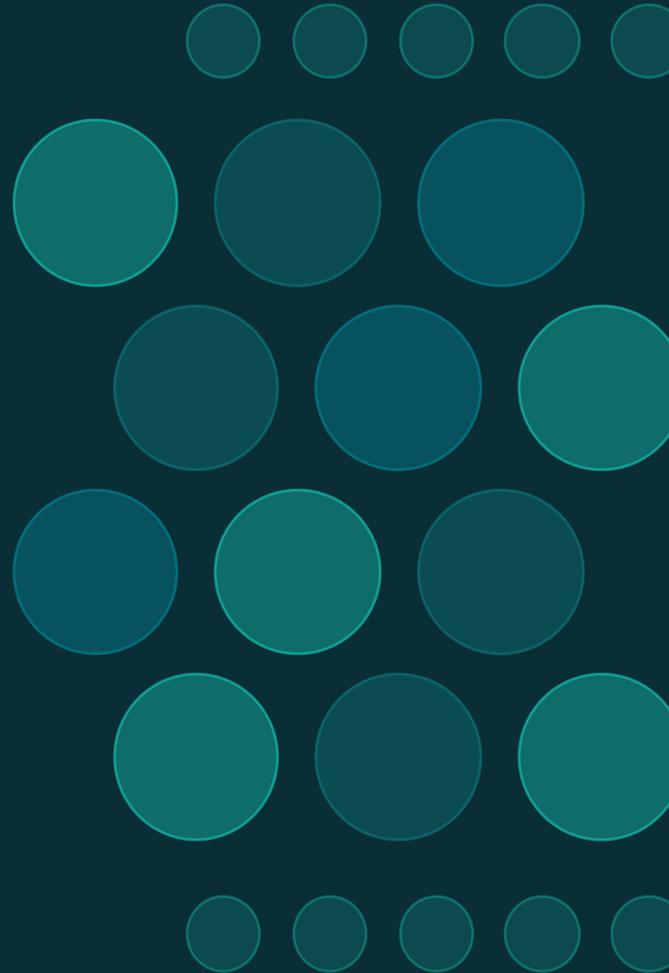


THE MICROBIOME OPPORTUNITY

THE HIDDEN ORGAN DRIVING THE FUTURE OF HEALTH

Kiran Krishnan

Research Microbiologist



THE SCALE OF THE OPPORTUNITY

\$99.9B

Probiotics Market

→ *\$220B by 2030*

\$9.7B

**Probiotic
Supplements**

→ *\$14.7B by 2030*

\$13B

Gut Health Supps

→ *\$21B by 2032*

\$95M

**Microbiome
Therapeutics**

→ *\$1B+ by 2030 (35%
CAGR)*

KEY INSIGHT

This is one of the fastest growing sectors in health innovation — spanning consumer products, diagnostics, and pharmaceuticals.

Three Macro Drivers

01

Chronic Disease Epidemic

- Metabolic disorders
- Autoimmune disease
- Inflammatory disease
- Neurological disorders

02

Consumer Awareness

- Gut health literacy
- Immunity focus
- Microbiome balance
- Wellness culture shift

03

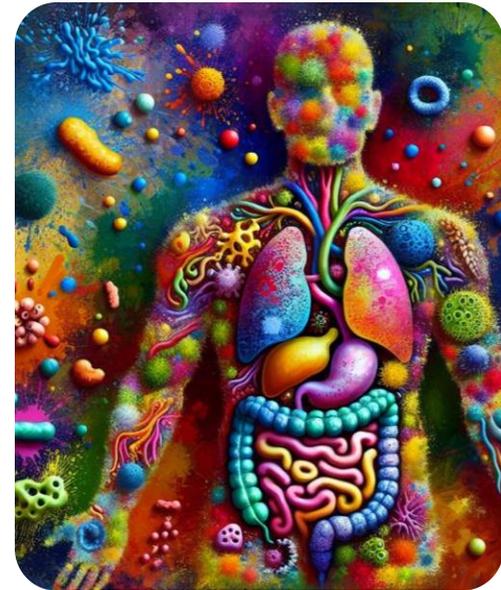
Scientific Breakthroughs

- Metagenomics
- Metabolomics
- Microbiome sequencing
- AI microbial modeling

The Microbiome

Your Body's Hidden Ecosystem

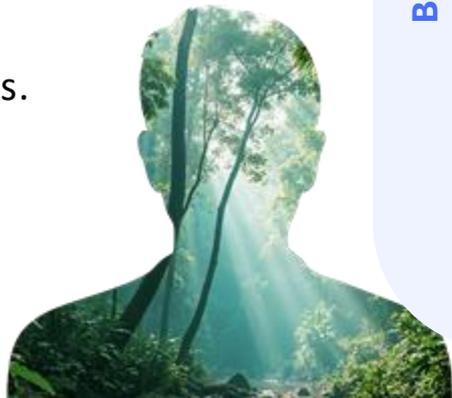
- You carry about **38 trillion microbes** — slightly more than your own human cells — living in and on your body.
- These microbes contain nearly **3 million genes**, compared to your **20 000 human genes**, forming a vast “**second genome**” that helps regulate your biology.
- Altogether, your microbiome weighs roughly **3 pounds (1–2 kg)** — about the same as your brain — and it's working just as hard.
- Microbes live everywhere — your **gut, skin, mouth, sinuses, lungs, and reproductive tract** — each community performing unique, essential jobs.
- Together, these trillions of organisms function as a **parallel organ system**, constantly communicating with your own cells to keep the body in balance.



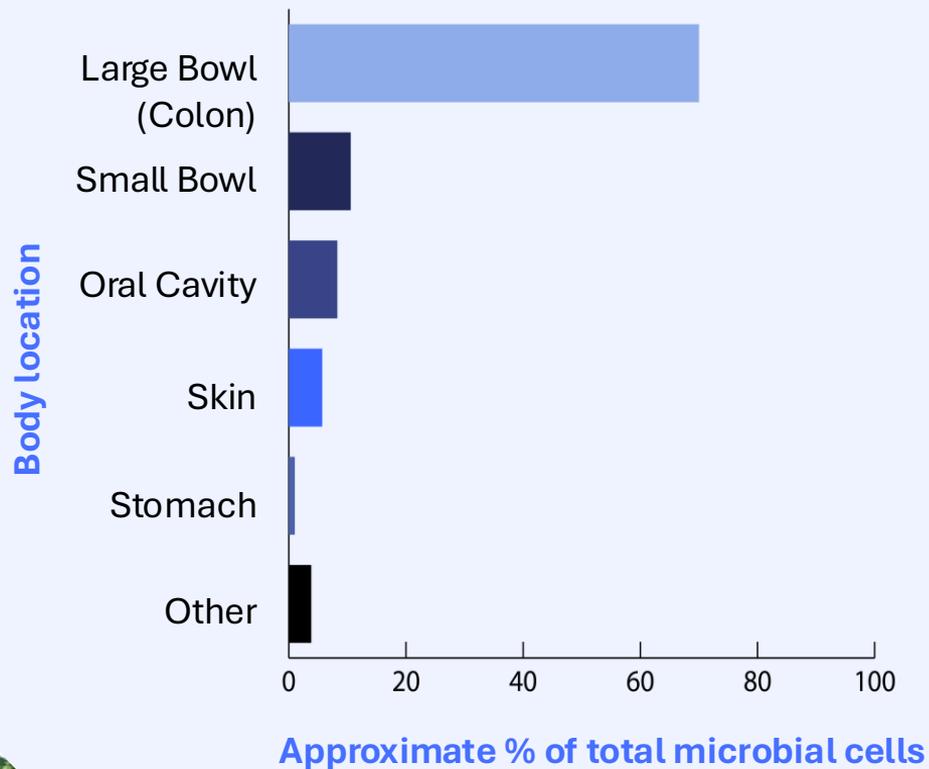
You Are a Holobiont

Distribution of Microbiome by Body Location

Most of the body's microbes reside in the colon, but each site contributes unique functions.



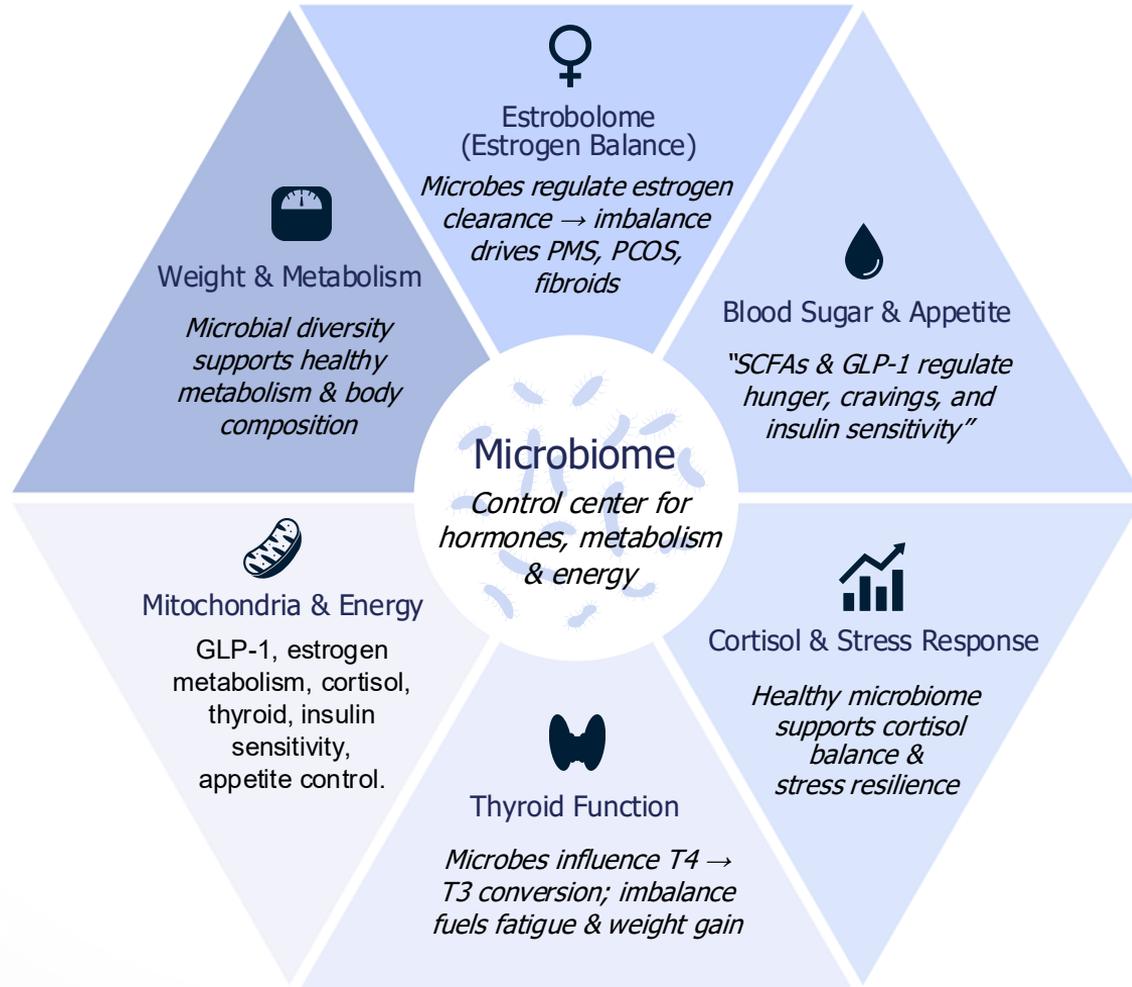
Distribution of Microbiome by Body Location



The Microbiome's Role in Human Health

- Acts as a **central regulatory organ** influencing digestion, metabolism, immunity, hormonal balance, detoxification, and cognition.
- **Educates and calibrates the immune system** — commensals promote tolerance; loss of diversity drives chronic inflammation and autoimmunity.
- Maintains **barrier integrity** (gut, skin, vaginal, oral) and prevents microbial translocation, endotoxemia, and mucosal breakdown.
- Produces **bioactive metabolites** (SCFAs, vitamins, neurotransmitters, bile acid derivatives) that regulate systemic host signaling.
- **Modulates brain and hormone networks** via neurotransmitter production, vagal signaling, and regulation of estrogen recycling, GLP-1, cortisol, and thyroid conversion.
- Supports **detoxification and xenobiotic metabolism** — microbial enzymes enhance liver detox pathways and reduce toxic burden.

The Gut Hormone Metabolism Energy Connection.





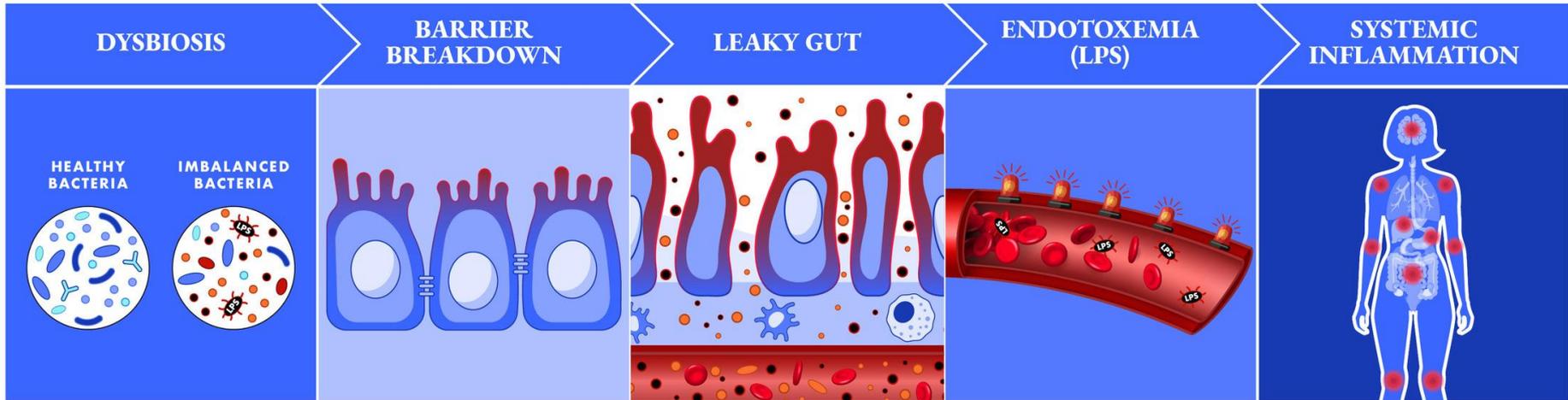
MY AREA OF MICROBIOME INNOVATION

14+ Studies!

MULTI-SPOREBIOTIC CONSORTIUM FOR METABOLIC ENDOTOXEMIA

Dysbiosis → Leaky Gut → Endotoxemia

Ground Zero for Chronic Disease



LOSS OF DIVERSITY,
OVERGROWTH OF THE
WRONG MICROBES

MUCOUS LAYER THINS,
TIGHT JUNCTIONS
LOOSEN

UNDIGESTED FOOD,
TOXINS, AND BACTERIAL
FRAGMENTS SLIP THROUGH

BACTERIAL TOXINS CROSS
INTO CIRCULATION,
SOUNDING THE IMMUNE
ALARM

CHRONIC IMMUNE
ACTIVATION SPREADS
THROUGHOUT THE BODY

THE METABOLIC SYNDROME



Heart Disease



Lipid Problems



Hypertension



Type 2 Diabetes



Dementia



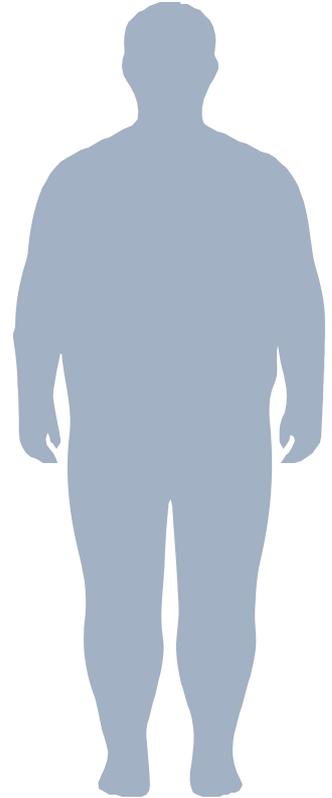
Cancer



Polycystic Ovarian
Syndrome



Non-Alcoholic Fatty
Liver Disease



How Endotoxemia Drives Chronic Symptoms & Conditions.

Condition / Symptom	How Endotoxemia Contributes
Fatigue & Low Energy	Inflammatory signals from LPS disrupt mitochondria the body's energy factories.
Brain Fog, Anxiety, Depression	LPS activates immune cells in the brain → disrupts serotonin & dopamine balance.
Joint Pain & Chronic Inflammation	Immune system is constantly on "high alert," creating systemic inflammation.
Skin Issues (Acne, Eczema, Psoriasis)	Leaky gut + immune overactivation show up as rashes, breakouts, and flare-ups.
Weight Gain & Metabolic Syndrome	LPS interferes with insulin sensitivity and appetite hormones, driving fat storage.
Hormone Imbalance (PMS, PCOS, Thyroid Issues)	Disrupted estrogen clearance, cortisol regulation, and thyroid conversion.
Autoimmunity	Continuous immune activation confuses the body → immune system attacks itself
Frequent Illness / Infections	A dysregulated immune system can't properly defend against real threats



Prospective Study

Oral spore-based probiotic supplementation was associated with reduced incidence of post-prandial dietary endotoxin, triglycerides, and disease risk biomarkers

Brian K McFarlin, Andrea L Henning, Erin M Bowman, Melody M Gary, Kimberly M Carbajal

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Author contributions: McFarlin BK designed the study, collected data, interrupted findings, and prepared manuscript; Henning AL, Bowman EM, Gary MM and Carbajal KM collected data, interrupted findings, and prepared manuscript.

Institutional review board statement: The study was reviewed

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Manuscript source: Invited manuscript

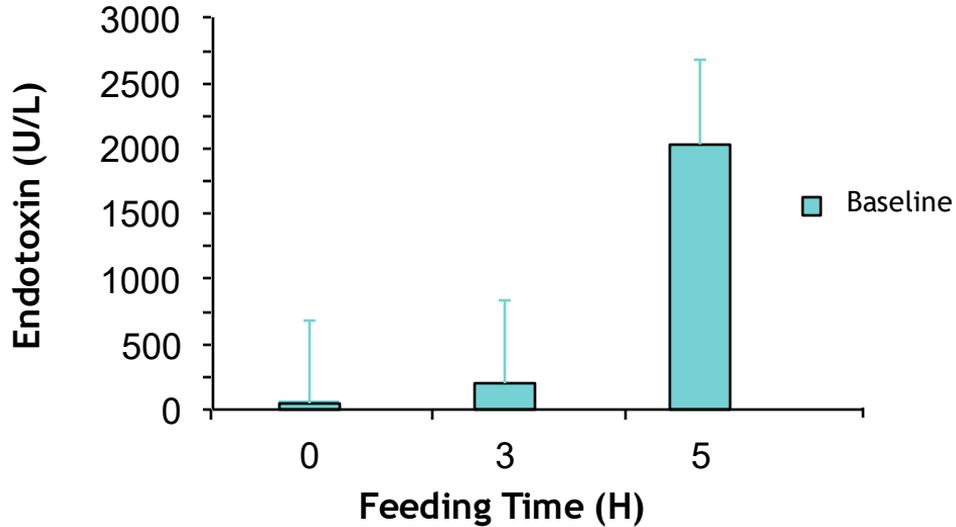
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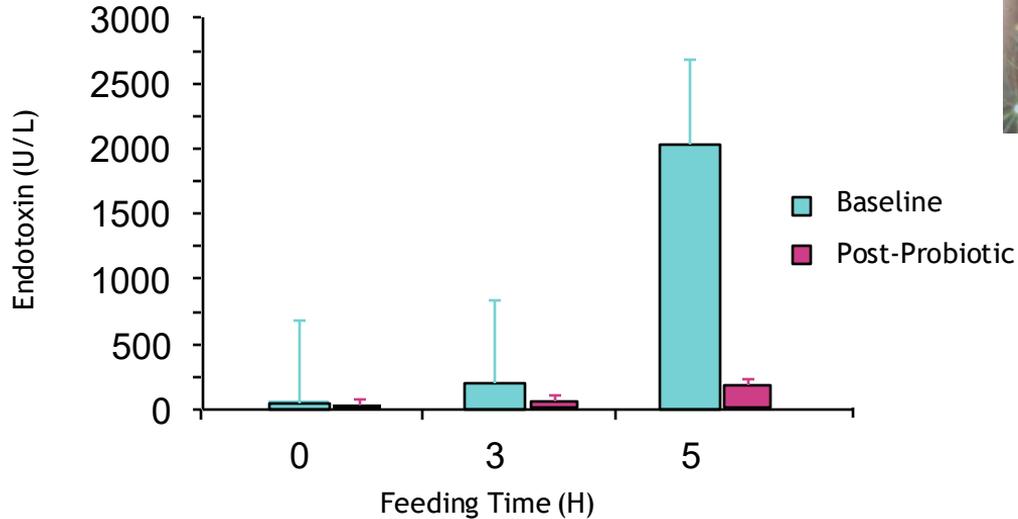
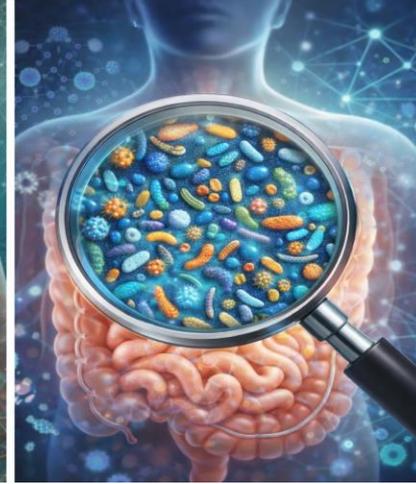
Peer-review started: February 8, 2017

First decision: April 17, 2017

The effect of 30-days of probiotic supplementation on post-prandial responses to a high-fat meal: Pilot Study
Principal Investigator: Brian K. McFarlin, PhD, FACSM, FTOS
University of North Texas



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HOW MICROBIOME SCIENCE IS RESHAPING HEALTHCARE

TRADITIONAL MEDICINE

Treat symptoms or human cells.

Focus on:

- Pathogen elimination
- Symptom management
- Single-target therapies
- Reactive interventions



MICROBIOME MEDICINE

Treat the ecosystem that regulates the body.

Mechanisms:

- Microbial metabolites regulating metabolism
- Gut bacteria controlling immune tolerance
- Microbial neurotransmitters influencing mood
- Bile-acid transformation affecting blood sugar
- Skin microbes regulating inflammation

FIRST GENERATION MICROBIOME PRODUCTS

The earliest commercial category — now massive consumer markets.

Probiotics

Prebiotics

Fermented Foods

Digestive Health Supplements



Global probiotics market expected to exceed \$220B by 2030

1. Precision Probiotics

Strain-specific microbes targeting specific conditions:

- Depression
- Respiratory Health
- IBS
- Skin disorders
- Immune dysfunction

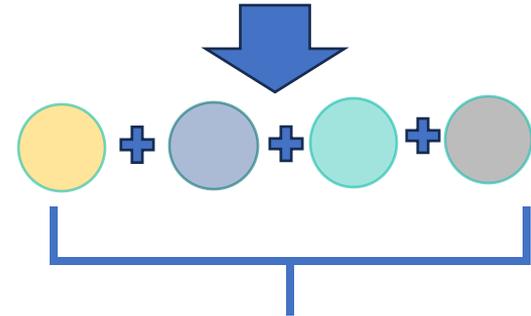




2. Customized Consortium Probiotics

Metagenomics Driven Consortium Formulations

Metagenome Analysis + In silico modeling



NEXT GENERATION MICROBIOME SOLUTIONS

POSTBIOTICS (FASTEST EMERGING)

Microbial metabolites or cell components — more stable, predictable, and scalable than live organisms.

Products include:

- Microbial peptides
- Short-chain fatty acids (SCFAs)
- Bacterial cell wall components

Market: \$135M → \$224M by 2030



VMK223 is a postbiotic supplement developed by veMico Ltd (UK), featuring a mixture of b-glucans extracted from heat-treated *Bifidobacterium breve* (strain BB091109).



PrimaColl®: This is their flagship product for the nutrition space. It is a **bioactive collagen polypeptide** produced via precision fermentation.

NEXT GENERATION MICROBIOME SOLUTIONS



MICROBIOME ANALYTICS

AI + sequencing to guide personalized diet and therapy recommendations.

Leading companies:

Viome

DayTwo

Tiny Health

Data → Diet → Measurable Outcome

New product categories now emerging

Live Biotherapeutic Drugs

Defined microbial therapeutics used like drugs — restoring microbial ecosystems rather than killing pathogens.

VOWST · FDA 2023

First oral microbiome therapeutic approved by FDA for recurrent *C. difficile* infection

REBYOTA · FDA 2022

First FDA-approved microbiome therapy — paving the way for an entirely new drug category

These regulatory milestones validate the entire microbiome therapeutic category — accelerating investment and innovation.

CONTINUED MICROBIOME INNOVATION AREAS

Major therapeutic sectors now being explored — each representing multi-billion-dollar markets

Metabolic Health

- Obesity
- Diabetes
- Insulin resistance

Mental Health

- Gut-brain axis
- Anxiety
- Depression

Skin Health

- Acne
- Eczema
- Aging

Immune Regulation

- Allergies
- Autoimmune disease

Longevity & Aging

- Inflammation control
- Mitochondrial function
- Immune aging

FOOD AND FOODLIKE PRODUCTS AS MICROBIOME THERAPY

The Rise of Functional Nutrition 2.0

Microbiome-Targeted Functional Foods

- Fiber blends targeting SCFA production
- High viscosity fibers for metabolic health
- Polyphenol-enriched foods



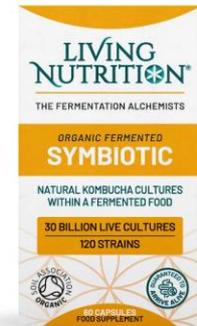
Personalized Nutrition Platforms

- Viome — microbiome testing + diet recs
- DayTwo — glycemic response prediction



Fermentation-Based Innovation

- Engineered for specific metabolite production
- Targeted microbial shifts



THE SKIN MICROBIOME: BEAUTY & DERMATOLOGY

\$435M

Microbiome skincare 2024 → \$835M by 2030

Prebiotic Skincare

Feeds beneficial microbes, supports barrier function

Probiotic Skincare

Live/lysed bacteria — Lactobacillus, Bifidobacterium strains

Postbiotic Skincare

Microbial metabolites: peptides, acids, enzymes. More stable & scalable

Microbiome Repair

Barrier restoration, anti-inflammatory signaling, acne & eczema modulation

\$11.5B

Skin microbiome market 2024 → \$24B+ by 2034



A NEW INDUSTRY IS FORMING

Microbiome-Driven Health Platforms

THE COMMON PATTERN

- 1 Measure the microbiome
- 2 Modulate it precisely
- 3 Track outcomes

NEW BUSINESS MODELS

- Subscription health platforms
- Personalized product ecosystems
- Data-driven wellness companies
- Microbiome SaaS + diagnostics

BIG INSIGHT

The winners will not be product companies.

They will be microbiome platform companies.

Across supplements, food, and skincare — the companies that win will combine measurement, modulation, and outcome tracking into integrated platforms.

THANK YOU

The microbiome may become one of the most transformative health technologies of the 21st century.