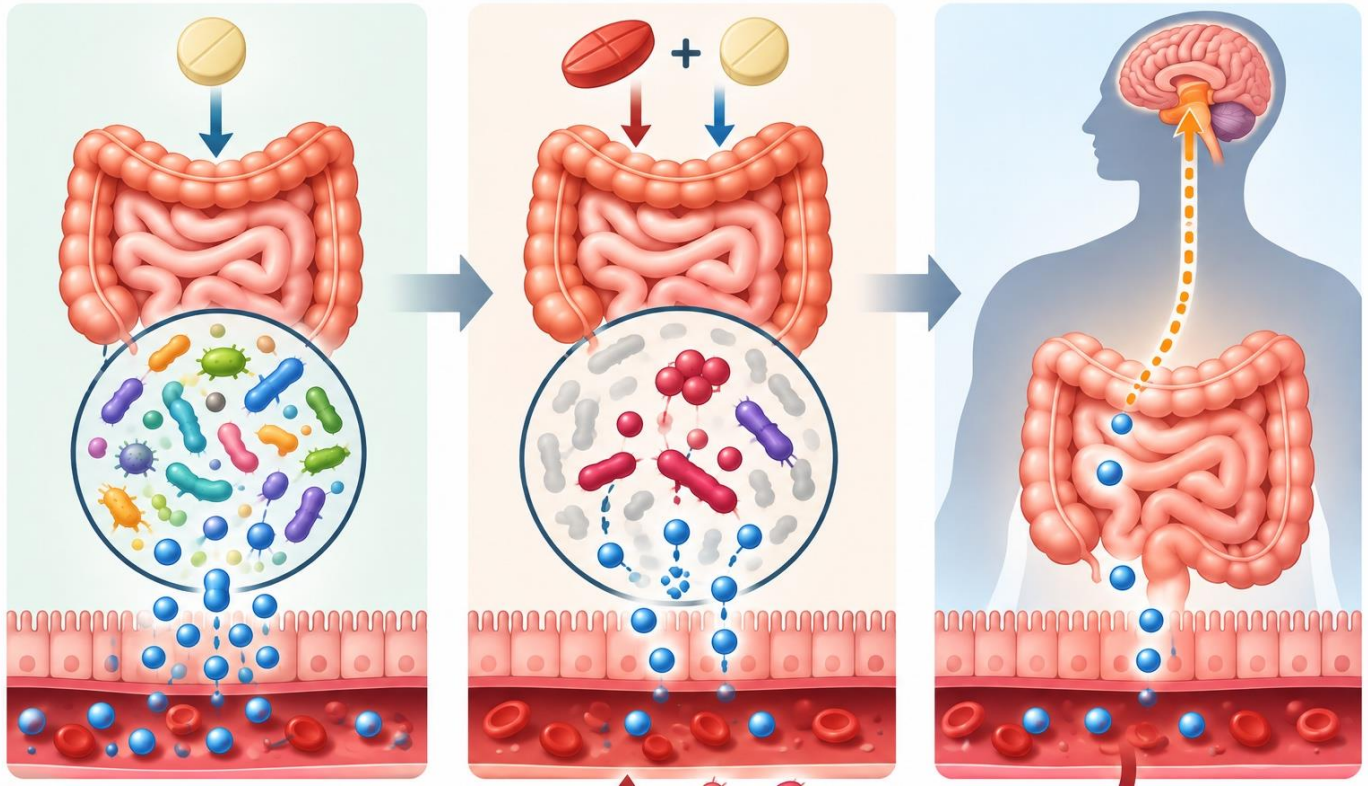
What happens?

- Diminished absorption
- Diminished metabolism
- Interference with {everything}

How will I know?

- Variable efficacy
- Increase in dyskinesia
- Increase in Rx
- "…nothing works…"

MICROBIOME AND PD MEDS



- Drug-microbiome-drug interactions explored
- COMT + L-DOPA associated with microbiome alterations
- Antimicrobial effects impact plasma concentration
- Reduction of L-DOPA metabolites

MICROBIOME - EDUCATION

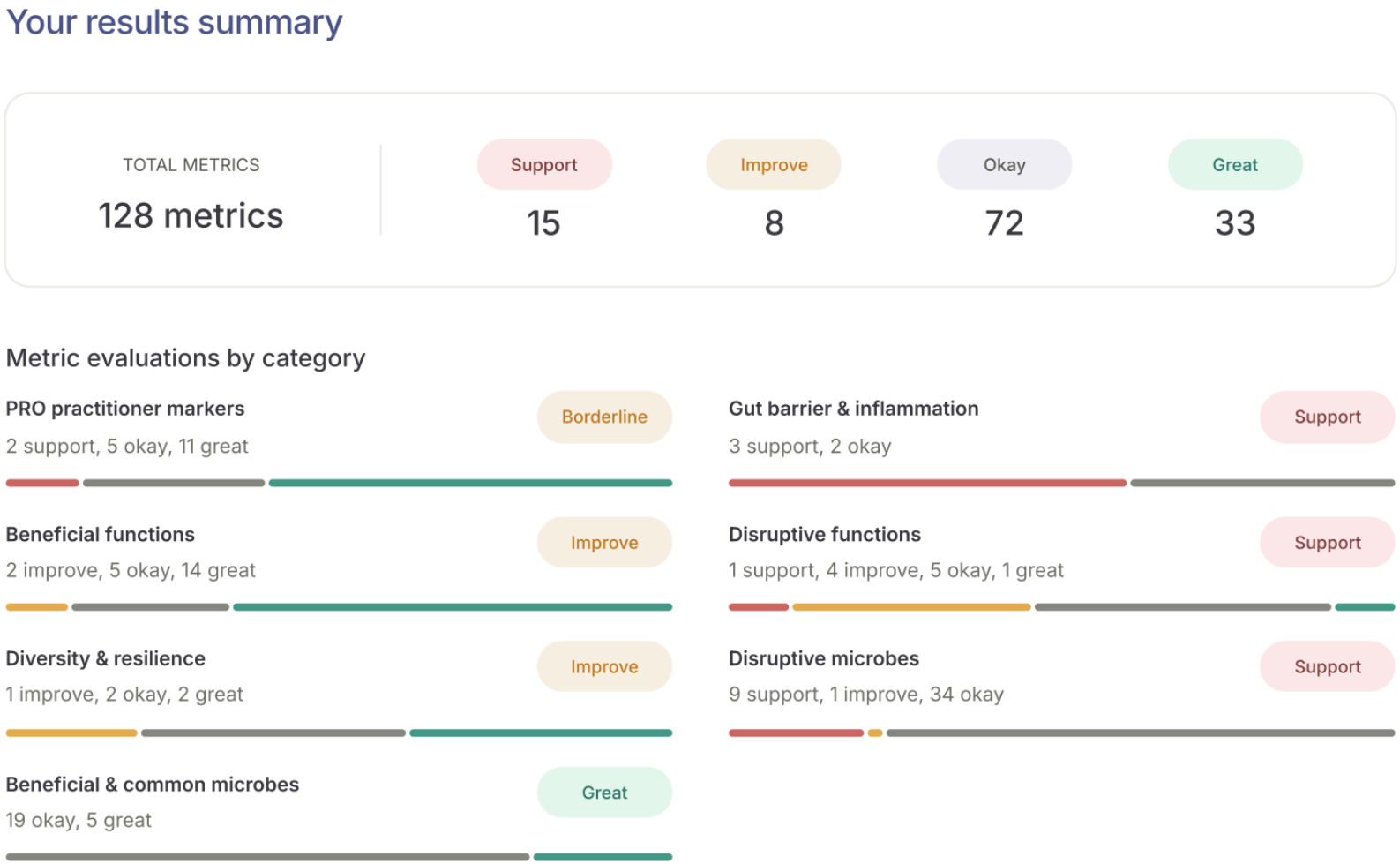
NOW WHAT?

TESTING AND TREATMENT

PUTTING INFO INTO ACTION

WHY TEST?

VARIATION IN BIOME, VARIATION IN TREATMENT



WHY TEST?

DYSBIOSIS

MICROBIAL FUNCTION

INFLAMMATION

DIGESTIVE HEALTH

WHY TEST?

Bacterial overgrowth/Dysbiosis
Microbial function
Inflammation
Constipation
Dehydration
Celiac disease
IBD/IBS
Leaky gut
Nutrient deficiency
Digestive health/insufficiency
Malabsorption

WHY TEST?

STABILITY AND BALANCE

TREMOR

COGNITIVE FUNCTION

NUTRIENT DEFICIENCIES

TESTING AND TREATMENT

PUTTING INFO INTO ACTION

TAKE YOUR POWER

Dr. Laurie Mischley

Encourage

MORE OF THESE WHEN POSSIBLE

On average, over the past month:	POINTS
I buy organically grown food when possible.	○
I cook most of my own food.	○
I use spices liberally.	○
1 point for each *food consumed in sufficient amounts:*	
Nuts & Seeds (1/2 cup nuts or 4 Tbsp spread, daily)	○
Olive oil (2 Tablespoons, daily)	○
Fresh Fruit (1 cup or 2 medium fruits, daily)	○
Fresh Vegetables (1/2 cup, 5+ times per week)	○
Seafood: Fish, Shellfish (4 oz, 2+ times per week)	○
Wine (8 oz, 2+ times per week)	○
Coffee (8 oz, 2+ times per day)	○

Avoid

LIMIT THESE WHEN POSSIBLE

1 point if you've had none in the past month: *(less than 1x/month)*	
Dairy (ice cream, butter, milk, cream, cheese, yogurt from animals)	○
Artificial sweeteners (aspartame, acesulfame K, saccharin, e.g. gum, diet drinks)	○
Pork	○
Beef	○
Chicken	○
Fried food (corn chips, potato chips, French fries, donuts, etc.)	○
Juice (8 oz, 1 glass)	○
Sugar (If this statement is true: "I avoid sugar.")	○
Soda (diet and/or regular)	○
Refined grains (pasta, bread, pastries, crusts, crackers, etc.)	○
Canned food (tomato sauce, beans, citrus, vegetables, soups, etc.)	○

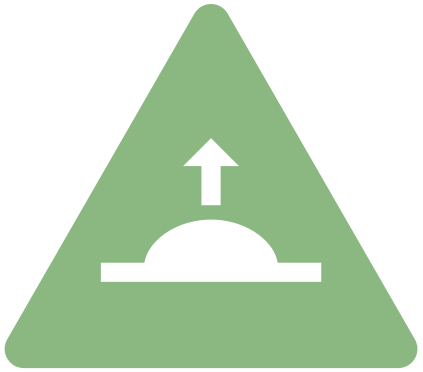
Total Points

NUTRITION – PRO21

Dr. Karin Duncan, 2026

NUTRITION – PRO21

The PRO-21 outperformed the MIND and MEDI diets



Orders of magnitude and superior explanatory power for variance in PD outcomes

Rigorous demands, cost barriers and feasibility

Faster Parkinson Progression

Dairy
Beef, Pork, Chicken

Artificial Sweeteners
Soda, Juice

Refined Grains
Fried Food

Food from a Can

Slower Parkinson Progression

Fresh Vegetables
Fresh Fruit
Nuts & Seeds, Seafood
Olive Oil, Wine, Coffee

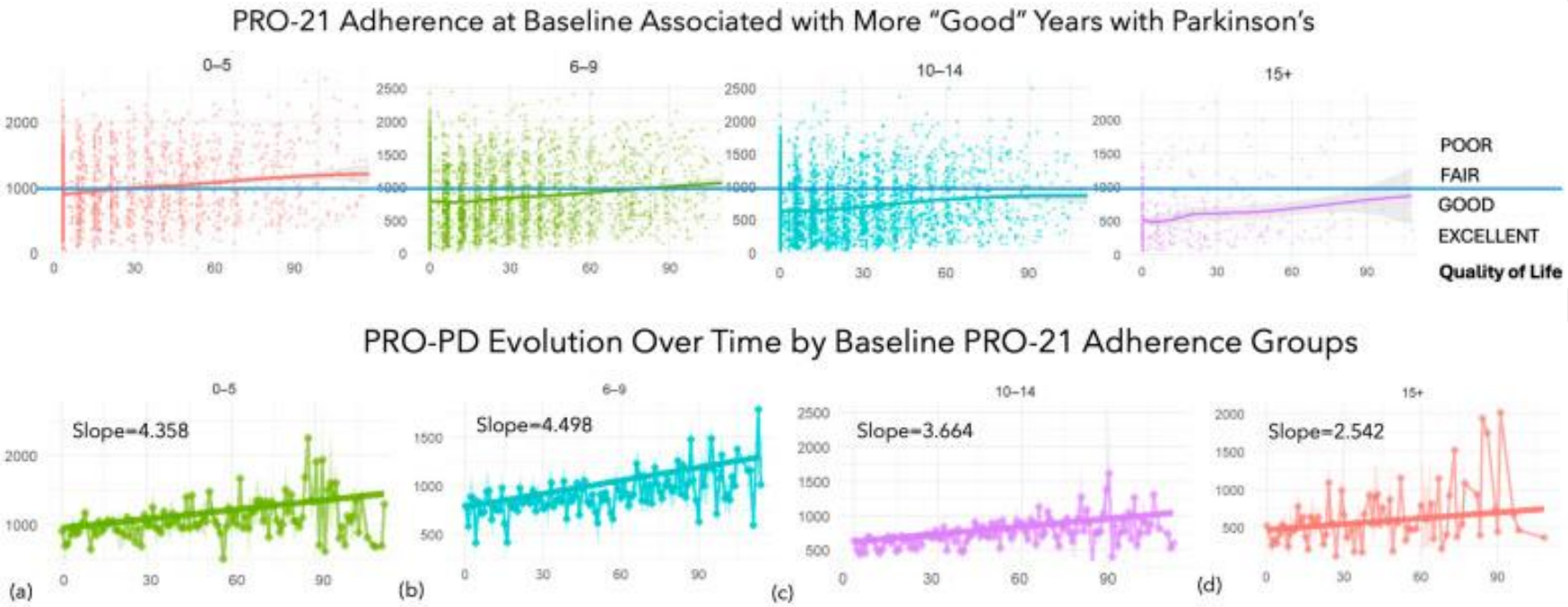
Home-Cooked Meals
Liberal Use of Spices

Buy Organic

FOOD TODAY FOR A BRIGHTER TOMORROW

NUTRITION – PRO21

NUTRITION – PRO21



ZOOMING IN AGAIN (QUICK)

MICROBIOME - PHYTOCHEMICALS

- Naturally occurring compound made by plants that hold influence on our function
  - *Inflammation*
  - *Oxidative stress*
  - *Immune function*
  - *GI microbiome*
  - *Cellular signaling*
- Promote growth of:
  - *Lactobacillus*
  - *Bifidobacterium*
  - *Prevotellaceae*
  - *Akkermansia muciniphila*

MICROBIOME - PHYTOCHEMICALS

- Enhance production of SCFAs
- Reduction of LPS levels
- Modulate inflammatory cytokines

MICROBIOME - PHYTOCHEMICALS

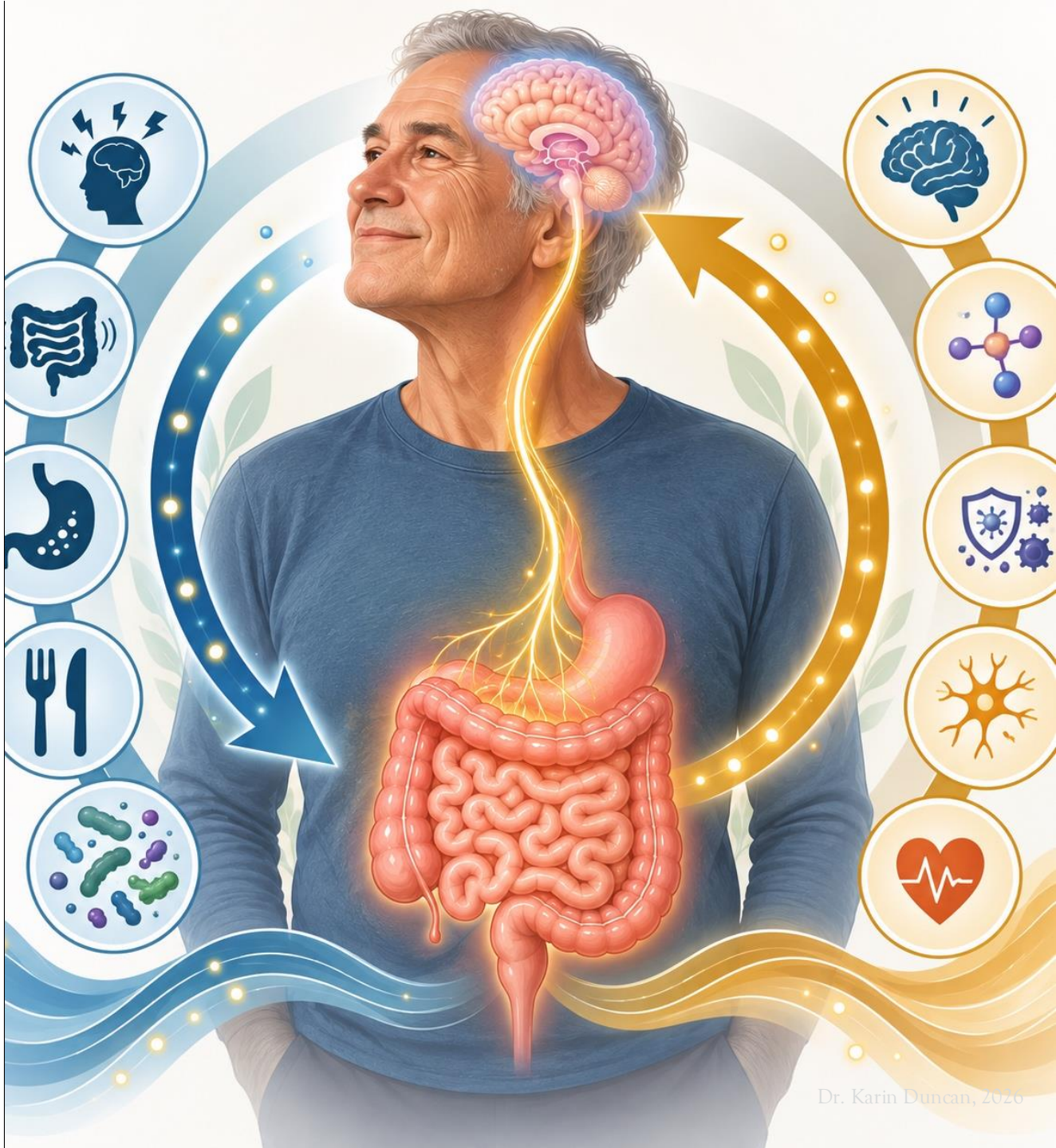
- Suppresses harmful microbiota
- Promote toxic metabolite accumulation
- Elevate LPS
- Trigger excessive pro-inflammatory signaling
- Chronic activation of microglia and astrocytes
- α-synuclein aggregation

TOLD YOU IT'D BE QUICK!

GUT-BRAIN AXIS

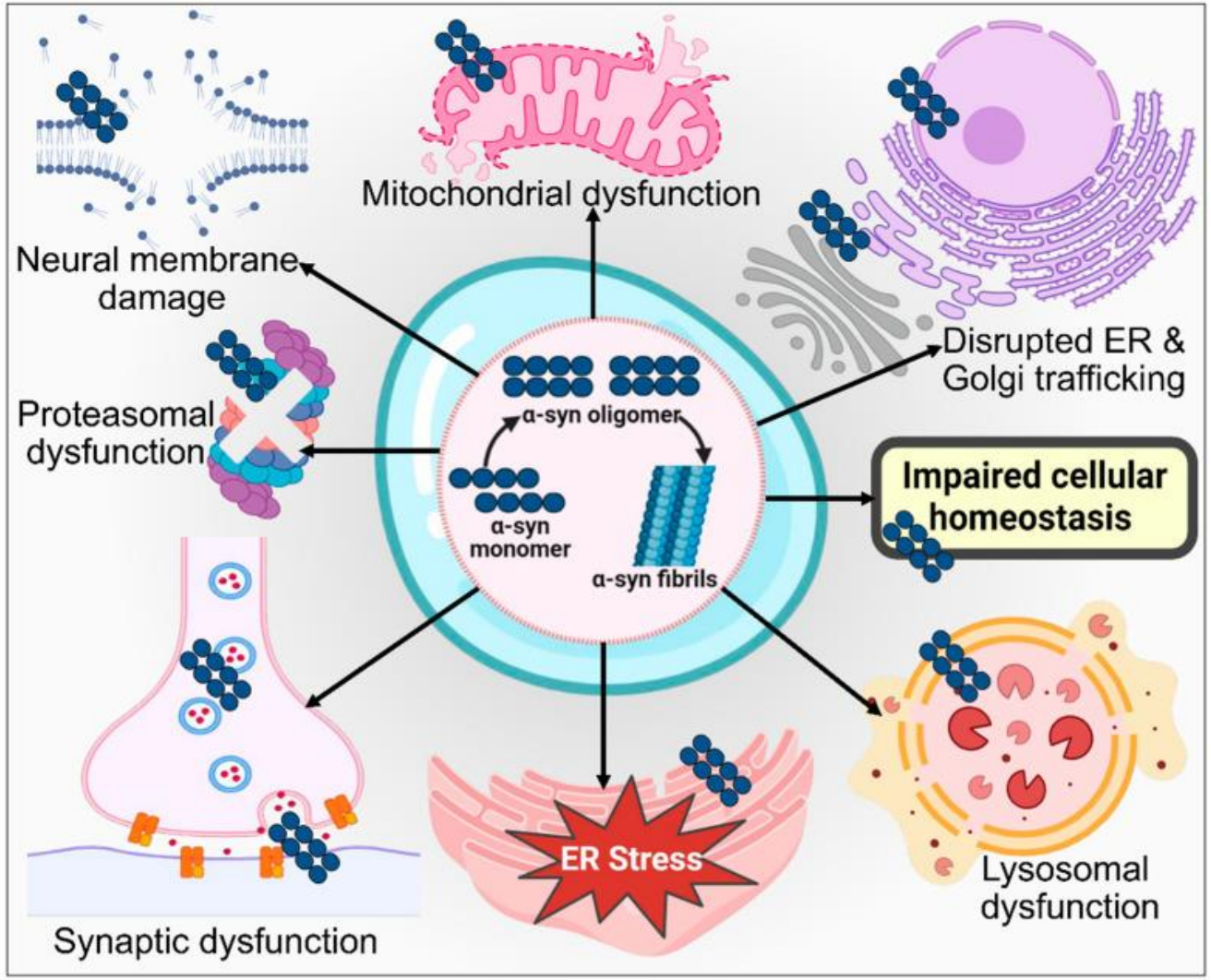
- Two-way communication
- Brain to gut:

  Digestion, movement, appetite
- Gut to brain:
  - *Mood, stress, inflammation, brain function*
- Pathways:
  - *Nerves, Hormones, Immune signals, Microbiome*



α-SYNUCLEIN

- Aggregates form in the gut before brain
- Produced by ENTEROENDOCRINE cells in gut lumen
  - *Constant contact with microbiota*
  - *Synapse with enteric neurons*
  - *Synapse with the VAGUS nerve*
  - *Conduit for gut-to-brain spread*



GUT-BRAIN AXIS: 3 KEY POINTS

Severing the VAGUS nerve reduces the load of α-syn aggregates in the brain

Transplanting the gut microbiomes of PwP into mouse models exacerbated motor dysfunction compared to mice receiving microbiome from people without PD

Functional intestinal cells can continuously propagate α-syn aggregates without destruction of themselves, which can advance the gut-to-brain spread and PD pathogenesis

HOW DO YOU FIX A LEAK?

HOW DO YOU IMPLEMENT?

Parkinson Symptom Tracking (PRO-PD App)

A Tool for Taking Control

FREE PRO-PD SCORE HERE

FINALLY! A fast, easy tool to track patient reported outcomes associated with PD

Free to download- Scores available immediately

PRO-PD APP INFO

PRO-PD TOOL

nutrients MDPI

Nutrients. 2026 Mar 31;18(7):1118. doi: 10.3390/nu18071118

Validation of a Patient–Reported Outcome Measure in Parkinson's Disease

Laurie K Mischley [1,2,3,*], Magdalena Murawska [3]

Editor: Chih-Li Lin

Author information · Article notes · Copyright and License information

PMCID: PMC13074223 PMID: 41978169

Abstract

Background: The Patient–Reported Outcomes in Parkinson's Disease (PRO-PD) scale is a 35-item visual analog measure designed to quantify symptom severity across motor and non-motor domains. Developed as a continuous, patient-centered outcome, PRO-PD captures patient-perceived change over time and is suitable for remote longitudinal assessment. This study evaluated the psychometric properties of PRO-PD across two independent datasets, including reliability, validity, factor structure, and minimal clinically

PRO-PD TOOL

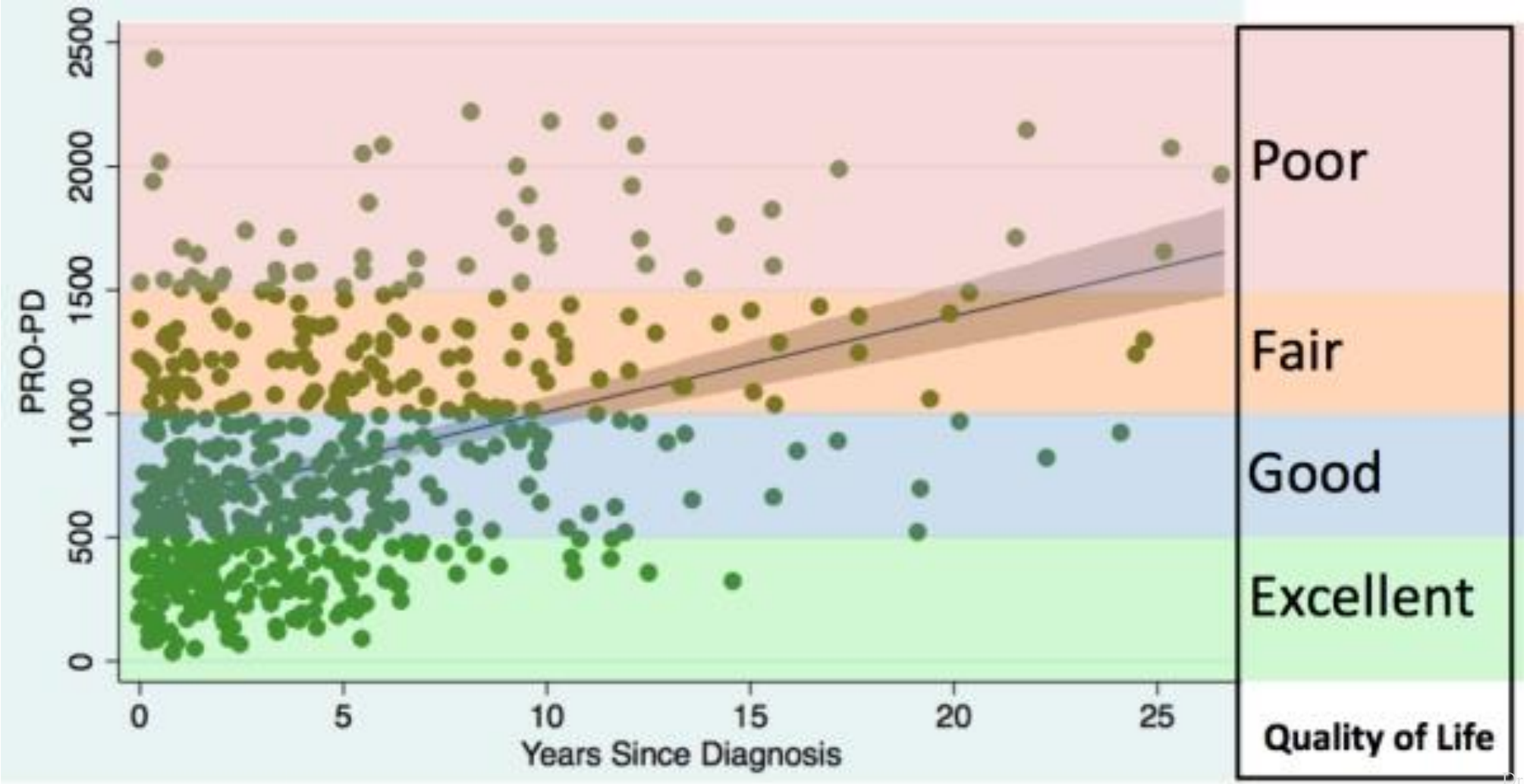
The Patient–Reported Outcomes in Parkinson's Disease (PRO-PD) scale is a 35-item visual analog measure designed to quantify symptom severity across motor and non-motor domains.

Developed as a continuous, patient-centered outcome, PRO-PD captures patient-perceived change over time and is suitable for remote longitudinal assessment.

This study evaluated the psychometric properties of PRO-PD across two independent datasets, including reliability, validity, factor structure, and minimal clinically important difference (MCID), and assessed its relevance to nutrition- and lifestyle-focused research.

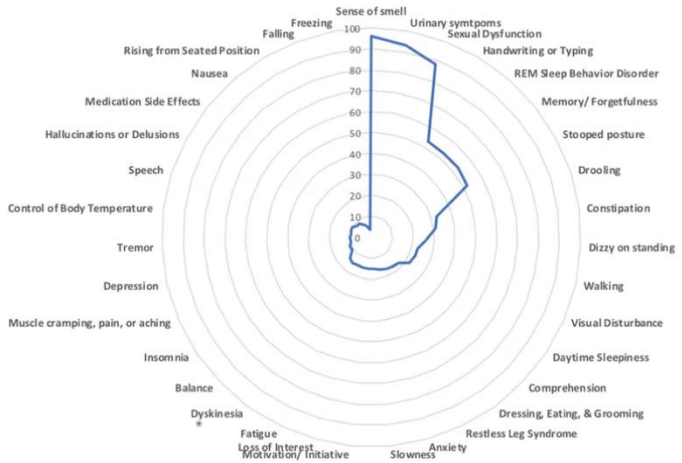
These findings support PRO-PD as a psychometrically robust outcome measure that can be completed remotely without trained administrators.

PRO-PD TOOL



PRO-PD TOOL

RADAR CHARTS

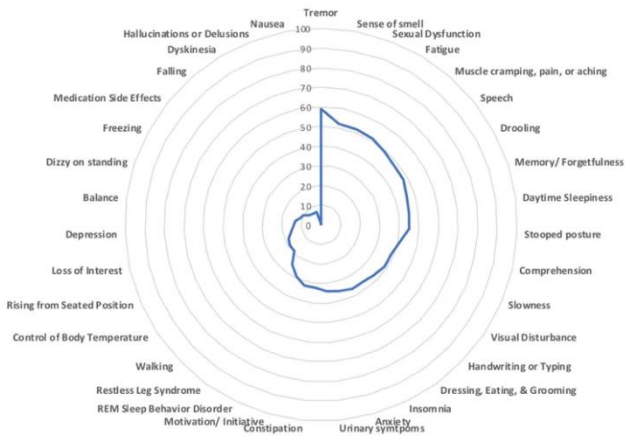


Parkinsonian Signature

200+ years into this disease, we all agree this isn't one disease, but nobody can figure out how to find/ define sub-types. Each person presents with a unique set of symptoms.

Personalized Medicine is Essential

It is not enough to treat PD, we have to treat the patient.
Each patient should identify which symptoms are contributing most, and target treatments toward those symptoms.
The more successful the management, the lower the PRO-PD score.



PARKINSON'S SCHOOL

An Online Course for Patients and Providers

Parkinson School Library

The Basics

Dr. Laurie K Mis...

Mischley Seminar Series

Monthly updates designed to keep patients in the know. Live: 28th @ 12pm PT

Dr. Laurie K Mis...

Dietary Implementation Ideas

Diet, Nutrition, and Eating with Kelly Morrow - 4th Monday of every month at...

Kelly Morrow, M...

Speaker Series

People with Parkinsonism Tell Their Story - 14th of every month

Dr. Laurie K Mis...

Partner Program

If you love someone with Parkinson's, join us on the 2nd Monday of every month a...

Dr. Karin Dunca...

Men's Circle

Men in Parkinson's with Joshua Farahnik - 3rd Wednesday of every month at 12pm PT

Dr. Joshua Farah...

PARKINSON'S SCHOOL ONLINE

"If you've met one person with *Parkinson's*, you've met one person with Parkinson's."

“

A few conclusions become clear when we understand this: that our most cruel failure in how we treat the sick and the aged is the failure to recognize that they have priorities beyond merely being safe and living longer; that the chance to shape one’s story is essential to sustaining meaning in life; that we have the opportunity to refashion our institutions, our culture, and our conversations in ways that transform the possibilities for the last chapters of everyone’s lives.”

- Atul Gawande, *Being Mortal*

“THANK GOD WE HAVE PATIENTS, OR WE WOULD KNOW NOTHING”
- *DR. LEANNA STANDISH*

DISCOVERY CALLS FREE

15 minute consult

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