

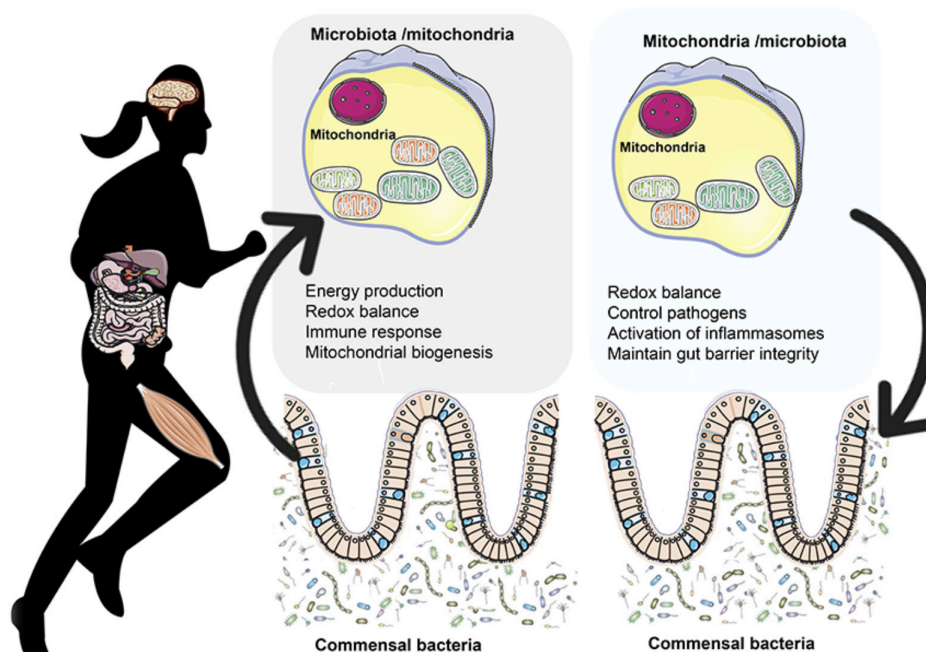


## Microbiome-Mitochondria Protocol

Research continues to highlight the importance of the microbiome and its systemic influences, which extend to mitochondrial function. Present in nearly every human cell, mitochondria help turn energy from food into usable energy called adenosine triphosphate (ATP). Mitochondria also help regulate the body's calcium use and clear away old and broken cells that are no longer needed. All of these vital cellular functions depend on a diversity and abundance of microbes that support robust intestinal and immune function, as well as healthy levels of inflammation throughout the body.

In contrast, microbial dysbiosis can result in the production of metabolites and signaling molecules that increase inflammation and disrupt mitochondrial function. Poor outcomes with infectious illnesses are often correlated with such dysbiosis. Could the mitochondria be playing a role?

Recent evidence shows there is a bidirectional interaction between mitochondria and microbiota. The gut microbiota is involved in mitochondrial biogenesis, while its secondary metabolites, such as short-chain fatty acids and secondary bile acids, also contribute to host energy production, reactive oxygen species (ROS) modulation, and inflammatory balance. Conversely, mitochondria, particularly mitochondrial ROS production, regulate the gut microbiota by modulating intestinal barrier function and mucosal immune responses.<sup>1</sup>



<https://www.frontiersin.org/articles/10.3389/fphys.2017.00319/full>

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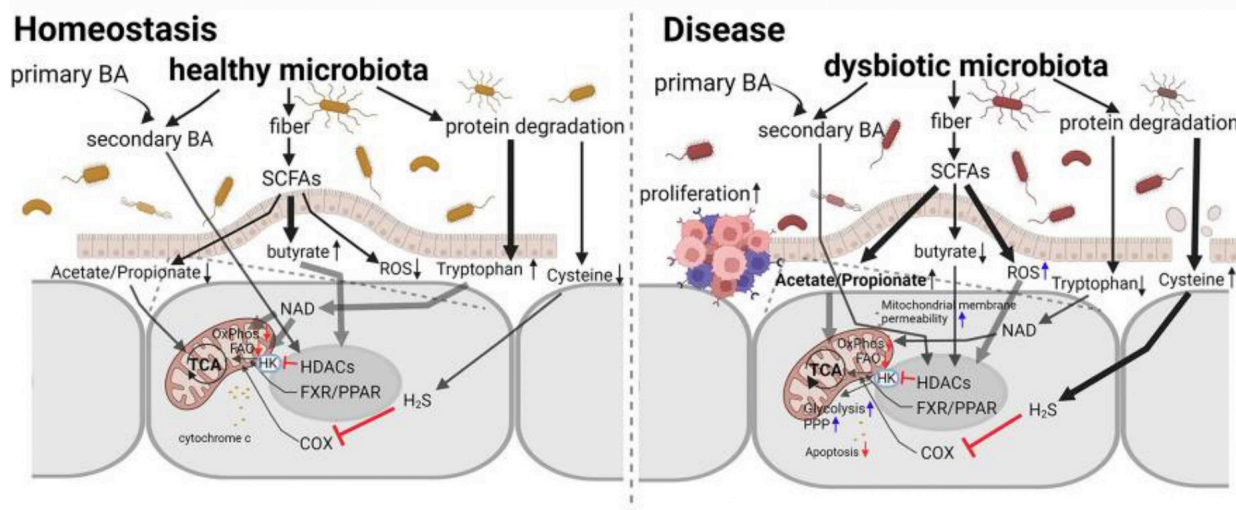


## What are some causes of elevated ROS?

- Dysbiosis (overproduction of inflammatory mediators)
- Infection (chronic and acute)
- Toxicity (environmental, foodborne and/or endogenous)
- Tissue injury
- Excessive exercise
- Carbohydrate and caloric excess
- Stress
- Some medications



We're only beginning to understand the complexity of interactions that occur as ROS levels change throughout one's lifespan and in various disease states. Low ROS levels are necessary for healthy cellular function and even signal mitochondria to initiate a cascade of events that ultimately protects the cell from further damage by ROS (mitohormesis). Moderate ROS levels may be beneficial to younger animals in natural settings but may harm aging animals in a non-stressful laboratory or sanitized environment. Excess ROS is damaging, even if needed for acute tissue repair. Human intestinal diseases and aging result in an increase in ROS levels, and higher levels have been shown to decrease the diversity of microbes in the gut.<sup>2</sup>



<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9623293/>

<sup>2</sup> <https://pubmed.ncbi.nlm.nih.gov/32810578/>

## Risk Factors Affecting the Microbiome-Mitochondria

Exposure to pharmaceutical medications and environmental chemicals can negatively impact the microbiota and mitochondria, leading to possible dysbiosis and mitochondrial dysfunction.<sup>3</sup>

These include:

- Antibiotics (particularly quinolones, aminoglycosides, beta-lactams)
- Proton-pump inhibitors
- NSAIDs
- Pesticides
- Heavy metals<sup>4</sup>

## Restoring the Microbiome to Benefit Mitochondria

By focusing first on our microbiome and understanding that [Microbes Matter Most](#), we can begin to correct imbalances in the microbiota. This correction will ultimately lead to improved mitochondrial dynamics.

Using the power of botanicals, we can shift the microbiome in favor of commensal microorganisms to minimize the growth of opportunistic and pathogenic microbes. In addition to the botanicals, which also support oxidative and inflammatory balance, we can use targeted supplementation to ultimately benefit mitochondrial function and the environment of the microbiome.

### Clinical Pearl #1 - Include Prebiotics

Encourage consumption of fiber, prebiotics, and resistant starches to increase the production of short-chain fatty acids (SCFAs) – the main products of fermentation by gut microbiota. This can help optimize microbial diversity and support mitochondrial function.

### Clinical Pearl #2 - Don't Forget the Mouth

Mitochondrial dysfunction has been positively correlated to aggravated periodontal inflammation in diabetic patients with periodontitis and might represent a therapeutic target.<sup>5</sup> Include a basic oral exam and questionnaire as part of your physical exam, and address oral dysbiosis.

<sup>3</sup><https://pubmed.ncbi.nlm.nih.gov/29221664/>

<sup>4</sup><https://doi.org/10.3402/mehd.v26.27458>

<sup>5</sup><https://pubmed.ncbi.nlm.nih.gov/28207937/>



# Lifestyle Recommendations

- Support your treatment with simple yet effective lifestyle recommendations. Check out the list contained in the [Bioclear™ Microbiome Detox Program Lifestyle Guide](#).
- Adopt a low-inflammation diet (Modified Paleo, Mediterranean, etc.), including a high intake of non-starchy vegetables. Be sure to include prebiotic-rich foods.
- Daily movement and exercise supports healthy gastrointestinal function and healthy microbial diversity and improves mitochondrial biogenesis and function.

## Therapeutic Plan Suggestions

General Dysbiosis Support – Bioclear® Microbiome Detox Program		
CORE PROTOCOL		
Biocidin® Liquid or Capsules	Titrate to 15 drops 2x/day	Titrate to 3 capsules 2x/day
G.I. Detox™+	2 capsules at bedtime. 1 hour away from food, supplements, and medications. Temporarily increase dose to 2 capsules 2-3x/day if Herxheimer's reaction observed/worsens.	
Proflora™ 4R	1 capsule any time	
ADDITIONAL SUPPORT		
Olivirex®	Titrate to 3 capsules 2-3x/day	
In the case of long-standing dysbiosis, testing for presence of pathogenic strains is highly recommended.		

### Questions?

For clinical questions, email [clinical@biocidin.com](mailto:clinical@biocidin.com) or call 800-775-4140, x3.

These statements have not been evaluated by the Food and Drug Administration. These products are not intended to diagnose, treat, cure, or prevent any disease.

