

Colibacillosis in layers



- Colibacillosis, a syndrome caused by *Escherichia coli*, is one of the most common infectious bacterial diseases of the layer industry. *E. coli* are **always found in the gastrointestinal tract** of birds and disseminated widely in feces.
- Colibacillosis often occurs concurrently with other diseases, making it difficult to both diagnose and manage. In most field cases, colibacillosis tends to manifest after a bird has experienced an infectious, physical, **toxic**, and/or **nutritional challenge** or trauma.
- Due to continuous bacterial exposure in the environment, colibacillosis can affect birds at any time throughout the grow and lay periods. Although all ages of birds are susceptible to colibacillosis, **younger birds** (those in the grow period) are more commonly affected with greater disease severity than older birds.

The main routes of transmission are through the respiratory tract, the skin, the reproductive tract, and the yolk sac infection, but as importantly also through the following:

- **Gastrointestinal tract:** Coccidiosis, general enteritis, mycotoxins, antibiotics, poor water quality, and abrupt feed changes all have the ability to disrupt the normal bacterial flora of the intestine. Pathogenic *E. coli* can invade the gut. When the **mucosal barrier is disturbed**, pathogenic ingestion of contaminated water, feed, and litter can serve as sources of *E. coli*.

- **Immune system:** Healthy birds with functioning immune systems are remarkably resistant to naturally occurring *E. coli* exposure in the environment. Immunosuppression caused by early disease challenges (e.g. IBD, reovirus, CAV, Marek's disease, adenovirus, etc.) can increase flock susceptibility to secondary bacterial infection.

How can Lumance® help ?

Effective control and prevention of colibacillosis depends on identifying and eliminating predisposing causes of the disease. Maintaining flock biosecurity is critical in the control and prevention. The goal is to reduce the level of *E. coli* exposure by improving biosecurity, sanitation, ventilation, **nutrition**, and flock **immunity**.

With Lumance® we focus on acting on the following fronts:

1. Supporting healthy immune systems and improving survivability by **reducing inflammation**
2. **Promoting competitive exclusion** and stimulating lactobacilli rebalancing the lumen content
3. Maintaining healthy **gut integrity and lowering bacterial translocation**
4. Reducing the risks of disbacteriosis and **enteritis...**

Lumance® mode of action

Lumance® is a complex structure that contains the **newest generation of butyrate**, combining slow release and protection technologies to ensure that acids, **medium-chain fatty acids**, **essential oils**, **anti-inflammatory compounds**, and **poly-phenols** are delivered in a gut active way for powerful and effective antibacterial control, high-quality tight junctions, neutralization of the produced ROS, and tempering of the inflammatory cytokine production.

Lumance® is an effective and powerful tool to reduce inflammation, promote villi growth, tighten the intestinal junction, control pathogens proliferation like *E. coli* and stabilize the microflora.

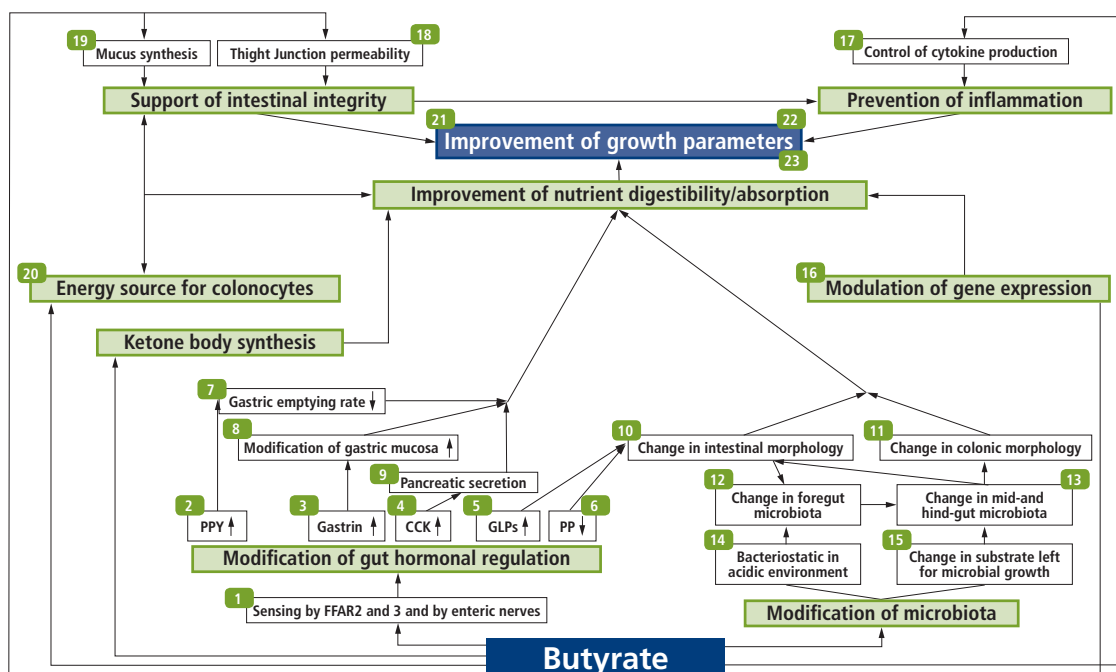
1. Butyrate modes of action

- Stimulating growth of villi and number of microvilli
- **Balancing microflora** with selective control of pathogens and microorganisms
- **Reinforcing the intestinal defense by releasing HDP (host defense peptides)**
- **Directing antimicrobial effect on *C. perfringens***
- Enhancing the intestinal barrier by facilitating **tight junction** assembly
- Protecting intestinal cells from **bacterial invasion and translocation**

- Acting as **signaling** molecule
- Protecting from oxidative stress and decreasing oxidative injury of tissues
- Enhancing the immune system with its **potent anti-inflammatory effect** and positively affecting the **immune system**
- Limiting the invasiveness of **salmonella**, reducing its colonization
- **Reducing incidence** of necrotic enteritis
- Becoming **preferred energy source** for the colonic cells (for epithelial cell proliferation and maintenance)
- **Reducing gene expression and salmonella invasiveness...**

2. Inflammation reduction

Inflammation of the intestinal tract is the result of an overactive immune response that is linked to an increased challenge of the intestinal immunity. As such, the production of inflammatory cytokines is a natural and positive response of the immune system, but the process is extremely energy demanding and will reflect almost instantly and significantly in the performance data of the farm.



Adapted from (Moquet et al., 2016)

Lumance® suppresses inflammatory response in LPS-stimulated macrophages through inhibition of nitric oxide synthase, suitable as antibiotic replacement



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Introduction

- Inflammation resulting from either feed or disease is inversely related to growth and health.
- Earlier, the beneficial effects of antimicrobial growth promoters (AGP) were attributed to their antibiotic character. This is unlikely for a variety of reasons:
 - i) Sub-therapeutic concentrations used
 - ii) The absence of a relationship between antibiotic activity and spectrum
 - iii) AGP still appeared to work in the presence of widespread antibiotic resistance
- It has therefore been proposed that AGP such as oxytetracycline (OTC) work rather by direct inhibition of the (intestinal) inflammatory response (Niewold. 2007).
- Consequently, alternatives to AGP should be anti-inflammatory rather than antibiotic.
- Among the proposed anti-inflammatory alternatives to antibiotics is Lumance® (mixture of SCFA, MCFAs, essential oil and plant extract) with anti-inflammatory activities (Innovad® NV/SA, Berchem, Belgium).

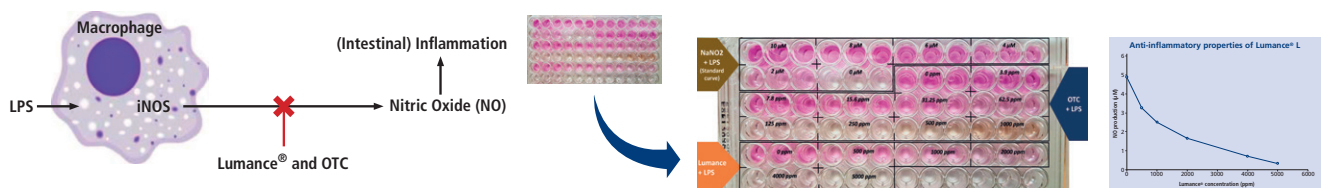
Materials and Methods

- Anti-inflammatory activity of Lumance® and OTC was tested using the RAW 264.7 assay, as described by Wu et al. (2003).



Results

- Lumance® and OTC had a strong anti-inflammatory effect *in vitro* and inhibited LPS-induced nitric oxide production by macrophages.
- Lumance® is an effective alternative for AGPs (OTC) that have direct anti-inflammatory effects on the animals gastrointestinal track.



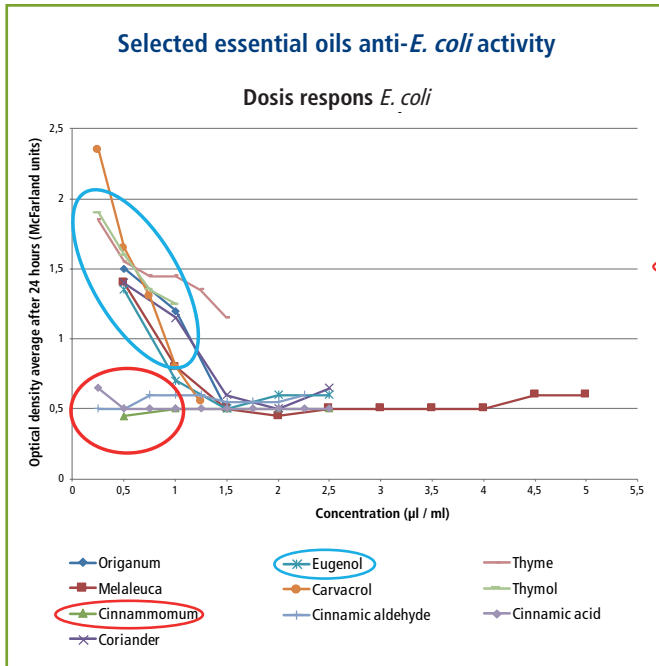
Discussion

- The non-antibiotic anti-inflammatory theory of antimicrobial growth promoters (AGP) predicts that effective alternatives can be selected by specific *in vitro* tests.
- Effective growth promoters must be inhibitors of inflammatory responses, including metabolic inflammation.
- Innovad's technology with Lumance® confirms the ability to successfully replace the anti-inflammatory and antibacterial effect of antibiotics geared towards digestive problems.

Lumance® mode of action

3. *E. coli* control

Essential oils, monobutyryn and butyric acid, present in Lumance® all exert an anti-*E. coli* activity.



Eugenol and cinnamic aldehydes interfere with the intracellular ATP (energy). They reduce the bacterial energy generation.

Butyrate's anti- <i>E. coli</i> activity			
		Control	Na-Butyrate
Duodenum	Lactic Acid (mM/l)	36	30
	<i>E. coli</i>	●	●
	Lactobacils	●	●●
Ileum	Lactic Acid (mM/l)	38	73
	<i>E. coli</i>	●●●●	●
	Lactobacils	●●	●●●●●
Caecum	VFA (mM/l)	184	209
	<i>E. coli</i>	●●●●	●
	Lactobacils	●●	●●●●●●●●

Galfi, P. and Neogrady, S., (1991)

Monobutyryn anti- <i>E. coli</i> activity		
MIC	<i>S. Typhimurium</i>	<i>E. Coli</i>
Butyric acid	1:400	1:400
Mono-esterified butyrins	1:1600	1:800

MIC concentrations for Monobutyryn (Innovad 2012)

Feeding Instructions when facing *E. coli* challenges

Pullet stage: 2 lbs/ton

Laying stage: 1-2 lbs/ton



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