Module 1:

Microbiome Essentials

Rebel health

Build Your Resilient Gut

MICROBIOME & BEYOND

with

Kiran Krishnan

The Human Holobiont

- Human genome has appx. 20 thousand functional genes - The Microbiome has over 3 *million*. (150x greater!)
- There are more microbial cells in (and on) your body than human cells
- There are *thousands* of species of bacteria that have been identified in the gut, skin, oral, and other biomes
- If you put all the microbes from your body in one place, they would weigh around 3 *pounds*. (Like your brain!)
- Our microbiome plays a role in digestion, nutrient absorption, immune regulation, metabolism, hormones & neurotransmitters, detoxification, and *thousands* of other processes in the body

What’s Happening to Our Microbiome?

Modern Life Factors

Highly Proc. Foods
Lack of Fiber
Lack of Diversity in Diet
Overuse of Antibiotics
Over Steril./Excess. Hygiene
C-Sections & Formula Feed
Acute & Chronic Stress
Disrupted Circadian Rhythm
Sedentary Lifestyle

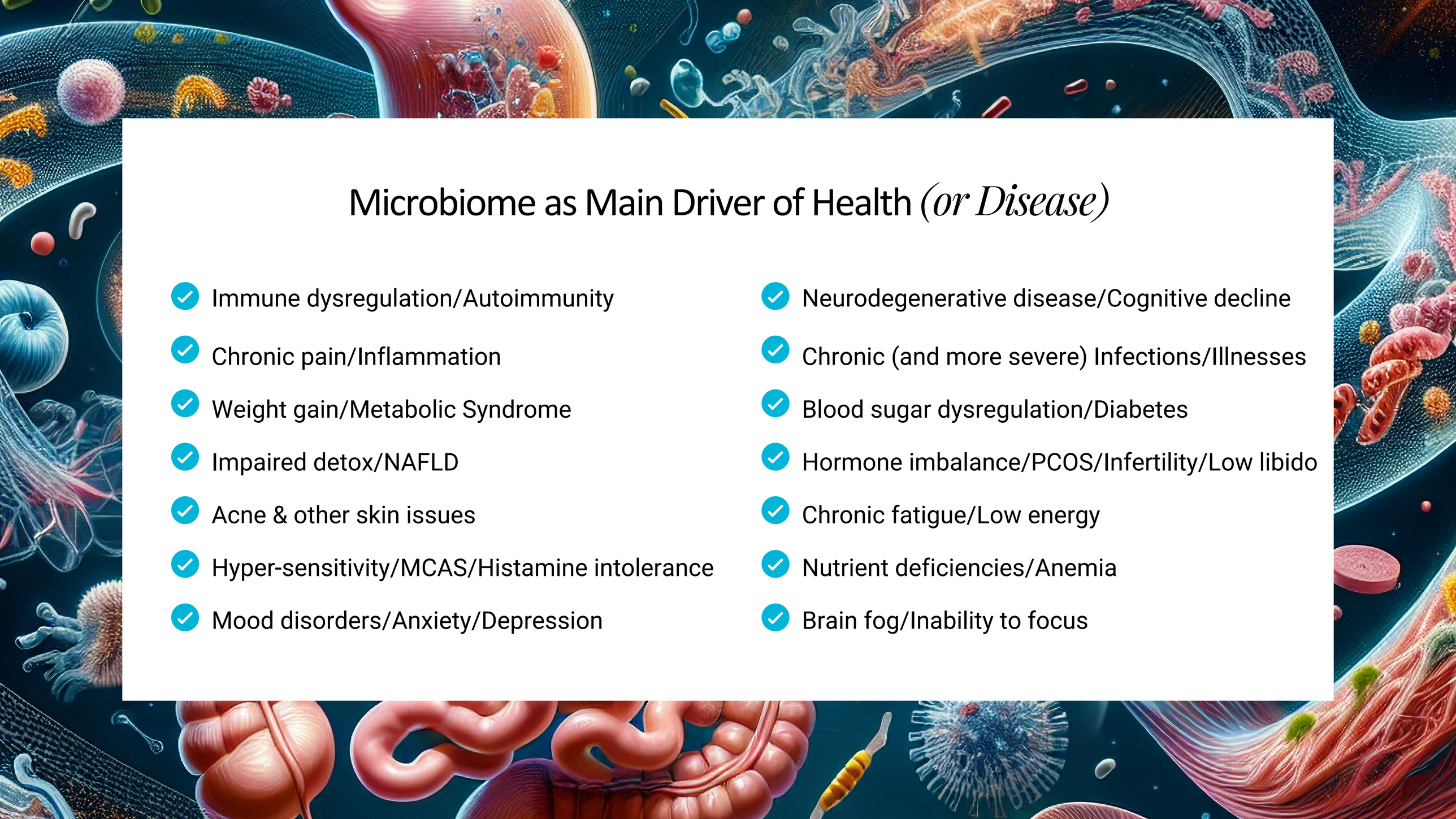
Loss of Microbial Diversity

At least 30-40%

Long-Term Consequences

- Autoimmunity
- Chronic Infections
- Metabolic Disorders
- Neurodegeneration
- Hormone Imabalance
- Mental Health Disorders
- ASD

And MORE…

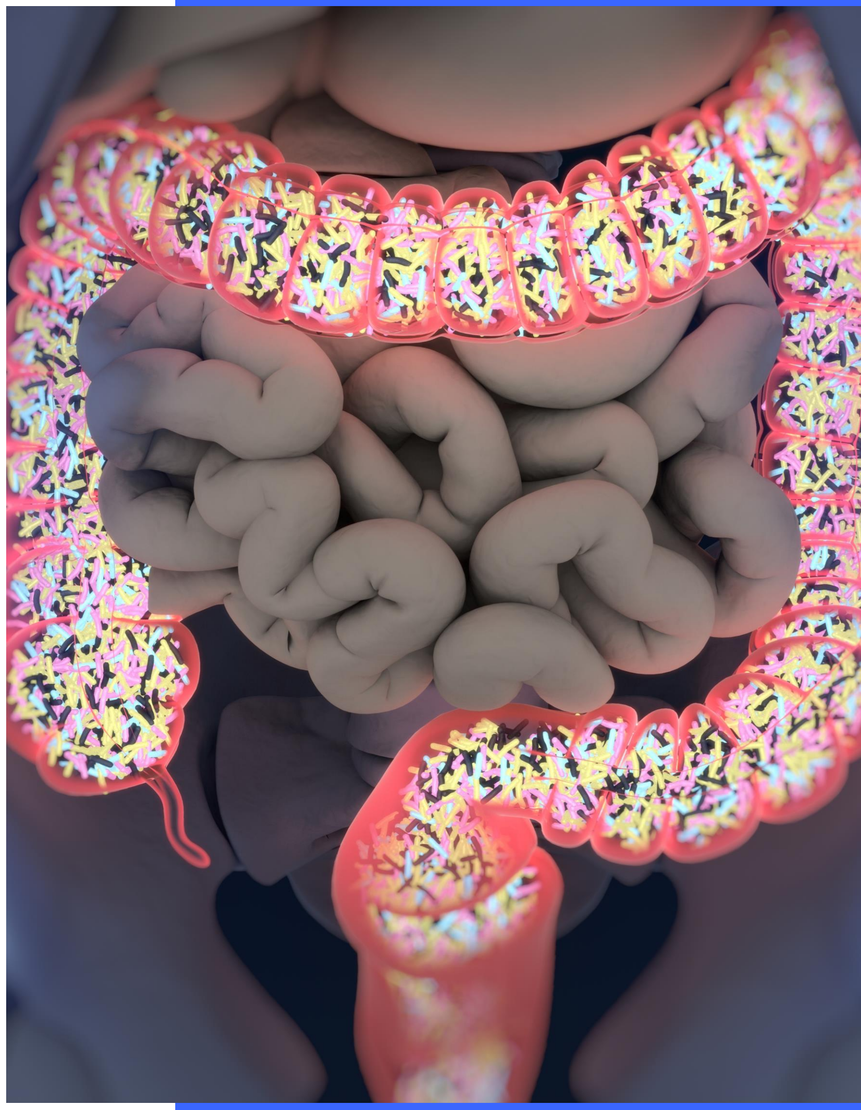


Microbiome as Main Driver of Health *(or Disease)*

- Immune dysregulation/Autoimmunity
- Chronic pain/Inflammation
- Weight gain/Metabolic Syndrome
- Impaired detox/NAFLD
- Acne & other skin issues
- Hyper-sensitivity/MCAS/Histamine intolerance
- Mood disorders/Anxiety/Depression
- Neurodegenerative disease/Cognitive decline
- Chronic (and more severe) Infections/Illnesses
- Blood sugar dysregulation/Diabetes
- Hormone imbalance/PCOS/Infertility/Low libido
- Chronic fatigue/Low energy
- Nutrient deficiencies/Anemia
- Brain fog/Inability to focus

The Gut Microbiome

- Over 2,000 species of identified bacteria - average person between 300-700 species
- Produces at *least* 90% of the body's serotonin, along with other neurotransmitters
- Aids in digestion (30-40% of the food you eat), nutrient absorption, and vitamin synthesis
- Produces over 1,000 bioactive metabolites needed for human function - 10's of thousands including proteins!
- Produces short-chain fatty acids (SCFAs), such as butyrate - which are *essential* for gut and overall health
- Regulates and *trains* our gut immune system (over 70% of immune system is housed in the gut)



* See BONUS Module w/ Jaclyn Downs on Genetics & Your Microbiome!

Initial Seeding & Development

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Build Your Resilient Gut

MICROBIOME & BEYOND

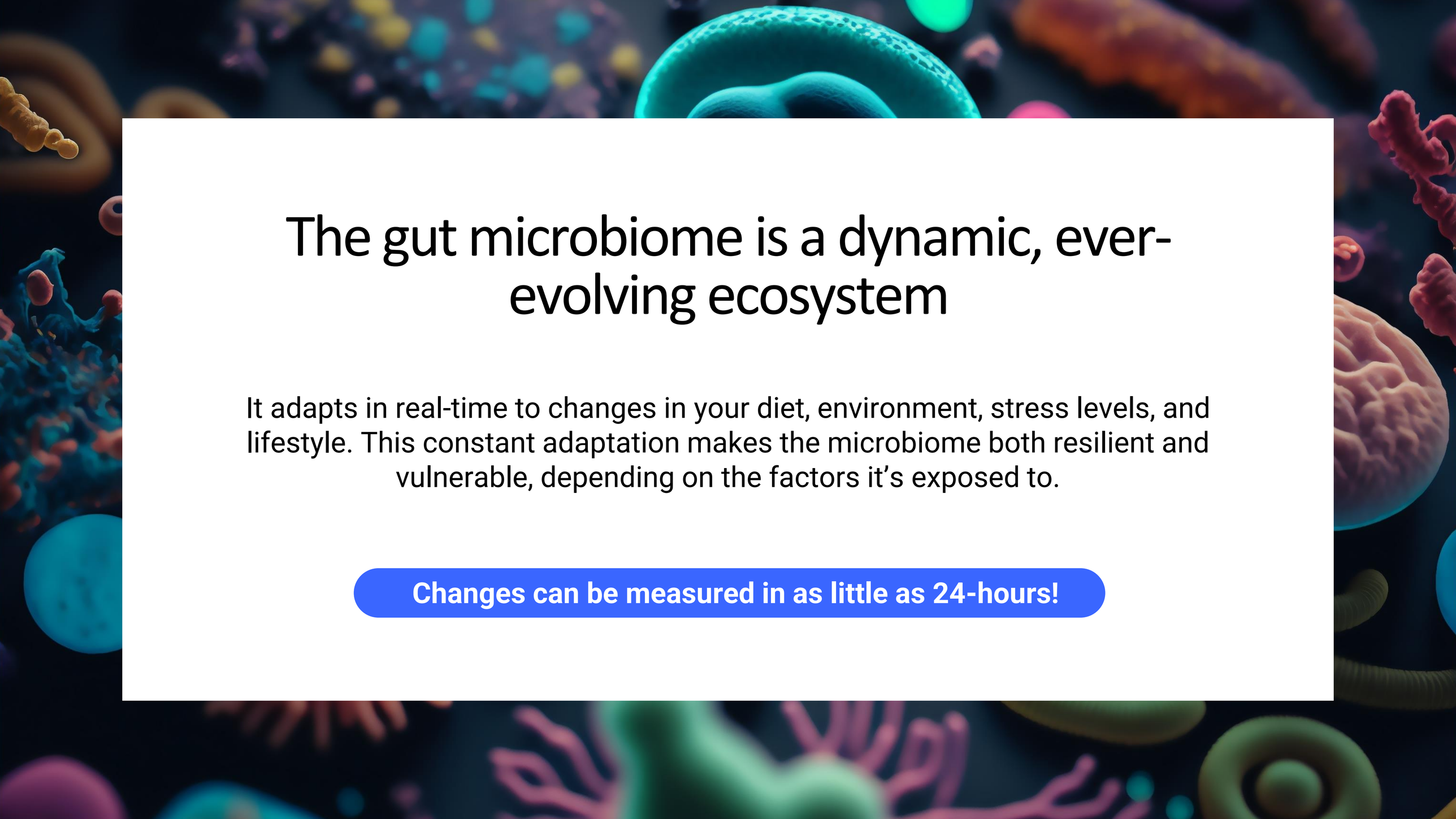
BIRTH

PARENTS/ CONTACT

BREASTMILK

EXPOSURE (NATURE & ENVIRONMENT)

EARLY DIET/ SOLID FOODS



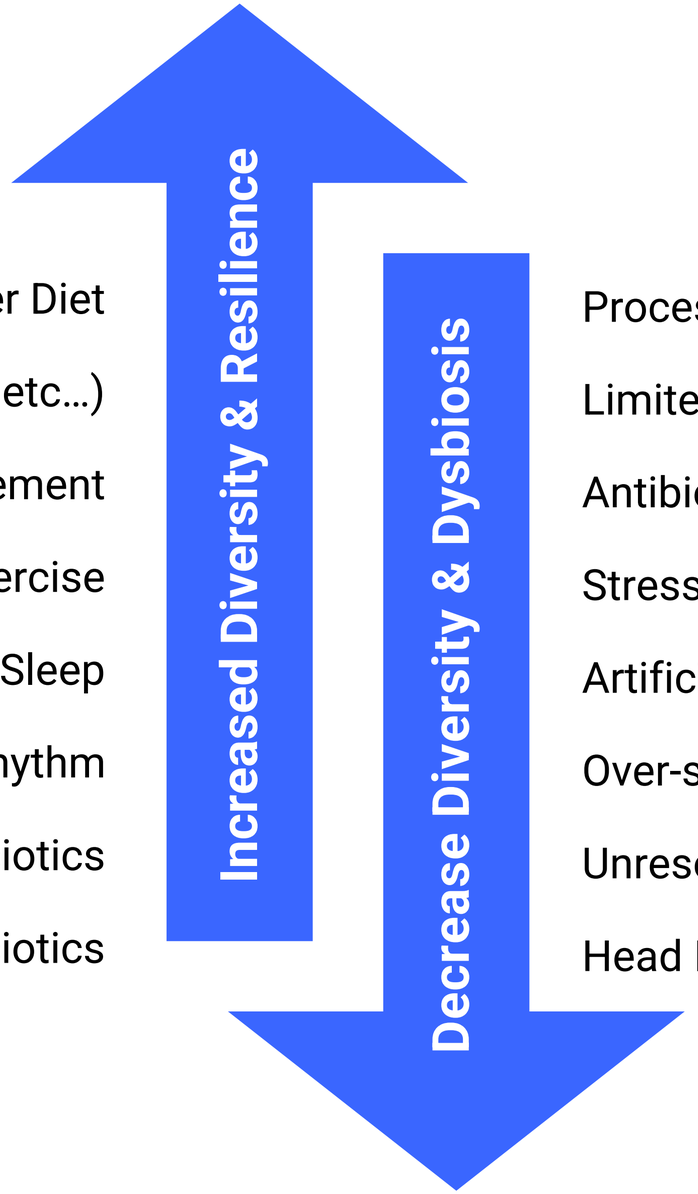
The gut microbiome is a dynamic, ever-evolving ecosystem

It adapts in real-time to changes in your diet, environment, stress levels, and lifestyle. This constant adaptation makes the microbiome both resilient and vulnerable, depending on the factors it’s exposed to.

Changes can be measured in as little as 24-hours!

Shaping the Gut Microbiome

What Helps or Hurts



Diverse, High-Fiber Diet

Exposure to Nature (Dirt, Animals, etc…)

Stress Management

Regular Exercise

Quality Sleep

Balanced Circadian rhythm

Spore-based probiotics

Precision prebiotics

Processed Foods

Limited/Restrictive and/or Low-Fiber Diet

Antibiotic Overuse

Stress (Chronic or Acute)

Artificial Sweeteners

Over-sterilization

Unresolved Trauma

Head Injuries/Physical Trauma

Study session:

Main Roles & Functions of the Gut Microbiome

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Build Your Resilient Gut

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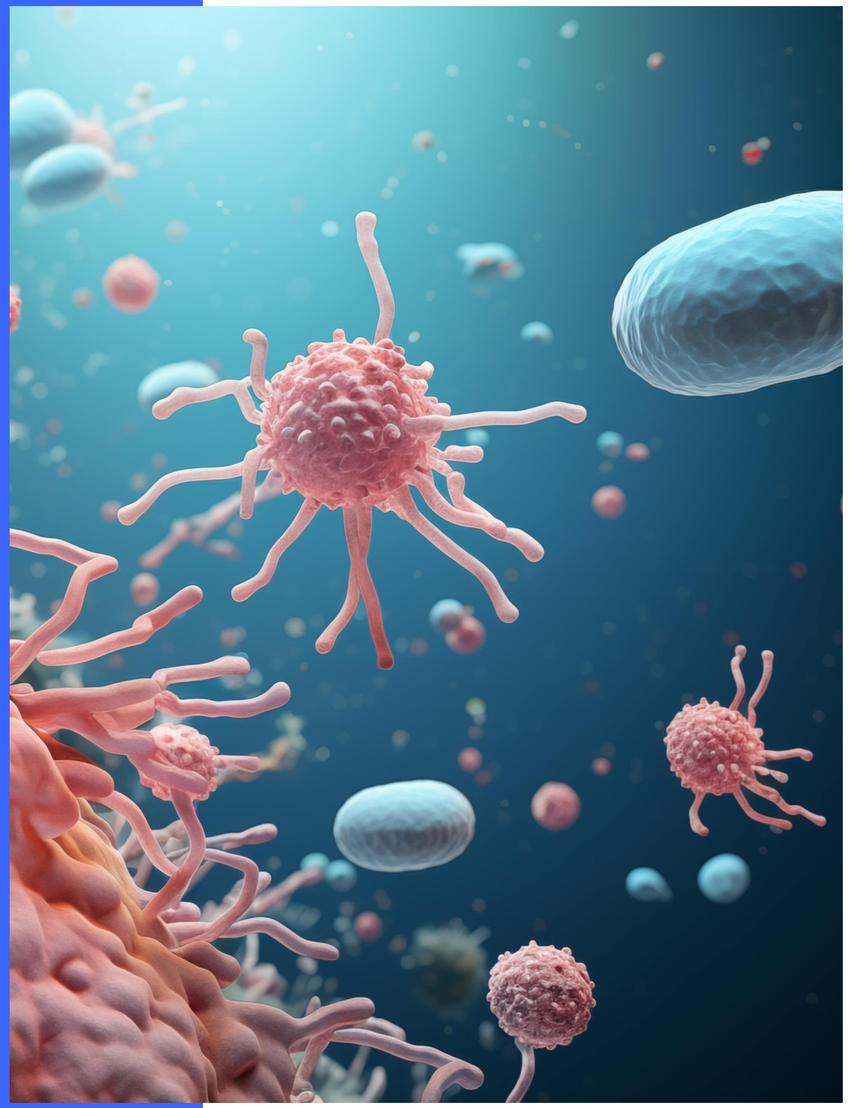
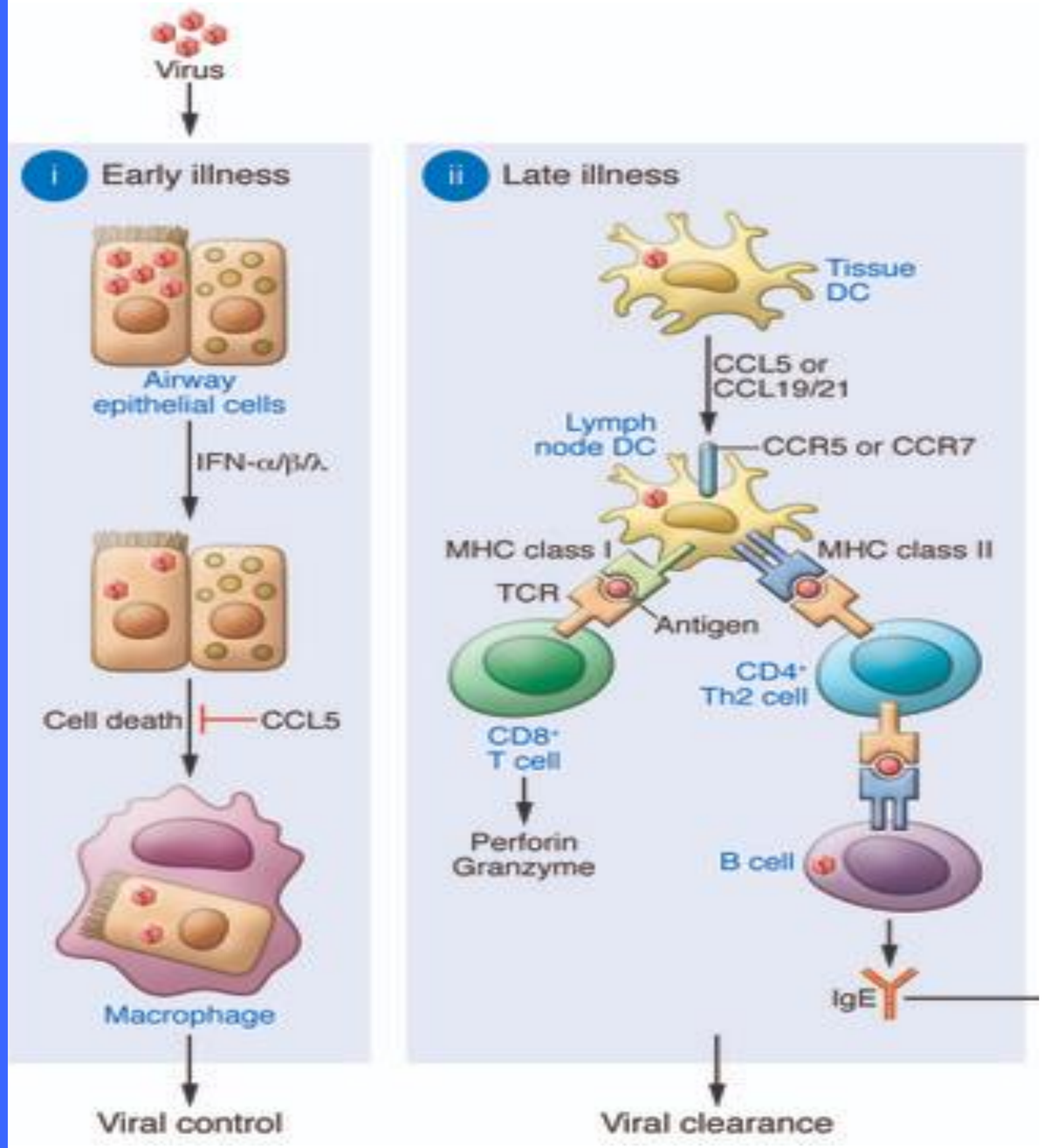
Gut-Immune-*Microbiome* Connection

- **Mucosal Barrier**
  - Over 400 sq. meters (skin is 2!) surface area
  - Largest portion of immune system (70%)
  - Lines all entry points to the body (not just the gut!)
  - COVERED with microbes!
- **Microbiome Communicates Directly w/ Our Immune System**
  - Trains immune cells to differentiate harmful pathogens vs. harmless substances or commensal microbes
  - Prevents overreactions (autoimmune & inflammatory conditions like MCAS) or underreactions (chronic infections)
  - Present antigens to immune cells - triggering appropriate reactions



Gut-Immune-*Microbiome* Connection

- **Microbiome & Lymphoid Tissue (GALT)**
  - Primary site of antigen sampling: includes Peter’s patches, the appendix and lymphoid follicles. These tissues detect pathogens and facilitate adaptive immune responses
  - Key site to produce T and B lymphocytes and it a key region to build tolerance
  - Where IgA is developed which is a critical first line of defense and allows for pathogen neutralization without inflammation. It’s also the site that produces tolerance to food and gut commensals
- **Dysbiosis has negative impact on cancer treatments and other conventional medical intervention**



Early innate response

Late innate response

Inflammation

Early adaptive

Anti-Inflammation

Long term adaptive

True immunity

Microbiome

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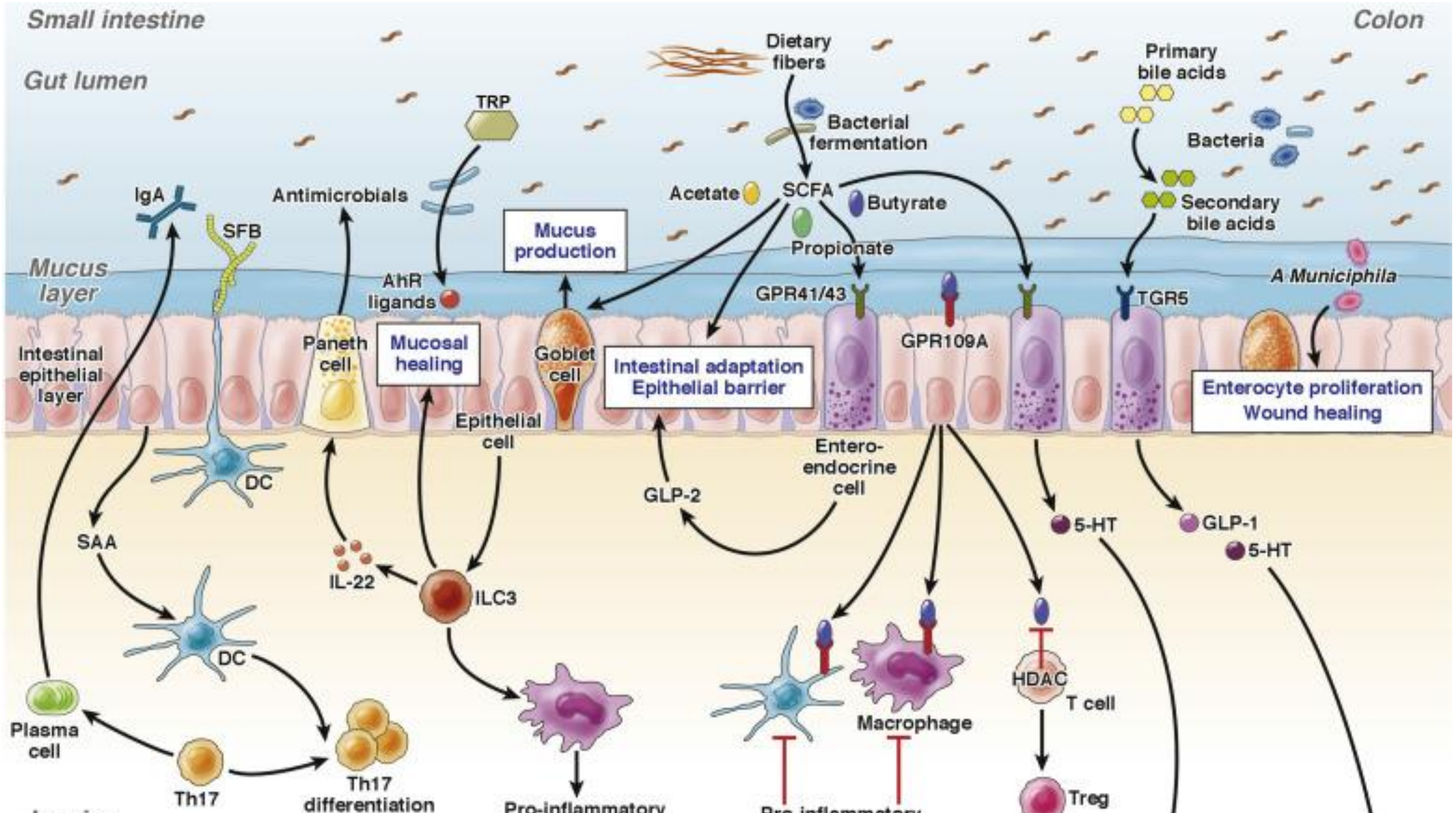
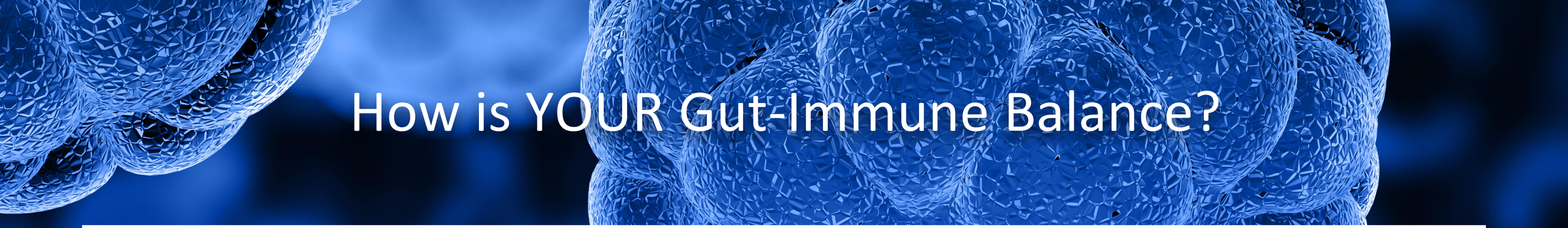
Microbiome – Immune Crosstalk





How is YOUR Gut-Immune Balance?

Signs & Symptoms of IMBALANCE

- Frequent digestive symptoms
- Food intolerances/reactions
- Chronic skin conditions (acne, eczema, rash, etc…)
- Chronic fatigue/low energy
- Frequent (and more severe) infections
- Persistent joint pain/chronic inflammation
- Autoimmune disease
- Anxiety, depression, brain fog, etc…
- Weight fluctuations and hormone imbalance

Signs & Symptoms of BALANCE

- Strong digestive health
- No/minimal food sensitivities
- Healthy, clear, vibrant skin
- Balanced energy levels
- Strong immune resilience
- Stable mental health
- Relatively free of pain/inflammation
- Balanced weight and hormones

For a DEEP dive into this subject, check out the Gut-Microbiome-Immune Connection video in the Advanced Training Vault!

Microbiome as Producer of Beneficial Compounds

Short-Chain Fatty Acids (SCFAs) Butyrate, Acetate, Propionate - Essential for gut health, energy metabolism, immune modulation + more!

Vitamins K2, B12, B9 (Folate), B6 - Essential for bone health, brain function, energy metabolism + more!

Neurotransmitters Serotonin, dopamine, GABA + *many* more - Regulate mood, stress, and emotional well-being

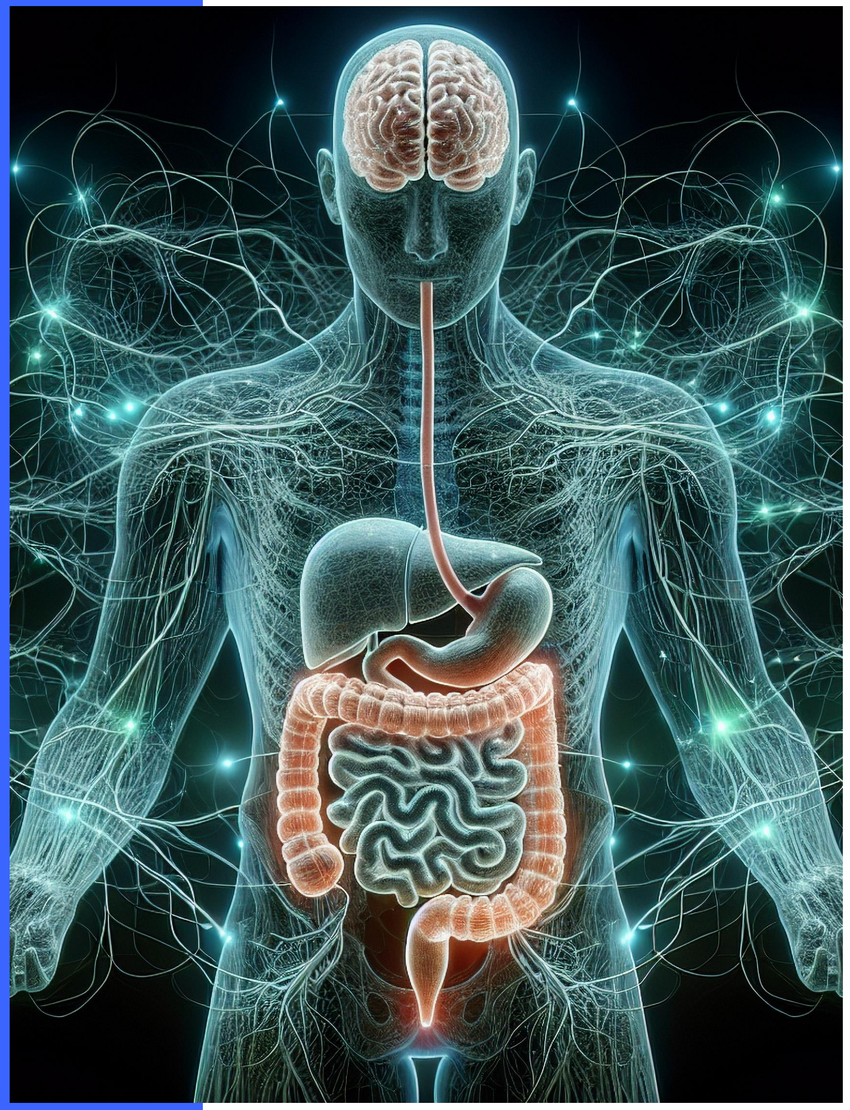
Antimicrobial Compounds Bacteriocins - Natural defense compounds that inhibit harmful pathogens

Anti-Inflammatory Compounds Urolithins, Indolepropionic Acid, etc…

Hormone-Regulating Compounds & BioActive Peptides

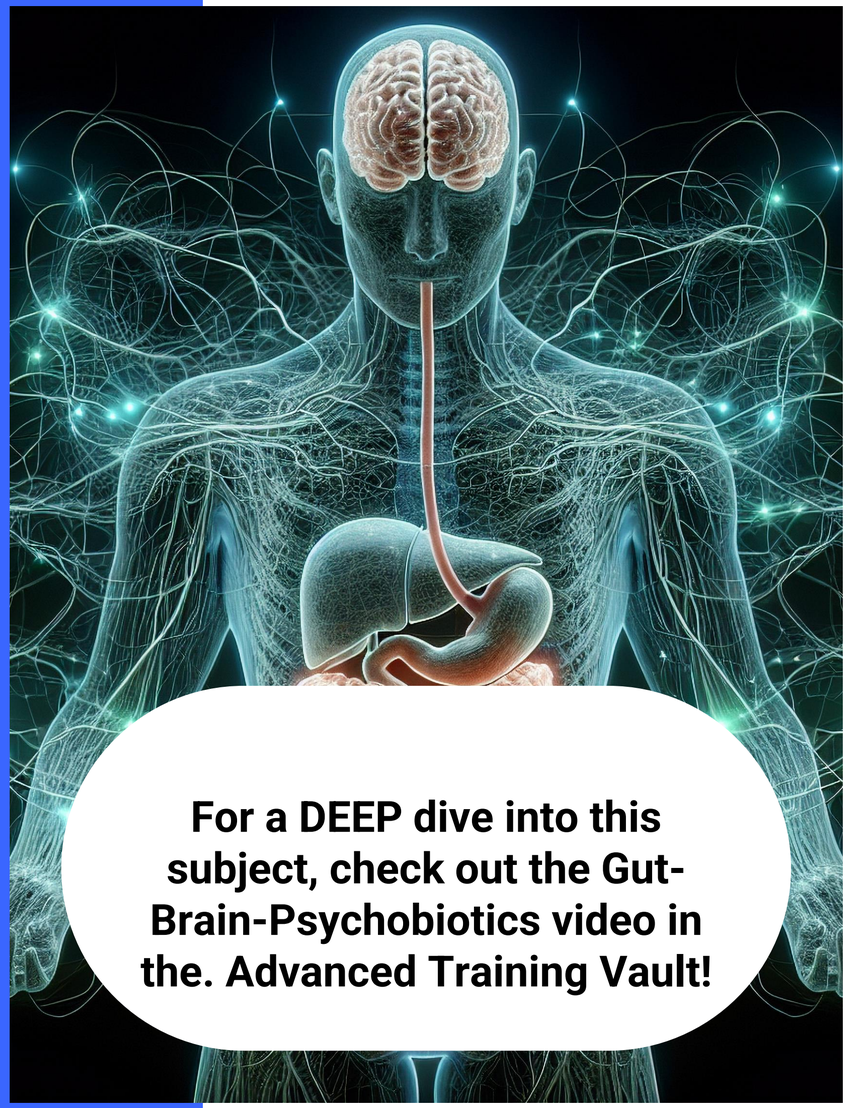
The Gut-Brain-*Microbiome* Connection: How Your GUT Shapes Your Mind

- **Gut as “Second” Brain (Enteric Nervous System)**
  - Approximately 90% of signals travel FROM the gut TO the brain. (Afferent signals)
  - Gut-brain communication via Vagus nerve and biochemical signaling
- **Neurotransmitter Production**
  - Produces and regulates *dozens* of neurotransmitters
  - 90% of serotonin produced in the gut, along with dopamine and GABAgering appropriate reactions
  - Dysbiosis linked to anxiety, depression, and cognitive decline/neurodegeneration

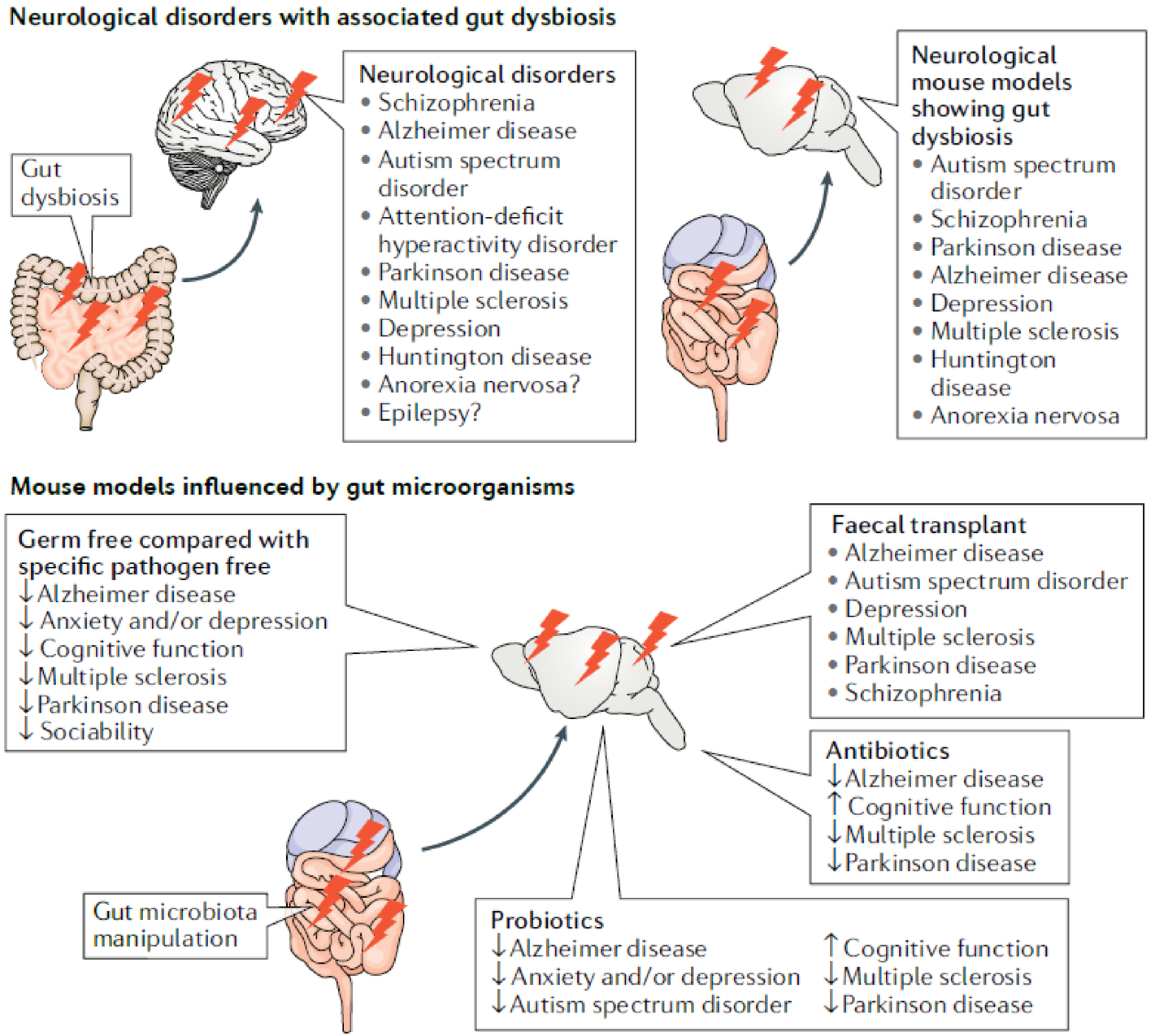


The Gut-Brain-*Microbiome* Connection: How Your GUT Shapes Your Mind

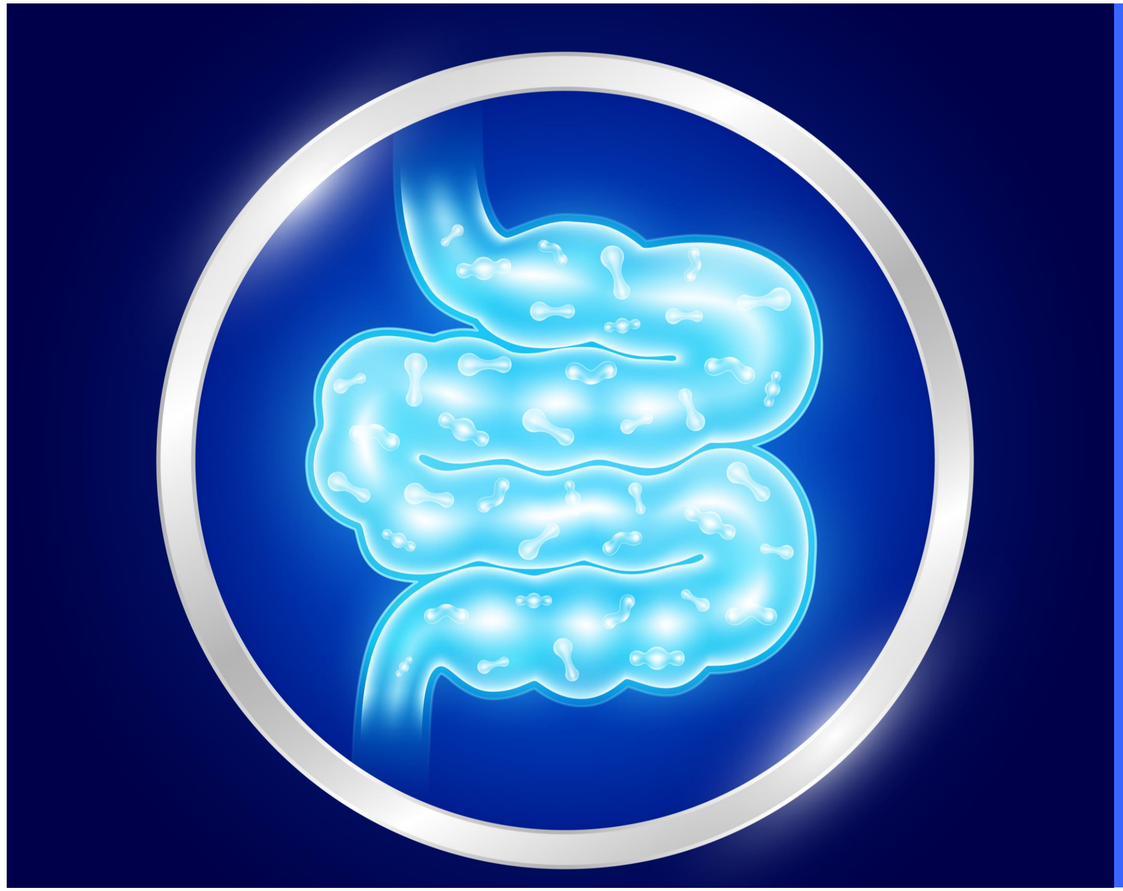
- **SCFAs and the Brain**
  - Neuro-protective, reduce neuro-inflammation, and support mental clarity
- **Stress and the Microbiome**
  - Chronic (and acute) stress negatively impacts the gut microbiome - like a course of antibiotics!
- **Psychobiotics**
  - Class of probiotics proven to help reduce anxiety, improve mood, lower the impact of stress, enhance cognitive function, and reduce gut-driven inflammation



Neurological Disorders with Associated Gut Dysbiosis



The Microbiome's Role in Digestion



- Breaks down complex carbohydrates & fibers via microbial fermentation
- Supports nutrient absorption & vitamin synthesis
- Helps w/ bile acid metabolism & recycling - key role in fat digestion/absorption
- Regulates gut motility via interactions w/ enteric nervous system
- Maintains gut barrier integrity - essential for optimal absorption of nutrients

The Microbiome, Appetite, & Metabolism

Build Your Resilient Gut
MICROBIOME & BEYOND

Appetite Regulation

- Via regulation of hunger hormones (ghrelin) and leptin sensitivity (signals fullness)
- SCFAs (butyrate) stimulates GLP-1, which controls appetite and regulates blood sugar levels
- The gut microbiota Influences GLP-1 through bile acid metabolism

Influences Cravings

- Dysbiotic organisms trigger cravings for sugar and processed carbohydrates
- Certain opportunistic pathogens like *Enterococcus faecalis* produces an enzyme that degrades GLP-1 which can lead to over-eating and poor glucose/insulin control

Metabolic Syndrome

Visceral Obesity

Hypertension

Insulin Resistance

High Triglycerides

Low HDL-Cholesterol

The Microbiome, Appetite, & Metabolism

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Blood Sugar Regulation

- SCFAs produced by microbiome improve insulin sensitivity, reducing blood sugar spikes through GLP-1 and PYY
- Microbial metabolites such as phenolic compounds derived from foods like berries can enhance glucose uptake and metabolism in muscle cells. The gut microbiome can modulate peripheral glucose metabolism
- Dysbiotic gut microbes up-regulate inflammatory responses such as inflammasomes and cytokines, elevation of inflammatory markers leads to insulin dysregulation and glucose control issues
- Beneficial microbes regulate *how* sugar is metabolized, reducing insulin resistance & type 2 diabetes

Fat Metabolism & Storage

- Microbes (Bacteroidetes) associated with increased fat breakdown and reduced fat storage - others associated with *decreased* fat breakdown and *increased* fat storage (Firmicutes)
- Spore-based probiotics shown to reduce triglyceride levels - showing microbiome's impact on fat metabolism and cardiovascular health

Microbiome as Regulator of GI Environment

Oxygen Regulation

- Adequate butyrate (produced by microbiome) reduces oxygen levels in the colon, maintaining a low-oxygen environment that favors beneficial bacteria.
- Gut microbiota also releases hypoxia-inducible factors (HIFs) that increase oxygen uptake by IECs.
- Dysbiosis I associated with increased oxygen levels in the large intestine and in conditions like IBD.
- Inflammation from a dysbiotic gut also causes the increase of potential pathogens that are facultative.

Gut Barrier Integrity

- Microbiome produces compounds that strengthen the gut lining, prevent leaky gut, and regulate immune responses.

Microbiome as Regulator of GI Environment

pH Balance

- SCFAs produced by the microbiome help acidify the colon, creating an environment that inhibits harmful bacteria.

Control Harmful Pathogens & Toxins

- Beneficial microbes (and probiotics) produce antimicrobial compounds that target harmful pathogens - and also aid in detoxifying/eliminating toxins in the gut.

The Gut-*Microbiome*-Hormone Connection: Regulator of Hormonal Balance

Estrogen Balance

Gut microbiome (Estrobolome) regulates estrogen metabolism - preventing imbalances/estrogen dominance and related conditions/symptoms (Ex - infertility, PCOS, cancers, etc…)

Cortisol Regulation

Healthy microbiome helps modulate cortisol, reducing chronic stress & inflammation

Insulin Sensitivity

SCFAs produced by microbiome improve insulin sensitivity, supporting blood sugar control

Hunger Hormones

Gut microbiome regulates hormones leptin, grehlin, and GLP-1 - all which play roles in regulating appetite

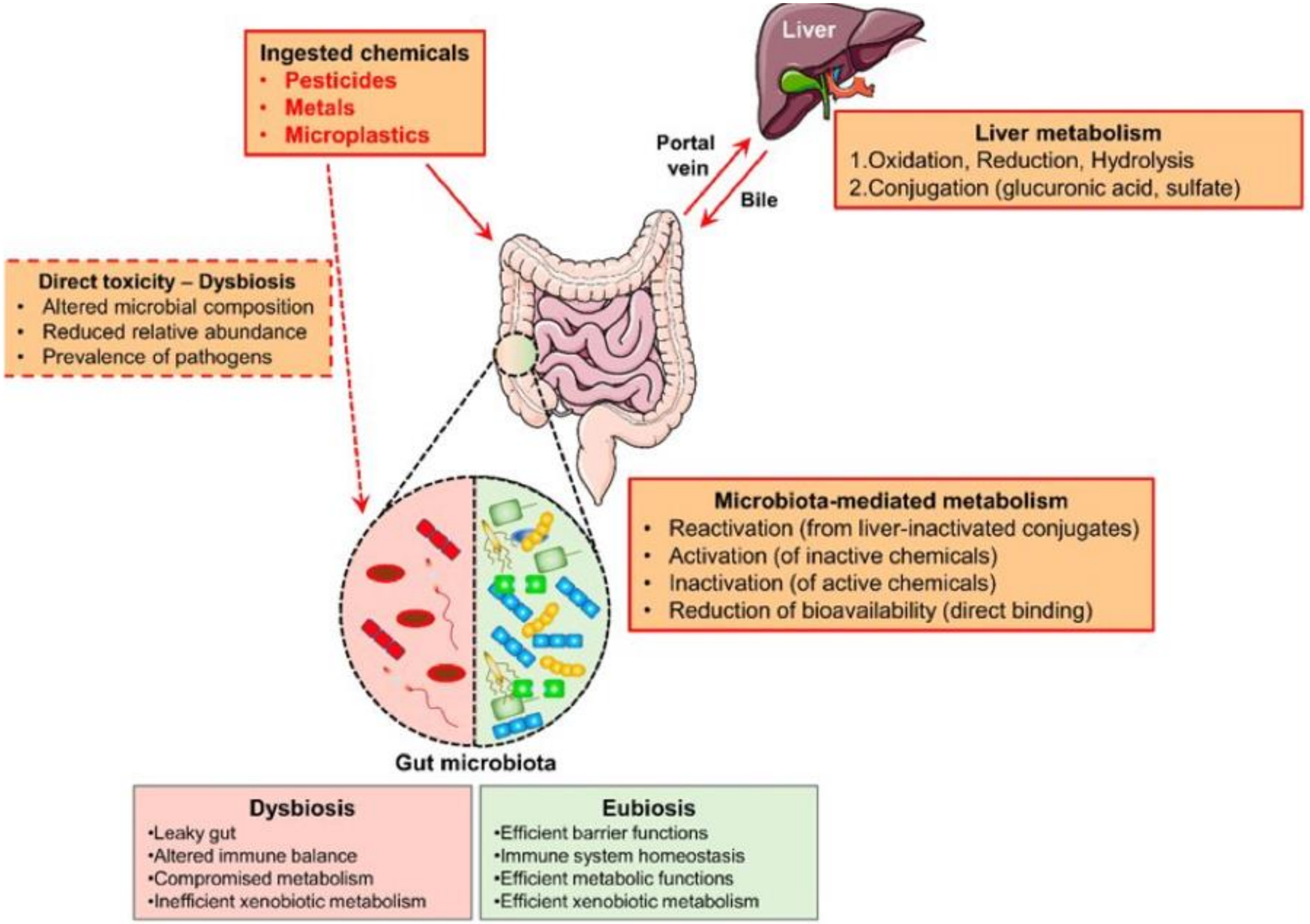
Hormone Detoxification

Gut microbes aid in the detoxification and elimination of excess hormones (such as estrogen)

Thyroid Health

Microbiome influences thyroid hormone conversion - essential for metabolic rate and energy balance

The Gut-*Microbiome*-Detoxification Connection



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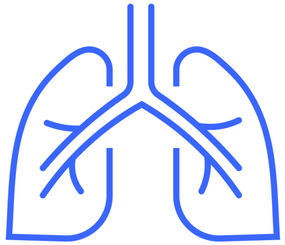
The Gut-*Microbiome*-Detoxification Connection

- Gut microbiome is involved in the biotransformation of xenobiotics, 430+ environmental chemicals, heavy metals, pharmaceuticals, and even microplastics!
- Bacillus (spores) can biodegrade some mycotoxins and glyphosate - although these compounds can be harmful to the overall health of the gut microbiome
- Microbiome plays significant role in the metabolism and detoxification process related to excess hormones - to clear them from the body and reduce occurrence of hormone-related diseases and symptoms
- Beneficial gut microbes help reduce LPS (endotoxins) - which trigger inflammation and contribute to almost all chronic disease (much more on this coming in Module 3!)
- Gut bacteria influence the metabolism and recycling of bile acids - essential for the elimination of fat-soluble toxins

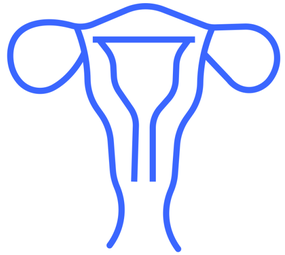
Dysbiosis is linked to impaired detox capacity, increased overall toxic burden, liver conditions such as NAFLD, and many conditions related to hormone imbalances

The *"Other"* Biomes

Oral Biome



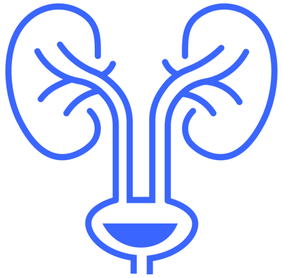
Respiratory/Lung Biome



Vaginal Biome

Nasal/Sinus Biome

Skin Biome



Urinary Tract Biome

Eye Biome

The Skin Biome

- The skin is our largest organ
- The skin biome is made up of over 1.5 *trillion* bacteria and up to 1,000 different species
- Serves as protective barrier against harmful pathogens - preventing infections & supporting immune function
- Modulates inflammatory responses and regulates response to allergens and pollutants
- Helps maintain the skin's acidic pH - which discourages the growth of pathogenic organisms, acne, and eczema
- Plays a key role in maintaining skin barrier integrity

Beneath the Surface: Systemic Impact of Skin Dysbiosis and “Leaky Skin”

- Baltimore Longitudinal Study of Aging - poor skin health = increased chronic disease!
- Skin barrier dysfunction drives local skin inflammation, but also systemic inflammation - impacting the whole body
- Skin dysbiosis and weakened skin barrier function is associated with higher risk of cardiovascular disease, metabolic syndrome, and autoimmune disorders
- When the skin barrier is compromised (“leaky skin”), it allows toxins, pollutants, and pathogens to potentially penetrate the skin

Beneath the Surface: Systemic Impact of Skin Dysbiosis and “Leaky Skin”

- Increased markers of systemic inflammation (CRP) were found in people w/ severe skin conditions
- Restoring the skin microbiome balance and improving barrier function led to reductions in systemic inflammation, improved metabolic function, and better overall health outcomes

How Healthy is YOUR Skin Biome?!

Dysbiotic Skin Biome

• Red, sensitive, irritated skin prone to conditions like acne and eczema

• Thin, dull, dry skin

• Sagging skin w/ many wrinkles and fine lines

• Discoloration and hyperpigmentation

Balanced, Healthy Skin Biome

• Skin is resilient w/ low levels of inflammation

• Skin repairs fast - fresh look, thick appearance

• Skin maintains moisture w/ adequate collagen

• pH is balanced, minimizing fungal/yeast growth

• pH is balanced, minimizing fungal/yeast growth

Major Disruptors/Influencers of the Skin Biome

- Age
- Gender
- Genetics
- Environment (pollutants, ecosystem, etc…)
- Climate
- Cosmetics
- Diet
- Hormones
- Immune Function
- Lifestyle
- Gut Health

As the skin biome changes, it alters the relationship between the host and the microbes and thereby impacts host aging and life expectancy.

The skin biome is arguably the most accurate predictor of biological age

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Build Your Resilient Gut

MICROBIOME & BEYOND

BEFORE

AFTER

BEFORE

AFTER

BASELINE

DAY 30

BASELINE

DAY 14

We'll cover many ways to build a resilient microbiome (including the skin biome) shortly - but one effective way to support the skin biome directly is with

SIV Biome-Balancing Serum

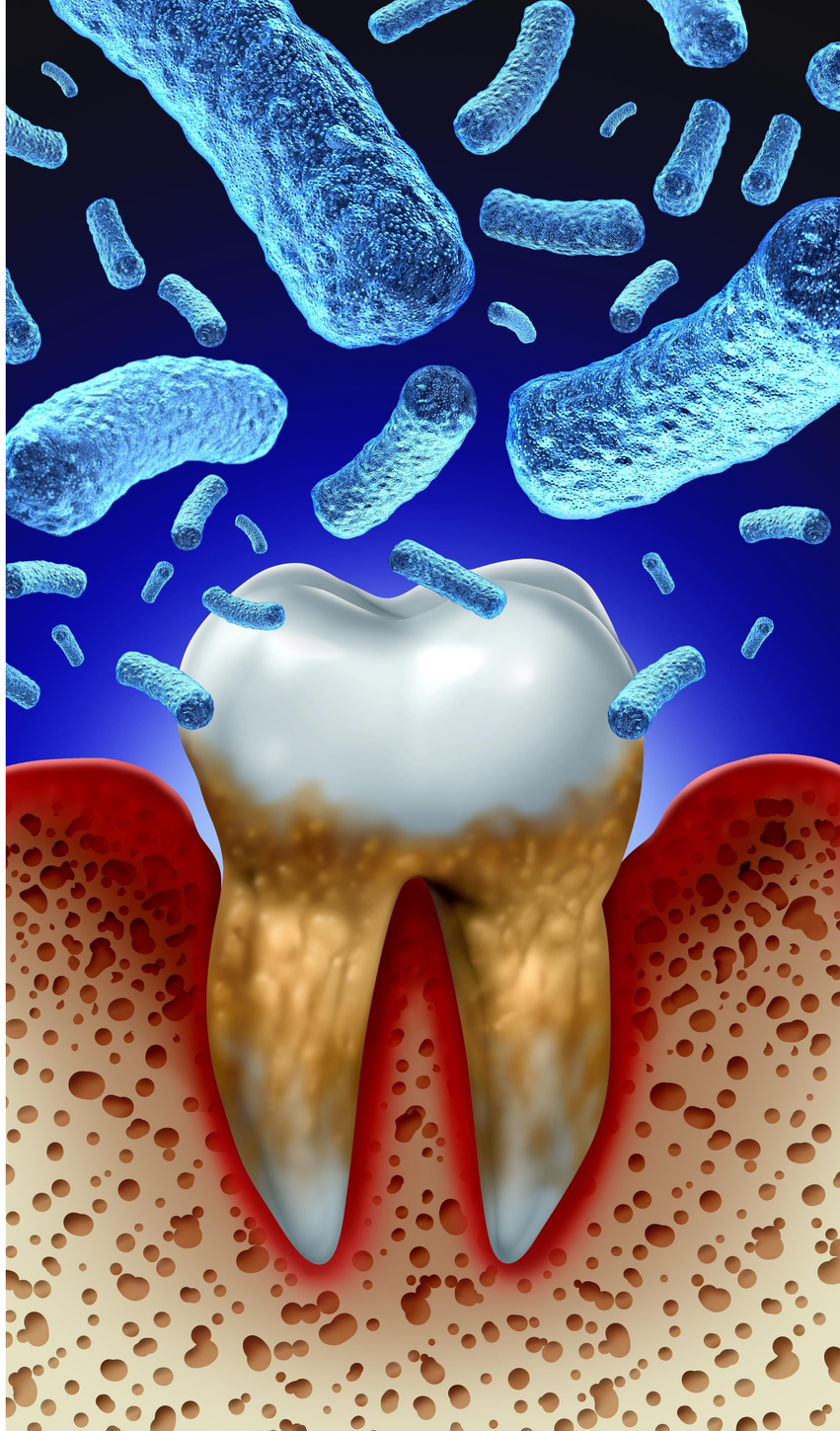
The Oral Microbiome

- Over 700 species of bacteria have been identified in the oral biome - making it equally as diverse as the gut biome!
- Essential for preventing overgrowth of harmful microbes - reducing infections and oral disease
- First line of defense vs. pathogens that enter through the mouth - stopping further travel into the body
- Help protect teeth by regulating the pH levels in the mouth - reducing cavities
- A healthy oral biome helps prevent periodontal disease and maintains gum health

Beyond the Mouth:

SYSTEMIC IMPACT OF ORAL MICROBIOME

- Certain beneficial oral microbes are critical for NO2 production, which regulates blood pressure and optimized cardiovascular health
- Oral dysbiosis is linked to systemic health conditions like heart disease, diabetes, neurodegenerative disease, autoimmune conditions, and even some cancers
- Harmful bacteria from the mouth can enter the bloodstream and cause systemic infections and inflammation
- Humans swallow, on average, approximately 1 *trillion* microbes per day
- Microbes from the oral microbiome can contribute to SIBO and other GI infections/overgrowths when combined with low HCL, inadequate bile, inhibited motility, etc…



How Healthy is YOUR Oral Microbiome?

Signs of Oral Dysbiosis

- Persistent bad breath
- Cavities and tooth decay + sensitivity
- Gum disease (periodontitis) - bleeding gums
- Systemic inflammation/chronic conditions

Signs of Healthy Oral Microbiome

- Fresh breath
- Strong teeth, no sensitivity
- Healthy gums, no bleeding or recession
- Balanced oral pH - minimal tooth decay/cavities

Supporting a Healthy Oral Microbiome

- Regular brushing (2x/day) with an oral-microbiome friendly toothpaste like FYGG + regular flossing (1x/day)
- Tongue scraping - can remove harmful bacteria and maintain healthy microbial diversity on the tongue
- Oral probiotics - such as Bristle Oral Probiotic
- Eat a real food diet - avoid processed foods, sugar, etc…
- Avoid use of antibacterial, alcohol-based mouthwashes
- Breathe through your nose - mouth breathing dries out the mouth, increasing risk of dysbiosis
- Reduce stress - which reduces saliva production, increasing risk of dysbiosis
- Regular visits to a functional/biological dentist - askthedentist.com/directory
- Oral Microbiome Testing w/ Bristle’s Oral Microbiome Test

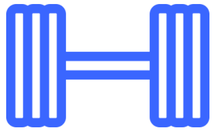
See BONUS Module w/ Dr. Mark Burhenne on the Oral Microbiome!

The 5 Pillars

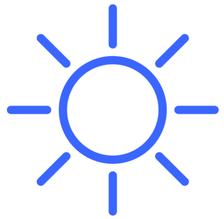
OF BUILDING A RESILIENT MICROBIOME & HEALTHY GUT

Food

Stress



Lifestyle

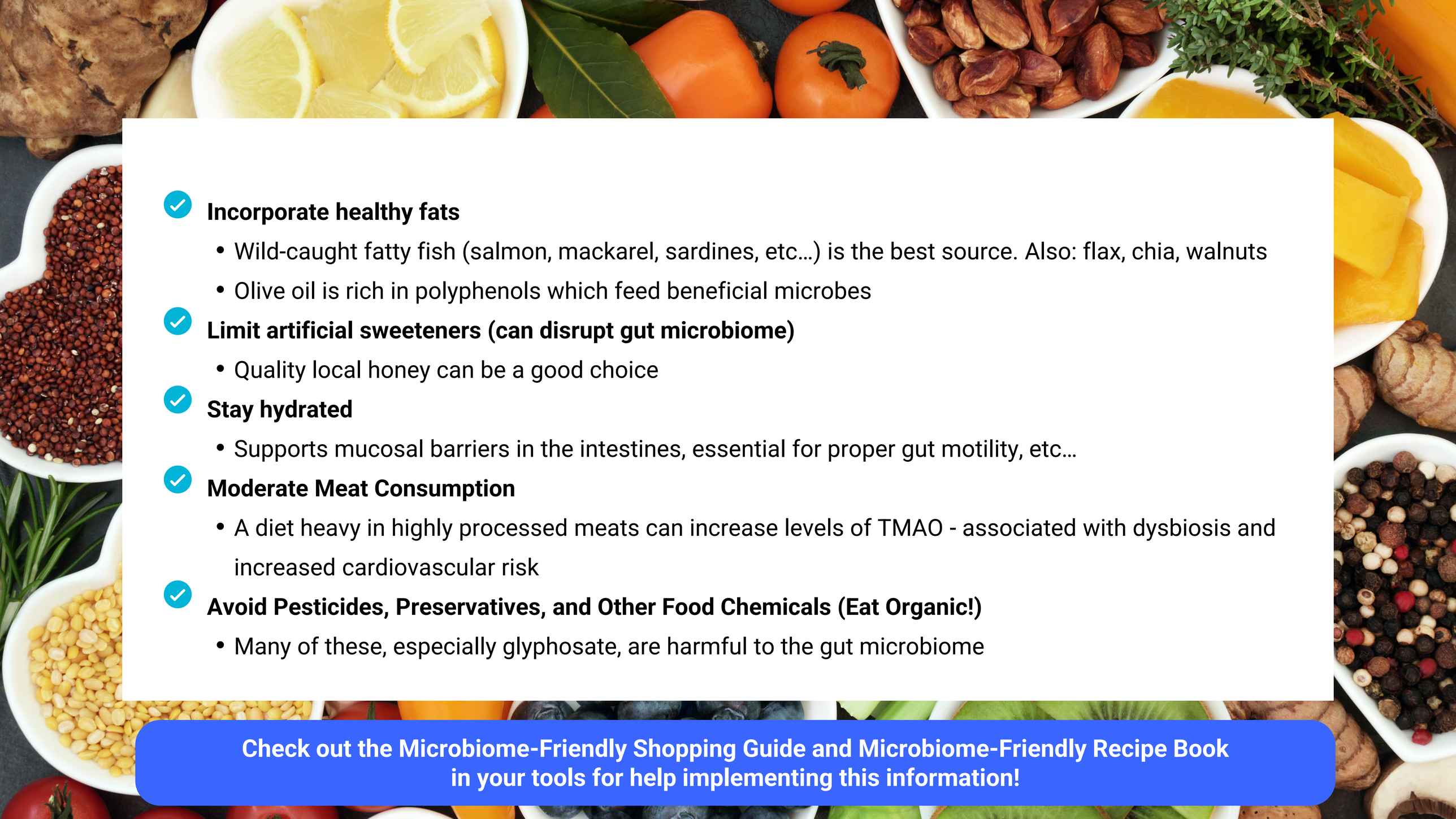


Exposure

Supplements

Pillar 1: Food

- **Eat a diverse range of colorful fruits and vegetables (polyphenols feed beneficial microbes)**
- **Adequate fiber intake is *essential* for a healthy, diverse microbiome**
  - Leafy greens, root vegetables, legumes, whole grains, nuts, and seeds
- **Prebiotic-rich foods feed beneficial microbes and increase SCFA production**
  - Resistant starches (green bananas, oats, cooked/cooled potatoes or rice)
  - Inulin (chicory root, garlic, onions, leeks)
  - Fructooligosaccharides (FOS) - (asparagus, artichokes, dandelion greens)
- **Minimize processed foods**
  - Sweets, sodas, sugary cereals, refined carbohydrates (like white bread, pasta, pastries, etc...), fried foods, etc...
  - These foods can feed harmful microbes in the gut *and* oral microbiome



- **Incorporate healthy fats**
  - Wild-caught fatty fish (salmon, mackarel, sardines, etc…) is the best source. Also: flax, chia, walnuts
  - Olive oil is rich in polyphenols which feed beneficial microbes
- **Limit artificial sweeteners (can disrupt gut microbiome)**
  - Quality local honey can be a good choice
- **Stay hydrated**
  - Supports mucosal barriers in the intestines, essential for proper gut motility, etc…
- **Moderate Meat Consumption**
  - A diet heavy in highly processed meats can increase levels of TMAO - associated with dysbiosis and increased cardiovascular risk
- **Avoid Pesticides, Preservatives, and Other Food Chemicals (Eat Organic!)**
  - Many of these, especially glyphosate, are harmful to the gut microbiome

Check out the Microbiome-Friendly Shopping Guide and Microbiome-Friendly Recipe Book in your tools for help implementing this information!

Build Your Resilient Gut
MICROBIOME & BEYOND

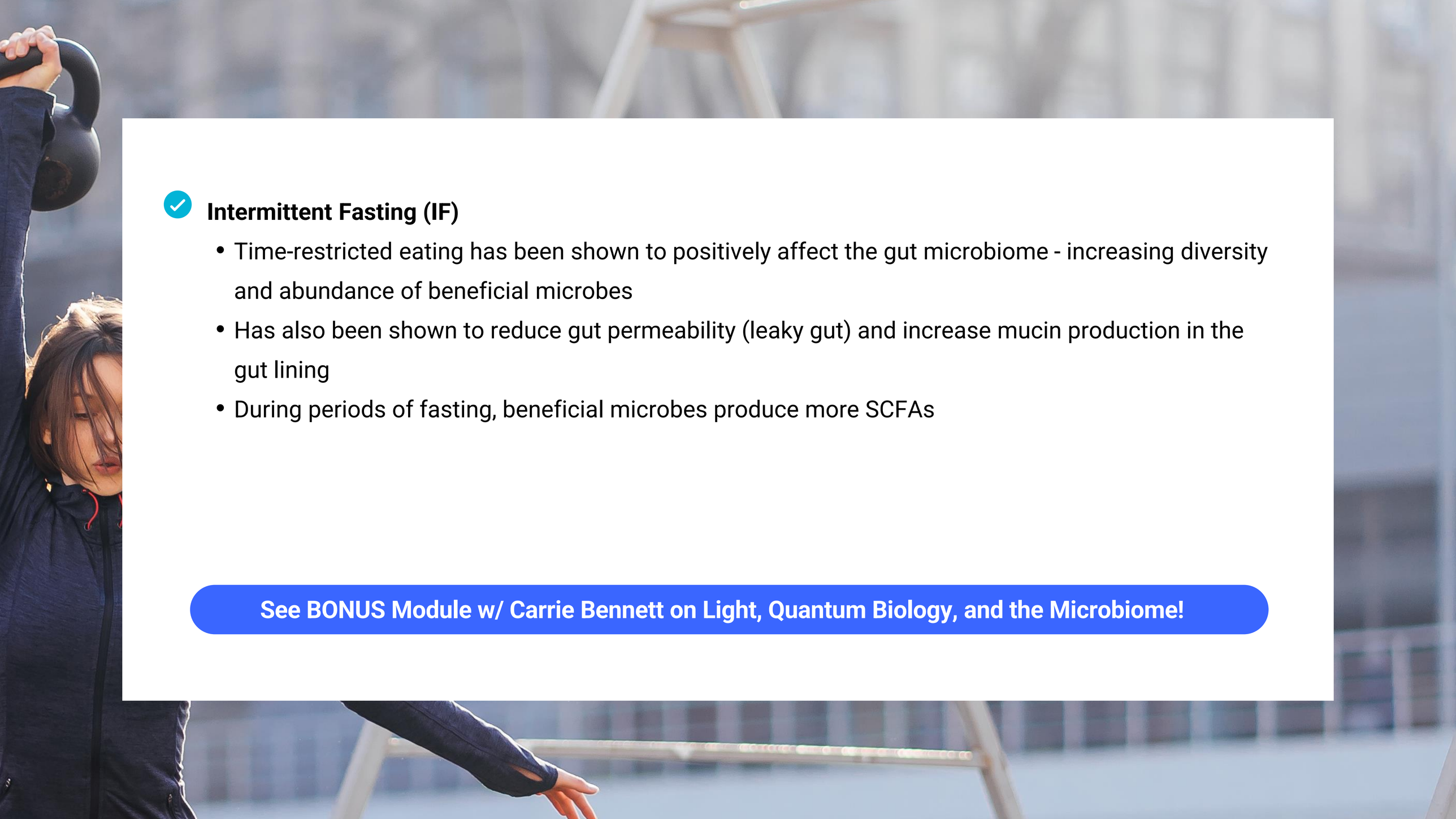
Pillar 2: Stress

- Breathing & Breathwork
- Meditation / Mindfulness
- Get Into Nature
- Nervous System Regulation
- Yoga - Qigong - Tai Chi
- Safe Trauma Resolution
- More JOY!

See BONUS Module w/ Michael Roesslein for Stress Reduction & Nervous System Support!

Pillar 3: Lifestyle

- **Exercise**
  - Increases microbial diversity and resilience compared to sedentary individuals
  - Strength training has the strongest beneficial impact on microbiome -Myokines!
  - Increases production of SCFAs
- **Optimize Sleep, Circadian Rhythm & Light Exposure**
  - The microbiome has its own circadian rhythm - irregular sleep/circadian patterns contribute to dysbiosis
  - Chronic sleep deprivation reduces beneficial bacteria and increases gut permeability (leaky gut)
- **Community, Connection & Socialization**
  - Loneliness and social isolation have been shown to increase stress & inflammation - both negatively impact the microbiome



Intermittent Fasting (IF)

- Time-restricted eating has been shown to positively affect the gut microbiome - increasing diversity and abundance of beneficial microbes
- Has also been shown to reduce gut permeability (leaky gut) and increase mucin production in the gut lining
- During periods of fasting, beneficial microbes produce more SCFAs

See BONUS Module w/ Carrie Bennett on Light, Quantum Biology, and the Microbiome!

Pillar 4: Exposure

Build Your Resilient Gut
MICROBIOME & BEYOND

- **Natural Birth vs. C-Section**
  - Infants born via C-section have fewer beneficial species of bacteria, like Bacteroides, which are crucial for immune development
  - They also face a higher risk of obesity, asthma, allergies, eczema, and autoimmune conditions, and are more likely to develop Type 1 diabetes compared to those born vaginally
- **Skin-to-Skin Contact w/ Parents (Especially Mom!)**
  - Allows infant to acquire essential microbes that help colonize their skin and gut - crucial for immune system development
- **Breast-Fed vs. Formula**
  - Breastfed infants develop a more diverse gut microbiome with higher levels of beneficial bacteria and a stronger immune system
  - They are at lower risk of infections, allergies, eczema, and chronic diseases like obesity and autoimmune conditions, while formula-fed infants are more prone to gut inflammation and related health issues

- **Exposure to Pets, Dirt, Nature**
  - Introduces children to a broad array of beneficial microbes, helping to develop a more diverse microbiome
  - Direct interaction with soil and nature exposes us to a wide variety of environmental microbes - supporting diversity and resilience
- **Overuse of Antibiotics**
  - Frequent antibiotic use disrupts the microbiome by killing both harmful and beneficial organisms - leading to dysbiosis and reduced diversity
  - This includes natural antimicrobials often used in functional health protocols/recommendations - which can indiscriminately kill both harmful *and* beneficial organisms in the gut
- **Over-Sterilization**
  - Excessive use of hand sanitizers, disinfectants, and sterilization practices can reduce microbial diversity
  - This includes alcohol-based antiseptic mouthwashes, which are harmful to the oral microbiome

Microbiome Foundations Bundle

MegaSporeBiotic

The world's #1 professional probiotic, proven to increase diversity & keystone species, reduce leaky gut and endotoxemia, reduce GI inflammation, support the liver, improve metabolic markers, and *more*.

MegaPre

The world's *first* precision prebiotic, designed to work synergistically with MegaSporeBiotic and selectively feed beneficial organisms in the gut - leading to a more diverse and *resilient* microbiome.

Tributyrin-X

The short-chain fatty acid butyrate is *essential* for optimizing the health and integrity of the gut lining, creating a low-oxygen environment where beneficial organisms thrive, and *dozens* of other systemic benefits.

The Microbiome Foundations Bundle contains 3 powerful, synergistic formulas to help you build a healthy, diverse, and resilient microbiome!