

## Modes of Action

### BiOWiSH™ MultiBio 3P & BiOWiSH™ MultiBio 3PS

#### Metabolic Effects

Monogastrics and ruminants

- Modulates pH levels in gastrointestinal tract through the production of lactic acid and other compounds
- Produces proteolytic enzymes allowing for increased digestion
- Increases digestion leading to greater nutrient utilization

Ruminants

- Modulates ruminal fermentation, as evidenced by shifts in rumen pH and volatile fatty acid profiles

#### Shifts the Gut Microbiome

- Consistently adds beneficial microbes to noticeably shift the gut microbiome
- Alters the microbial community
- Reduces pathogen loads

#### Resistance to Pathogen Colonization

- Outcompetes pathogenic strains for resources using the process of competitive exclusion or competitive inhibition. BiOWiSH™ microbial strains displace competitive pathogenic strains
- Competes with pathogens for substrates and adhesion sites to attain food and space within the gastrointestinal tract
- Supports increased production of compounds such as acidic mucins that are critical for the prevention of pathogen adherence to intestinal epithelial cells
- Produces hydrogen peroxide which is important for the inhibition of gram-negative bacteria (most likely to be pathogenic)

#### Improves Feed Digestion

- Decreases manure production as a result of increased fiber digestion
- Reduces methane production by supporting the growth of non-methanogenic bacteria
- Increases digestible energy intake

#### Maintains Barrier Function

- Maintains gut health by supporting healthy gut morphology, and cytoprotection to maintain barrier functionality in the gut as well as the hepatopancreas in shrimp
- Maintains and enhances epithelial barrier function by stimulating epidermal receptors which strengthen tight junctions or adjacent cells
- Increases resistance to a pathogenic attack because of the enhanced epithelial barrier function

#### Modulates Immune Response

- Reduces gastrointestinal inflammation due to decreased levels of pro-inflammatory cytokine and increased levels of anti-inflammatory cytokines
- Improves immune response because the immune system is "primed" prior to pathogen exposure resulting in a more pronounced immune response in the presence of a pathogen

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