Welcome to Petfood Forum China 2019

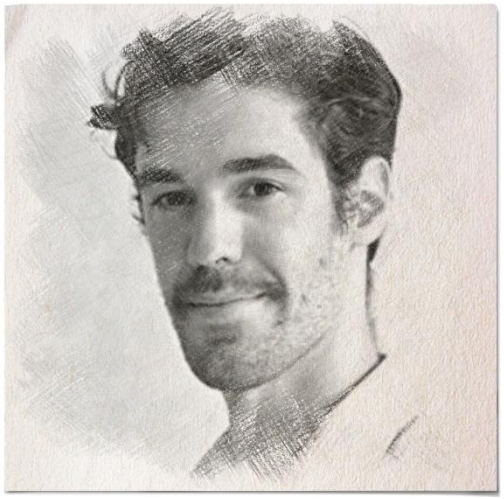
Petfood Forum China

20 AUGUST, 2019
KERRY HOTEL, SHANGHAI, CHINA

PetfoodIndustry

WATT GLOBAL MEDIA

Algal Polysaccharides to improve Gut Health and Immunity in Pets



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CONTEXT

Cats and dogs in the world

- 57% of the world population possess a pet

- 900 millions (2018)
- 600 millions (2018)

The numbers increase every year

→ Cats and dogs are considerate as part of the **family**

→ Higher concerns about their health
Need to prolong their life expectancy
Geriatric
'Exotic' Industrial compound feed

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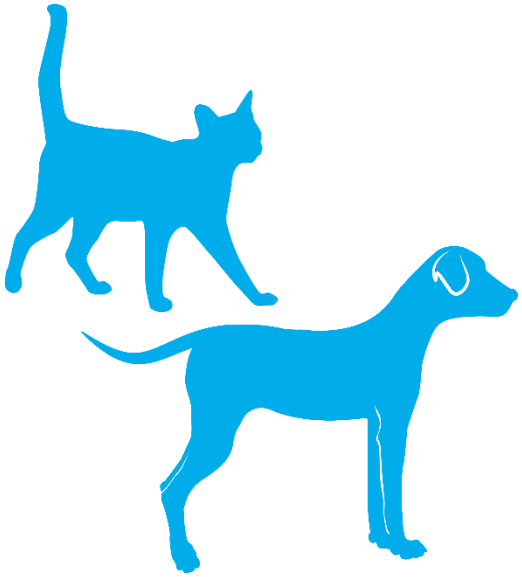
CONTEXT
GLOBAL GUT CHALLENGES



→ The gut system is challenged throughout the life of the animals, **it has to be reinforced!**

Young animals

Adults

Seniors

Birth :
Kitten and puppies immmature enzymatic system and microflora

Ageing:
immunosenescence
Inflamm-ageing

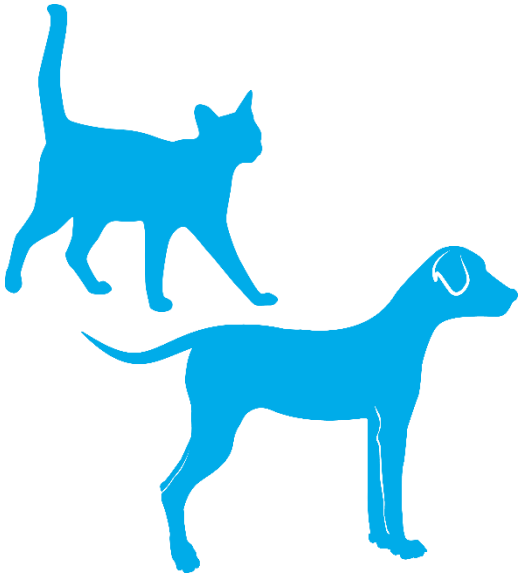
Stressful periods:
Weaning → changes in the gut microbiota
Change in diet

Diet
Quality
Quantity
Composition
Allergens

Sanitary pressure:
pathogens, parasites,
Genetic
predispositions to diseases

Heat Stress
Exercise
Others…

CONTEXT
GLOBAL GUT CHALLENGES



→ The gut system is challenged throughout the life of the animals, **it has to be reinforced!**

NUTRITIONAL SOLUTIONS and TOOLS

Gut Inflammation

Hypoallergenic Diets

- The ability to induce an antibody mediated hypersensitivity response appears to be dependent upon the **size and structure of the protein**.
- The allergens in soybean protein, for example, are between 20 and 78 kilodaltons, suggesting that soybean proteins with a molecular weight below this threshold would be **less likely to illicit an immune-mediated response**.
- Hypoallergenic diets are particularly beneficial as elimination diets for the diagnosis and management of **food hypersensitivity**

-> when a patient appears to be allergic to multiple allergens,

-> when a complicated dietary history makes it difficult to identify a "novel" protein,

-> or when a patient has severe IBD.

Gut Inflammation

Dietary Fiber

- The **gelling and binding properties of fatty acids** and deconjugated bile acids **in soluble fibers** may be beneficial in certain gastrointestinal diseases. The use of soluble (fermentable) fiber in preference to insoluble (non-fermentable) fiber is generally advocated because most **soluble fibers generate butyrate**, the principle source of energy for the colonocyte, and other short-chain fatty acids.
- Short-chain fatty acids may **lower** the colonic luminal **pH**, impeding the growth of pathogens.
- The health benefits derived from dietary supplementation of prebiotics have been documented in humans and feeding **oligofructose** to dogs decreased the concentrations of **fecal ammonia and amines** and increased the numbers of bifidobacteria in dog feces.

Brockett M, Tannock GW. Dietary influence on microbial activities in the cecum of mice. *Can J Microbiol* 1982;28:493-499.
Hussein HS, *et al*. Petfood applications of inulin and oligofructose. *J Nutr* 1999;129(7 Suppl):1454S-6S

Gut Inflammation

Fat

- **Avoiding excessive fat** can be instrumental in the management of various gastrointestinal diseases because fat delays gastric emptying in dogs and high-fat foods may contribute to osmotic diarrhea.
- Malabsorbed fatty acids are **hydroxylated** by intestinal bacteria and stimulate colonic water secretion, exacerbating diarrhea as well as gastrointestinal protein and fluid losses.

Cummings JH, *et al*. Influence of diets high and low in animal fat on bowel habit, gastrointestinal transit time, fecal microflora, bile acid, and fat excretion. *J Clin Invest* 1978;61:953-963.

Gut Inflammation

PolyUnsaturated Fatty Acids

- Fish oil has been reported to be beneficial in ulcerative colitis and Crohn's disease patients, but the results are controversial.
- Only a few studies found significant decreases in rectal LTB_4 concentrations; the others simply reported clinical improvement.
- There are no published studies in the veterinary literature to date demonstrating the efficacy of n-3 fatty acid supplementation in managing canine or feline patients with IBD.

Seidner DL, *et al*. An oral supplement enriched with fish oil, soluble fiber, and antioxidants for corticosteroid sparing in ulcerative colitis: a randomized, controlled trial. *Clin Gastroenterol Hepatol*. 2005 Apr;3(4):358-69.

Gut Inflammation

Probiotics

- Administration of probiotics to dogs and cats with IBD represents a novel alternative therapeutic modality that warrants further investigation.
- It has been demonstrated that colitis in both humans and mice is associated with increased levels of cytokines such as TNF-α, IL-6, IL-12p70 and IL-23. Thus, a proper selection of probiotic strains for the treatment of IBD is crucial and should be based on the **estimation of their capacity to induce anti-inflammatory pattern of cytokines** (IL-10^{high}, TGF-β^{high}, IL-12p70^{low}, IL-23^{low}, TNF-α^{low}).
- Apart from immunomodulatory effects, probiotics have a protective effect on the normal microflora of the human gut by their **competitive antimicrobial activities** directed toward intestinal pathogens.

Becker C., Dornhoff H., Neufert C, *et al*. Cutting edge: IL-23 cross-regulates IL-12 production in T cell-dependent experimental colitis. *J. Immunol* 2006;177, 2760-2764.
Fuss IJ, Becker C, Yang Z, *et al*. Both IL-12p70 and IL-23 are synthesized during active Crohn's disease and are down-regulated by treatment with anti-IL-12 p40 monoclonal antibody. *Inflamm Bowel Dis* 2006;12, 9-15.

Gut Inflammation

Herbs

- Plaintain leaf (*Plantago spp.*) is a ubiquitous weed with dark green, fibrous leaves. It also contains mucilage and tannin constituents, and is rich in antioxidant chlorophyll, fiber, and a very rich assortment of vitamins and minerals, all of which are beneficial in the maintenance of **mucous membranes** and healthy flora.
- Licorice root (*Glycyrhizza glabra*) is well known by herbalists as a powerful anti-inflammatory, immune stimulant, vulnerary (speeds wound healing), antimicrobial herbal medicine that is remarkably effective in the digestive tract. It is especially useful for **healing ulceration of the stomach**
- Part of licorice's effect in the gut can be attributed to its **glycyrrhizin** content. Glycyrrhizin's chemical structure is similar to **anti-inflammatory** corticoids. The herb contains several other saponin constituents, as well.

Source: Greg Tilford, All You Ever Wanted to Know About Herbs for Pets*, (Bowtie, 1999).*

Gut Inflammation

Vitamins and Minerals

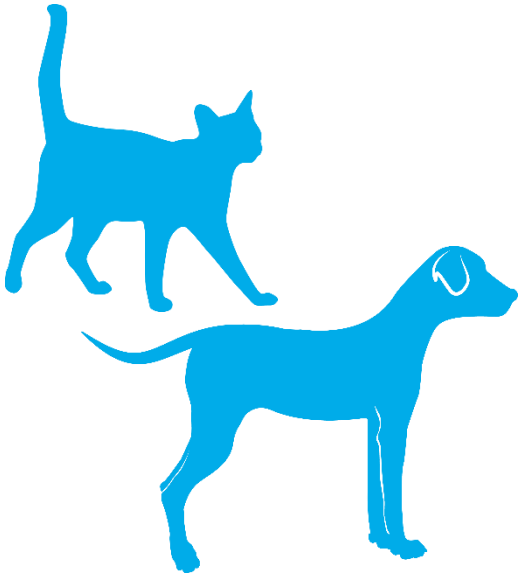
- **Water-soluble** vitamins are often depleted by the **fluid losses** associated with diarrhea and **fat-soluble** vitamin loss can be significant in animals with **steatorrhea**. Magnesium deficiency has been well documented in Yorkshire Terriers with severe inflammatory bowel disease and lymphangiectasia. Cats with severe IBD frequently have subnormal serum cobalamin concentrations.

Others

- Patients with mild-to-moderate IBD can often be successfully managed with dietary modification and **antimicrobial** (tylosin or metronidazole) administration.
- Dogs and cats with lack of response to more conservative therapy or patients with severe IBD based on activity index scores or histologic findings should be managed with immunomodulatory therapy.

Kimmel SE, *et al*. Hypomagnesemia and hypocalcemia associated with protein-losing enteropathy in Yorkshire terriers: five cases (1992-1998). *J Am Vet Med Assoc* 2000;1;217(5):703-6.

CONTEXT
GLOBAL IMMUNE CHALLENGES



Young animals

Adults

Seniors

Ageing: immunosenescence

Less protective antibodies

Birth :

Kitten and puppies born without antibodies

Stressful periods: Weaning → changes in the gut microbiota

Vaccination programs:

Multiple vaccines + booster every 1-3 years

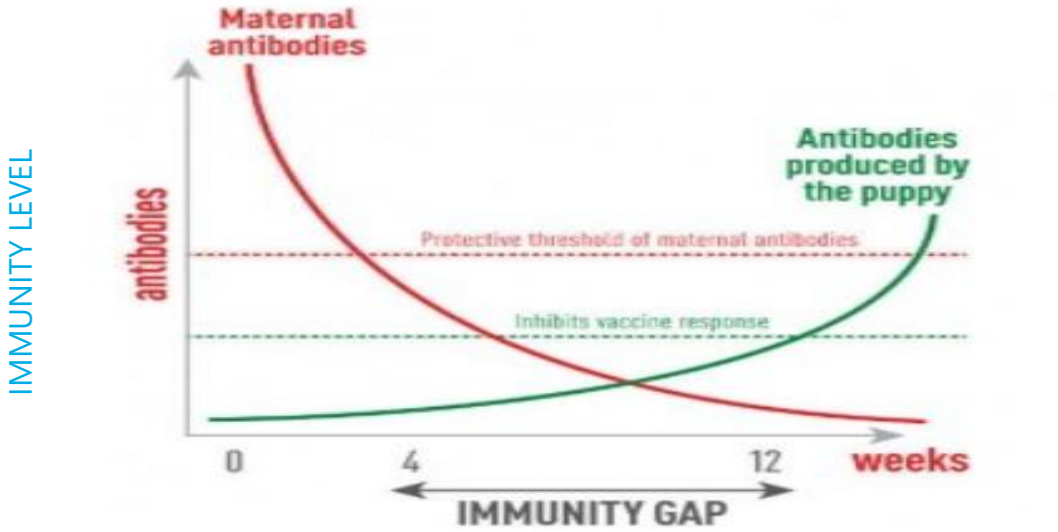
Sanitary pressure: pathogens, diseases,

Genetic predispositions to diseases

Others…

→ The immune system is challenged throughout the life of the animals, **it has to be reinforced!**

CONTEXT
IMMUNE PROTECTION VARIES IN THE HOST ANIMAL



Optimal level of protection

Passive immunity
= Maternal antibodies

Active immunity
= Innate + Adaptive immunity.
Acquired by the animal

→ Protected by maternal immunity during the first 12 -16 weeks

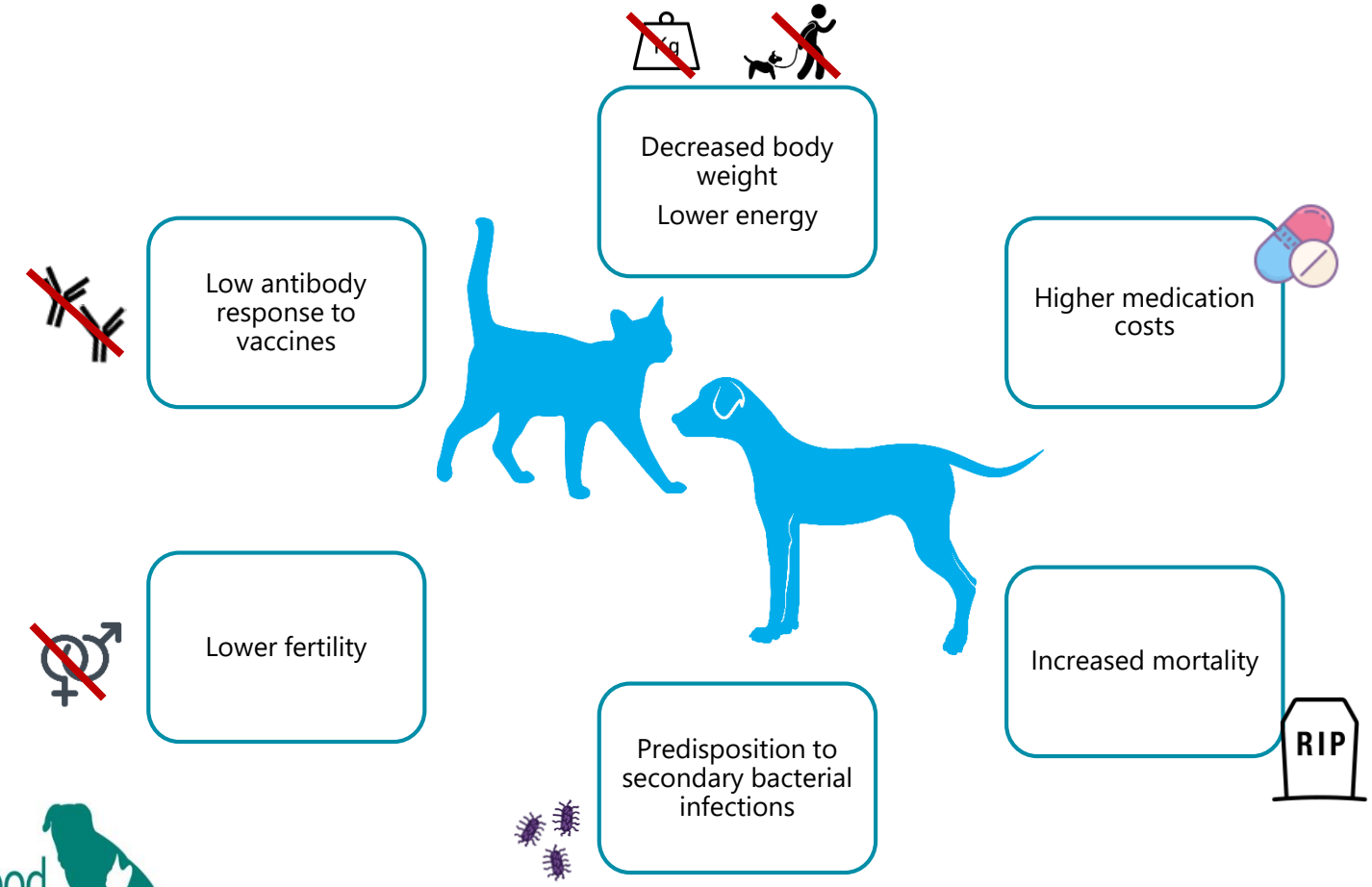
→ Protected by maternal immunity during the first 8 -16 weeks

High variability

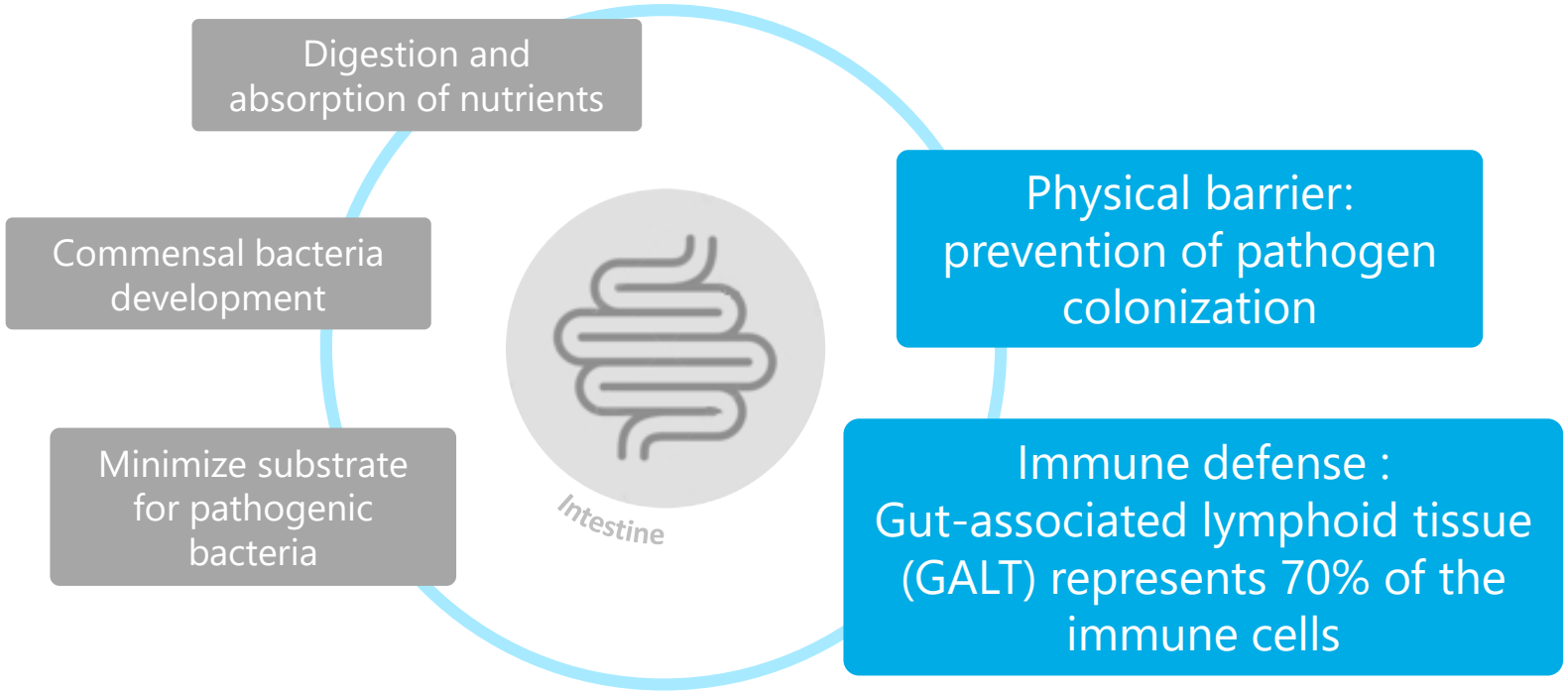
Fragilized by weaning

→ All young animals experience **immunity gap** that challenge their health and performance.

CONTEXT
NEGATIVE CONSEQUENCES OF IMMUNE CHALLENGE



CONTEXT
INTESTINAL HEALTH AND IMMUNE STATUS



Intestinal health
Immune status

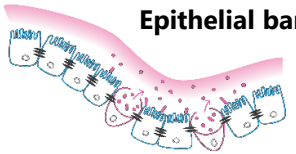
→ The **intestine** is the **main site of immune functions**.

CONTEXT
IMMUNE SYSTEM

Innate immunity

1st line of defense

Epithelial barriers



Block the attachment and entry of pathogens

2nd line of defense

Phagocytic cells

Dendritic cell *Macrophage* *Neutrophil*

Destruction of pathogens & Antigen presentation

NK cells

Lysis of infected cells

Complement system

Elimination of pathogens by neutralization

Immune mediators

Stimulation of adaptive response

Adaptive immunity

3rd line of defense

Humoral-mediated

B-lymphocyte

Secretion of antibodies

Elimination of pathogens by neutralization & Presentation of antigens to phagocytic cells (opsonization)

Cell-mediated

T-lymphocyte

Identification and destruction of infected cells

HOURS ≠ **DAYS**

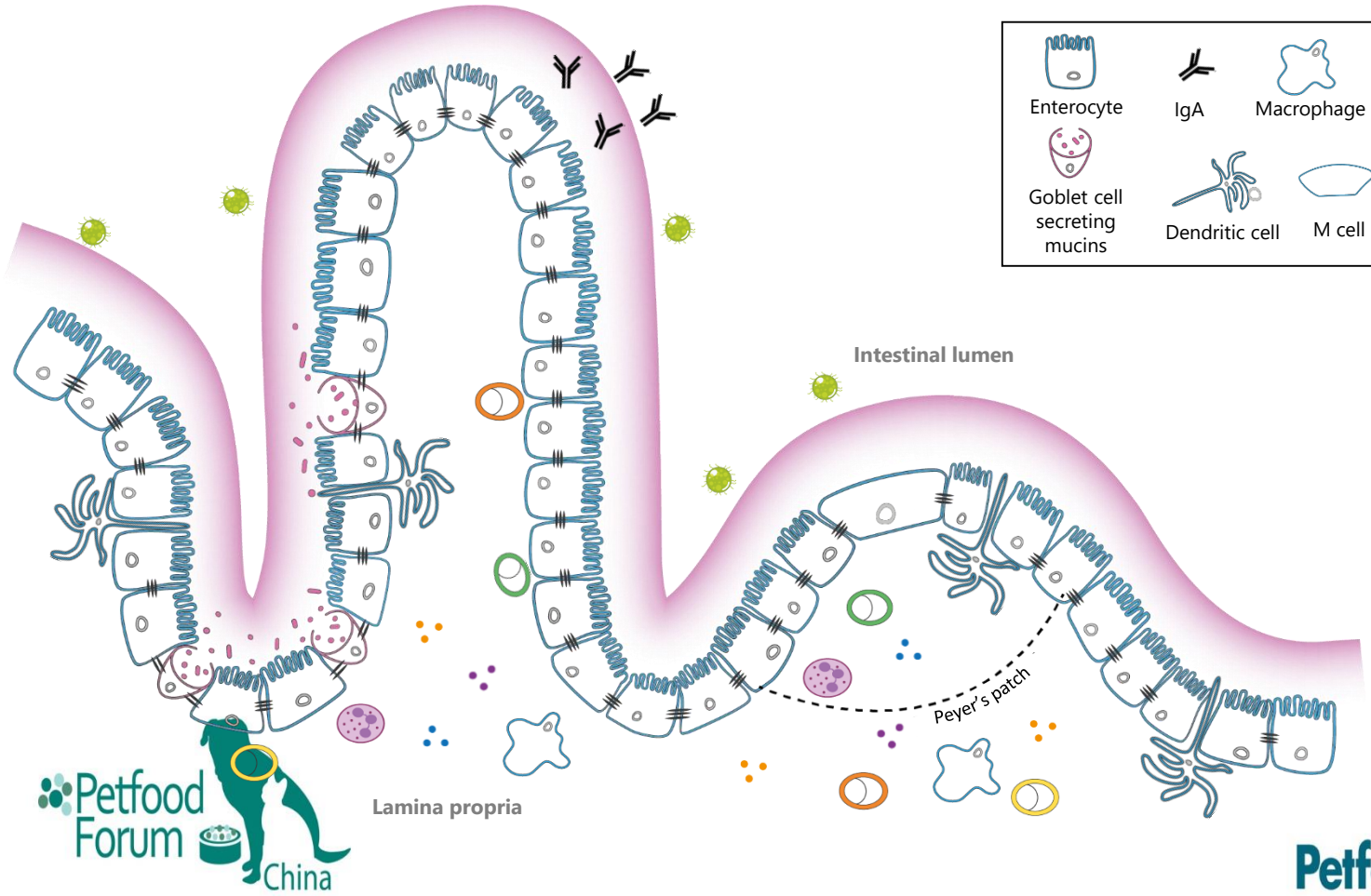
Fast to develop
Costly in energy
Non-specific

Long to develop
Memory
Specific

IMMUNE SYSTEM

GLOBAL ORGANIZATION

→ A **dynamic system** to fight microbes

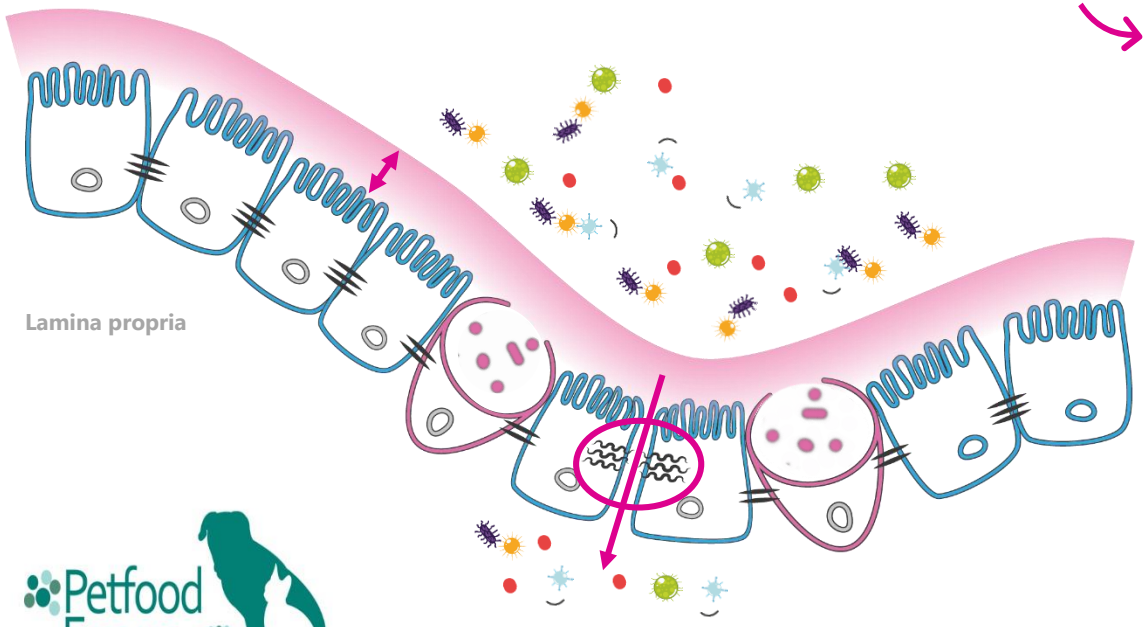


CHALLENGE
IMPACT ON INTESTINAL HEALTH AND IMMUNE STATUS

What happens in the gut in case of **challenging situation**?

→ Decrease of the protective mucus layer

→ Alteration of tight junctions



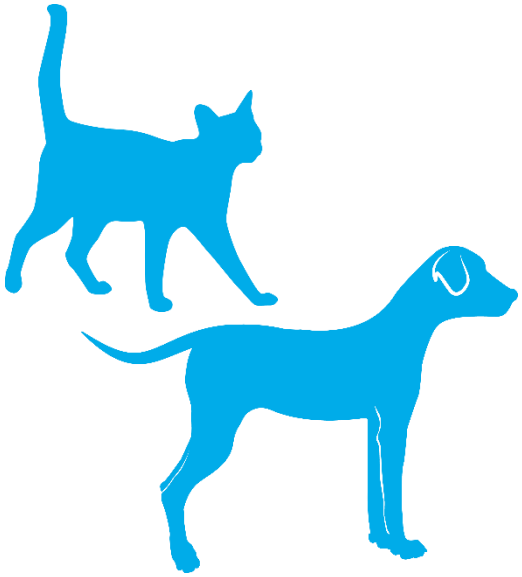
As a consequence…

↘ **Increase of intestinal permeability**

↘ **Translocation of pathogens & toxins**

↘ **Overwhelmed immune system**

CONTEXT
GLOBAL IMMUNE CHALLENGES



→ The immune system is challenged throughout the life of the animals, **it has to be reinforced!**

NUTRITIONAL SOLUTIONS and TOOLS

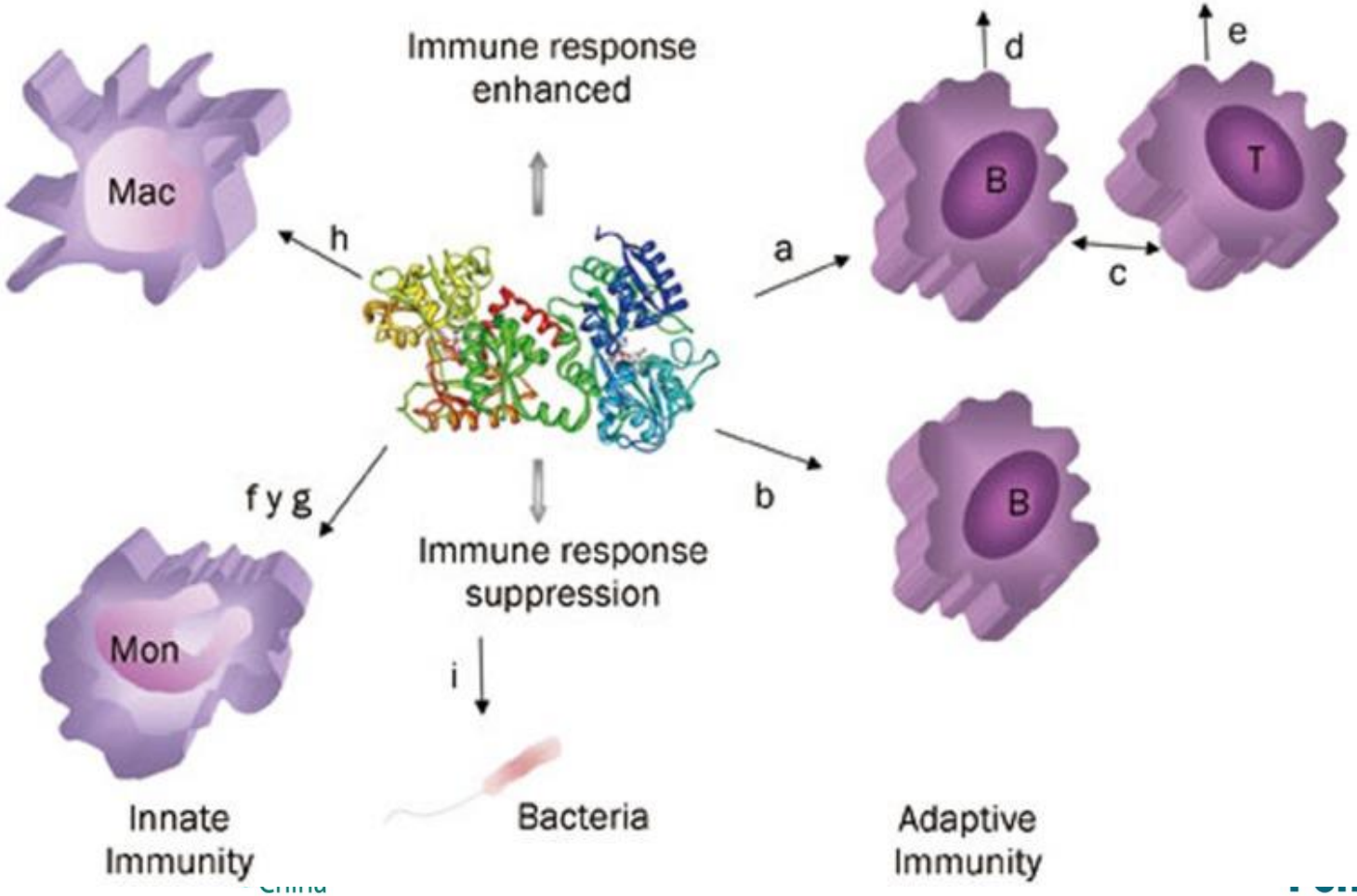
IMMUNE SYSTEM

Lactoferrin

- The first occurrence of an infant formula containing Lf was in Japan in 1986, and this product, which was called “BF-L dry milk”, was marketed by the Morigana Milk Industry. Currently, Lf can be found in various products, such as yogurt, pet food, cream, and milk and other beverages.
- Lf is the **first line of defense** for any entry point in the body. It is found in small quantities in most body fluids such as saliva, tears, nasal secretions and **intestinal fluids** (*eg*, bile), as well as in **neutrophils** (the secondary granules of white blood cells).
- Lf is synthesized by the mucosal lining (*eg*, in the mouth or intestinal tract) and neutrophils, and it is released in response to inflammatory stimuli. The low physiologic serum levels of Lf increase significantly upon host infection.

Immunomodulatory effects of lactoferrin, Tania Siqueiros-Cendón et Al. Acta Pharmacol Sin. 2014 May; 35(5): 557–566.

IMMUNE SYSTEM
Lactoferrin



- Schematic representation of the influence of host Lf on immune cells. (a) Promotes B- and T-lymphocyte maturation; (b) Negative regulation of B-lymphocytes through LPS binding; (c) B- and T-lymphocyte interaction; (d) induces IgA and IgG secretion; (e) promotes T-lymphocyte proliferation; (f) decreases IL5 and IL10 secretion; (g) down regulates NFκβ activation of monocytes; (h) enhances the phagocytic activity of macrophages; and (i) prevents the interaction between LPS and CD14 as a TLR4. B, B lymphocytes; T, T lymphocytes; Mf, macrophages; Mon, Monocytes; Neu, Neutrophils.

IMMUNE SYSTEM
Lactoferrin

- Colostrum, the first milk produced by the mammary glands of mammals after giving birth, contains elements with immunomodulatory properties, and these elements have attracted the attention of some pharmaceutical and nutritional industries as a dietary supplement.
- Lf is present in bovine colostrum at a concentration of 500 mg/100 g and is a **GRAS** (generally recognized as safe) product that is currently used in several countries as a supplement for infants. To date, no adverse effects regarding its use have been documented.

- Lactoferrin did not alter the intestinal morphology and had a **minor impact** on colonisation with lymphocytes and plasma cells. CD8 lymphocytes were increased in the epithelium of the colon of the lactoferrin groups.

Source : Histological and immunohistochemical evaluation of duodenal and colonic biopsies after oral bovine lactoferrin supplementation in beagle puppies. S. Handl
Immunomodulatory effects of lactoferrin, Tania Siqueiros-Cendón et Al. Acta Pharmacol Sin. 2014 May; 35(5): 557–566.

IMMUNE SYSTEM

Probiotics

- Probiotics have also been utilized to **facilitate eradication of intestinal parasites**. A recent study documented the ability of the probiotic organism *Enterococcus faecium* SF68 to antagonize *Giardia intestinalis* infection in mice.
- Oral feeding of *E. faecium* strain SF68 starting 7 d before inoculation with *Giardia* trophozoites significantly **increased the production of specific anti-*Giardia* intestinal IgA and blood IgG**. This humoral response was mirrored at the cellular level by an increased percentage of CD4(+) T cells in the **Peyer's patches** and in the spleens of SF68-fed mice.
- The improvement of specific immune responses in probiotic-fed mice was associated with a diminution in the number of active trophozoites in the small intestine as well as decreased shedding of fecal *Giardia* antigens (GSA65 protein).

Benyacoub J, *et al*. *Enterococcus faecium* SF68 enhances the immune response to *Giardia intestinalis* in mice. *J Nutr* 2005;135(5):1171-6.

IMMUNE SYSTEM

Prebiotics

- Use of prebiotics in companion animal nutrition is often considered advantageous over probiotics because of the ease of handling, ability to withstand **processing and storage** etc.

- The results indicated that supplementation of MOS at the rate of 15 g/kg in the diet of dog augmented the cell-mediated immune response and serum lipid profile without any influences on digestibility of nutrients, hindgut fermentation and antioxidants indices.

Effect of dietary mannanoligosaccharide supplementation on nutrient digestibility, hindgut fermentation, immune response and antioxidant indices in dogs. J Anim Sci Technol. 2017; 59: 11.

IMMUNE SYSTEM

Beta-glucans in dog food

- Beta-glucans are **water-soluble plant fibers**, comprising chains of up to 2000 glucose units in so-called beta form. Glucose is a simple sugar, existing in solution as mixture of alpha and beta rings. The glucose building blocks of beta-glucans are joined by one of three linkage types. Beta-glucan constructions can differ as to linkage pattern, spatial structure and functionality.
- **Corn, rice, barley, wheat and oat** contain different amounts of similarly linked beta-glucans. Another type of beta-glucans is found in baker's yeast. The five cereal grains and yeast are commonly used as petfood ingredient.
- Dog-food labels **rarely highlight the beta-glucans in whole cereals**. In contrast, added concentrates of beta-glucans, isolated from the outer layer of baker's yeast, are reputed to strengthen dog's immune system.

IMMUNE SYSTEM

Beta-glucans in dog food

- Free beta-glucans are **recognized by immune cells in the intestinal wall**. As a result, certain specialized cells may more efficiently capture and disarm harmful bacteria and viruses, while others produce more offensive antibodies.
- Such immunostimulation has been shown in dogs challenged with foreign substances (antigens), while ingesting purified beta-glucans derived from yeast or oyster mushroom. The amount ingested was equivalent to 0.08 % in dry food. Similar diet intervention also relieved symptoms in dogs with inflammation in joints, skin or bowel.
- In dogs, food with added, purified beta-glucans can stimulate the immune response elicited by antigens. The risk, if any, of overstimulation is unknown. There is **no evidence that extra intake of beta-glucans, as purified additives, prevents development of diseases in dogs**. Nevertheless, beta-glucans did ameliorate inflammatory diseases.

IMMUNE SYSTEM

Herbs

- Some herbs demonstrate a direct immune-enhancing activity (Larix, Plantago derivatives…). In most cases this enhancement actually **balances immune function** rather than being purely stimulating.
- Eg. when given as the ground-up parts of the entire (fresh or dried) plant, **echinacea** has been shown to increase lymphocyte numbers when they are abnormally low, thanks to one of several biochemicals it contains. The same plant contains another biochemical that actually decreases the lymphocytes when their numbers are abnormally high.
- Many herbs, ounce for ounce, have as much or more **antioxidant activity** than that found in vitamins A, C, and E. Herbs can be given on a daily basis, in the form of a pinch of fresh or dried herb sprinkled over your dog's food or a mild tea made from the herb and poured over his food.

IMMUNE SYSTEM

Specific nutrients that are indicated for immune-system health include:

vitamins A (beta-carotene), C, E, and B-6; zinc; selenium; linoleic acid; and lutein.

B-Carotene

- Dogs (1): Toll-like receptor (TLR) ligands might induce a greater anti-inflammatory gene expression profile in vivo in dogs.
- Cats (1): Domestic cats can readily absorb ß-carotene across the intestinal mucosa. Beta-carotene is also is taken up by peripheral blood leukocytes and is distributed into subcellular organelles, notably the mitochondria. B-carotene may play an important role in maintaining the structural and functional integrity of leukocytes.

INNOVATIVE SOLUTION from **Macro-Algae**:

MSP®

(Marine Sulfated Polysaccharides)

ALGAE TECHNOLOGY

INTEGRATED PROCESSING, FROM RESOURCE TO FINAL PRODUCTS

SPECIFIC EXTRACTION of sulfated polysaccharides : MSP®

COLLECTION | WASHING | PHASE SEPARATION | HYDROLYSIS | EXTRACTION

MSP®

Certifications

FAMIQS European Feed Additives and PreMixtures Quality System

Feed Safety GMP+ Assurance

QS. Quality scheme for food.

ISO 9001:2008

ISO 22000:2005

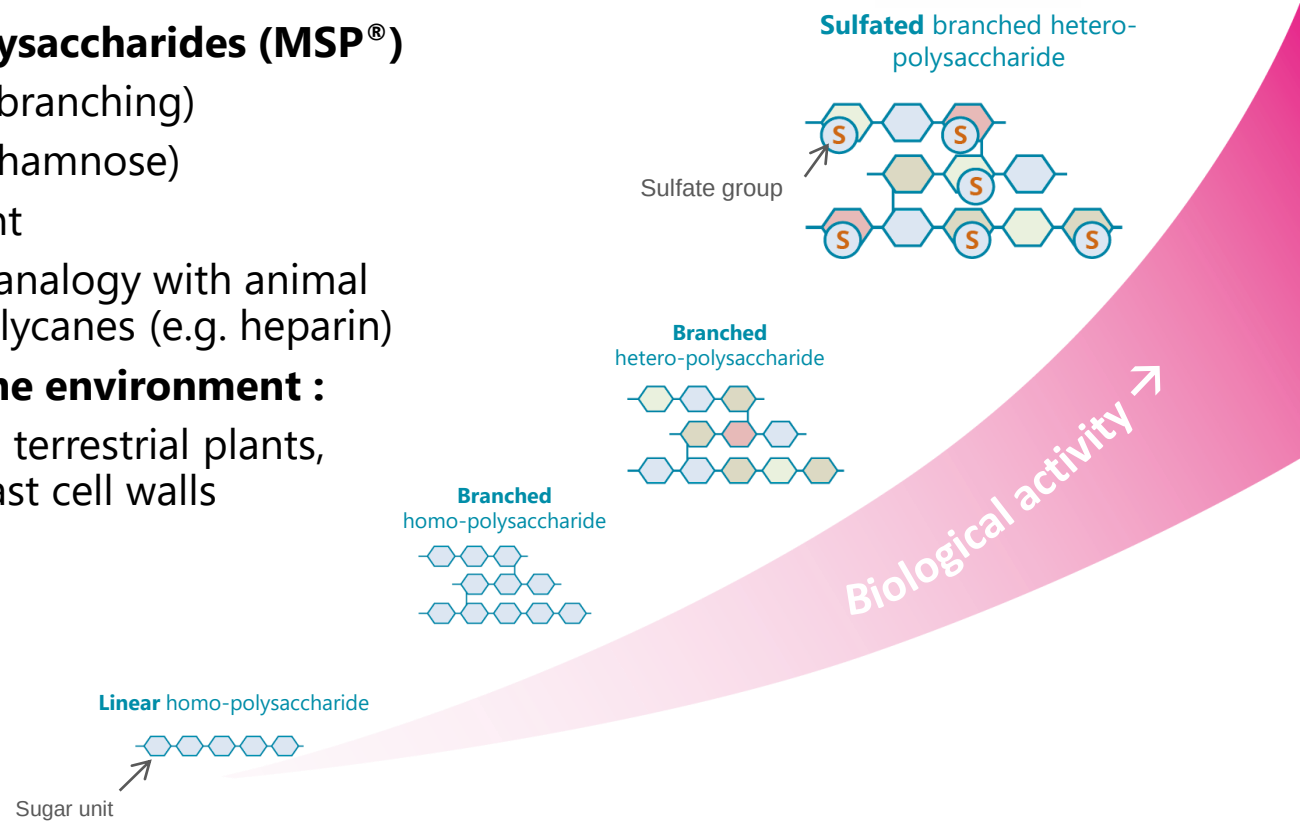
OLMIX ALGAE TECHNOLOGY
SPECIFIC EXTRACTION OF MSP®

MSP®

PATENTED TECHNOLOGY

- **Algae sulfated polysaccharides (MSP®)**
  - 3D structure (branching)
  - Rare sugars (rhamnose)
  - Sulfate content
  - Phylogenetic analogy with animal glycosaminoglycanes (e.g. heparin)
  - **Only in marine environment :**

→ Not present in terrestrial plants, microalgae & yeast cell walls



Petfood Forum China

Extraction is a key to reveal the full potential of algae!

PetfoodIndustry WATT GLOBAL MEDIA

OLMIX ALGAE TECHNOLOGY
SPECIFIC MSP® USED IN ALGIMUN®

- **GUT HEALTH → MSP®BARRIER**

MSP® BARRIER

- Extracted from red algae (*Solieria chordalis*)
- Mode of action:
  1. Reinforcement of tight junctions
  2. Increase of mucins secretion

- **IMMUNITY → MSP®IMMUNITY**

MSP® IMMUNITY

- Extracted from green algae (*Ulva sp.*)
- Mode of action:
  1. Activation of membrane receptors
  2. Stimulation of immune mediators synthesis
  3. Activation of immune cells

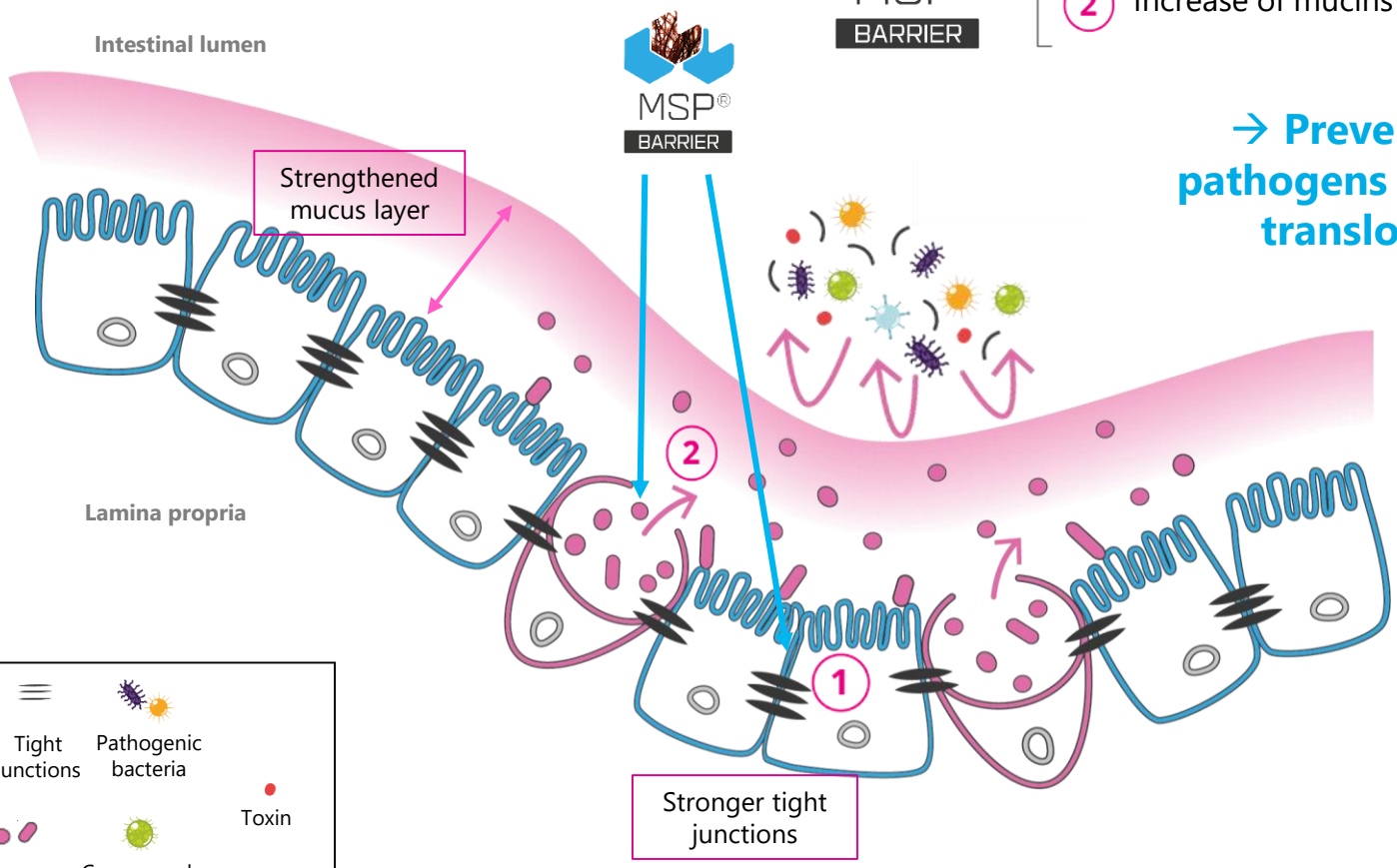
MSP®

MSP® BARRIER

MSP® BARRIER
MODE OF ACTION

MSP® BARRIER

1. Reinforcement of tight junctions
2. Increase of mucins secretion



→ **Prevention of pathogens and toxins translocation**

MSP® BARRIER
INTESTINAL BARRIER REINFORCEMENT *IN VITRO* (1/2)

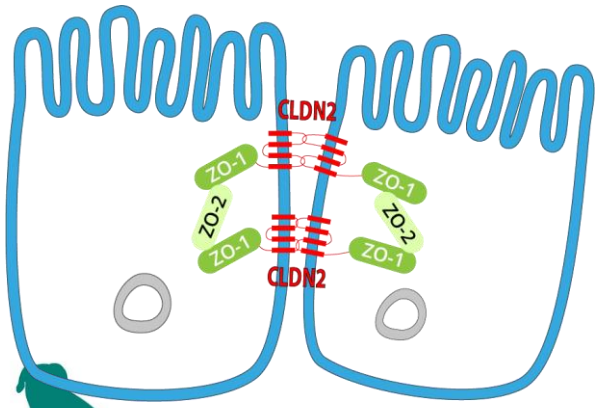
Intestinal Biotech Development

MSP® BARRIER

Model: measurement of mRNA expression of two colonic epithelial cell lines.

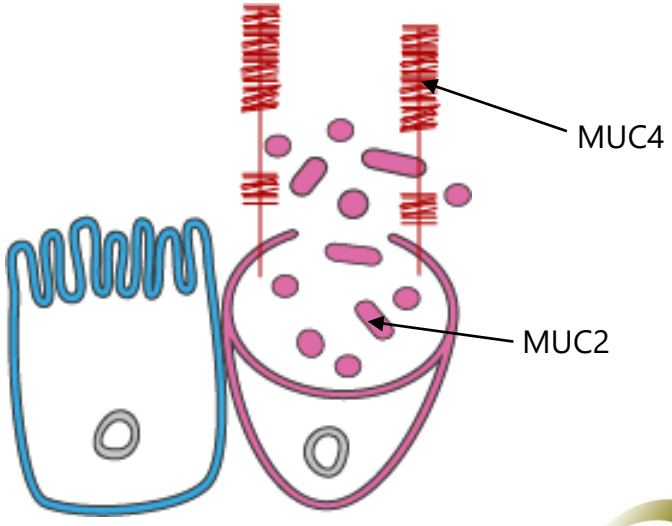
① Reinforcement of tight junctions

Tool : evaluated with Caco2 cells



② Increase of mucins secretion

Tool : evaluated with HT-29 MTX cells



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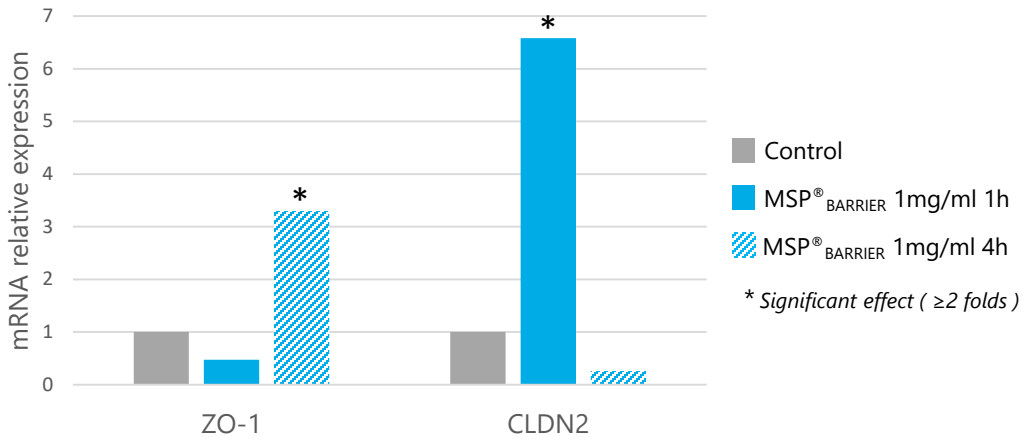
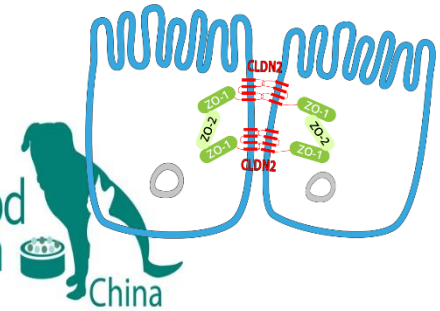
MSP® BARRIER
INTESTINAL BARRIER REINFORCEMENT *IN VITRO* (2/2)

Intestinal Biotech Development

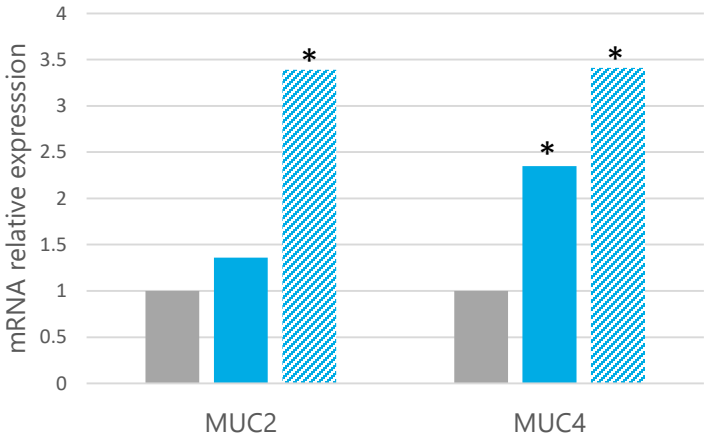
1 Reinforcement of tight junctions



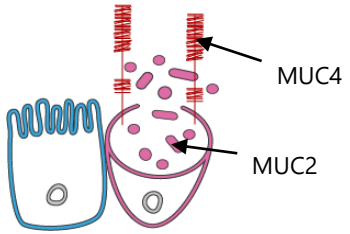
→ MSP® BARRIER upregulates the gene expression of different tight junction proteins (CLDN2, ZO1)



2 Increase of mucins secretion



→ MSP® BARRIER upregulates the expression of gel-forming mucins (MUC2) and membrane bound mucins (MUC4)



→ Prevention of pathogens and toxins translocation

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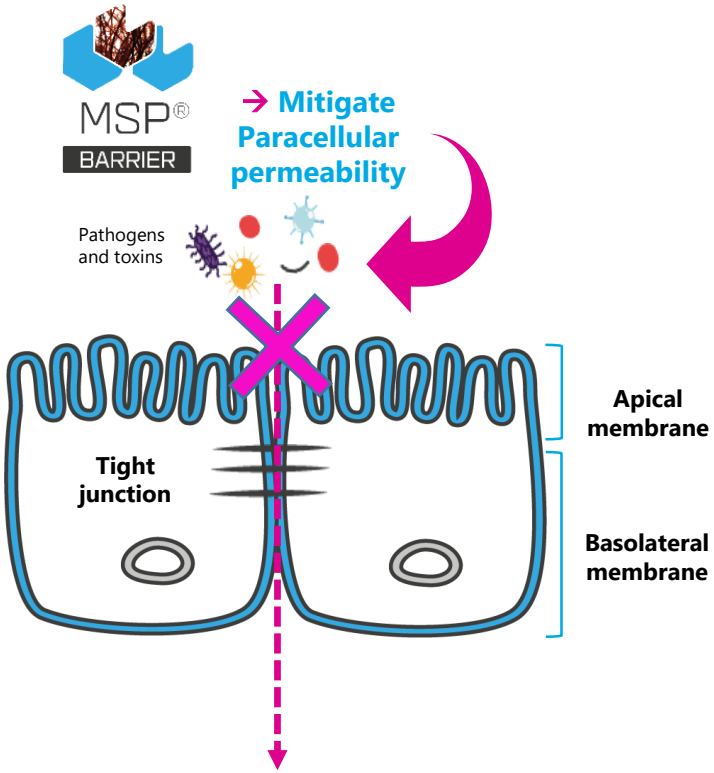
MSP® BARRIER

REINFORCEMENT OF INTESTINAL BARRIER *IN VIVO* (2/2)

Results



→ MSP® BARRIER improved gut barrier function

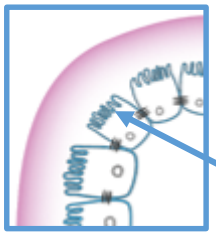
MSP® IMMUNITY

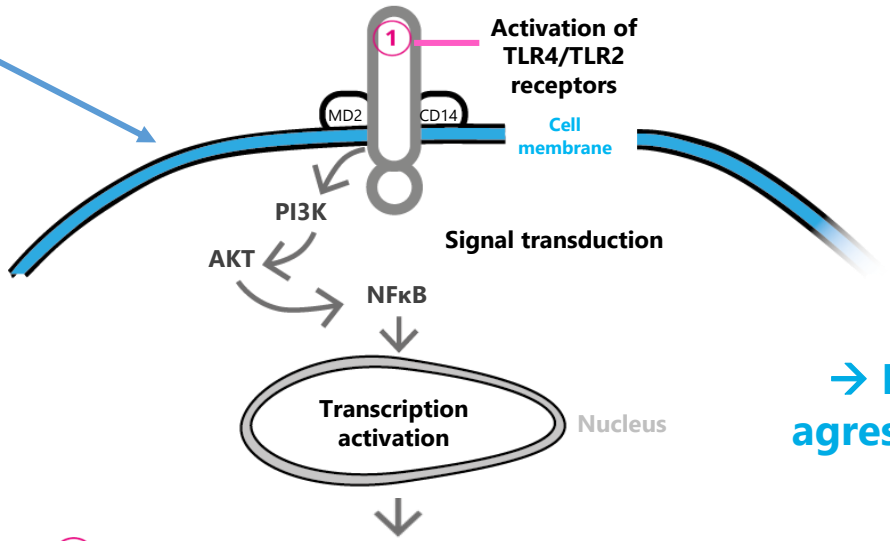
Results

MSP® IMMUNITY MODE OF ACTION

MSP® IMMUNITY

1. Activation of membrane receptors TLR4/TLR2
2. Stimulation of immune mediators synthesis
3. Activation of immune cells





→ **Better response to agressions by pathogens**

INRA SCIENCE & IMPACT

2 **Stimulation of immune mediators synthesis**

IL-8	IL-6	TGFβ
CCL20	IL-1α	IL-12p40
TNF-α	IL-1β	PPARγ

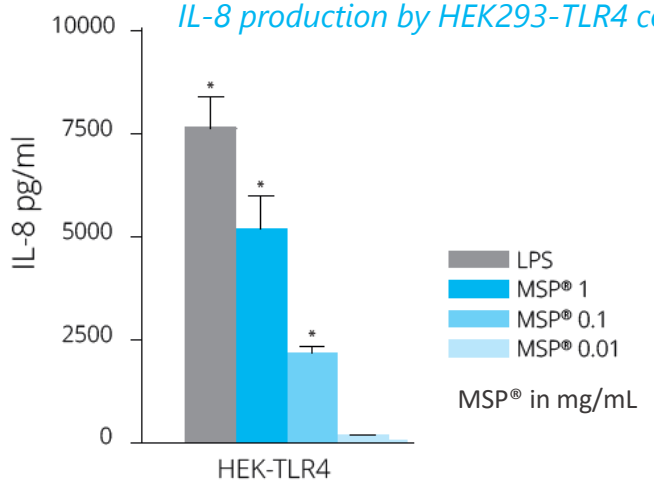
3 Activation of immune cells

MSP® IMMUNITY
IN VITRO IMMUNOMODULATORY EFFECT

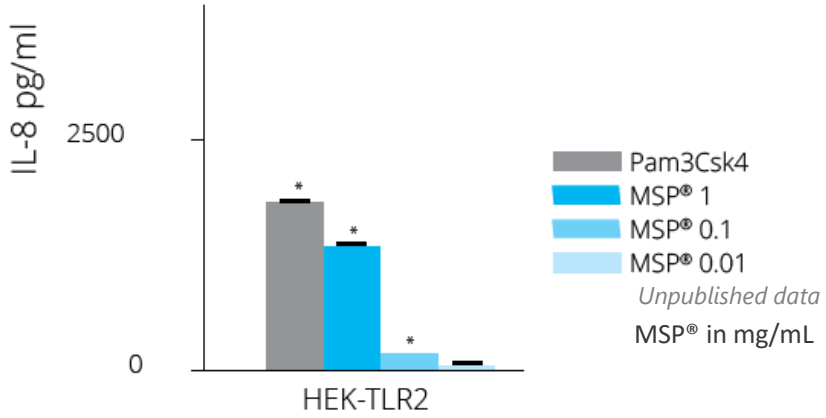
① Activation of membrane receptors TLR4/TLR2

IL-8 production (ELISA)→ marker of cellular receptor activation upon **MSP® IMMUNITY** stimulation.

IL-8 production by HEK293-TLR4 cells



IL-8 production by HEK293-TLR2 cells



Data are expressed as the mean value ± S.E.M. of triplicate assays.
P<0.01

→ **MSP® IMMUNITY** stimulates the production of IL-8 via the activation of TLR4 & TLR2

Adapted from Berri et al., *2017.*

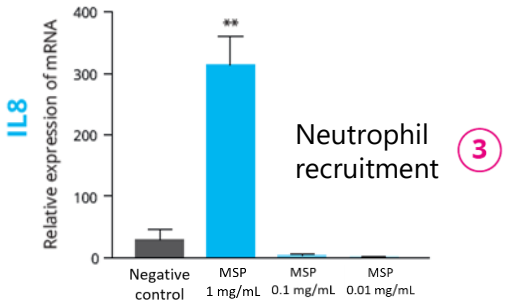
MSP® IMMUNITY
IN VITRO IMMUNOMODULATORY EFFECT

Adapted from Berri et al., *2016.*

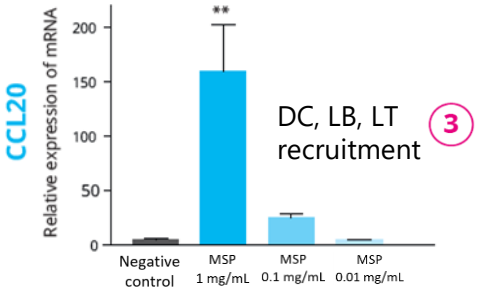
(2) Stimulation of immune mediators synthesis

IPEC-1 cell line - measure of expression of mediators mRNA

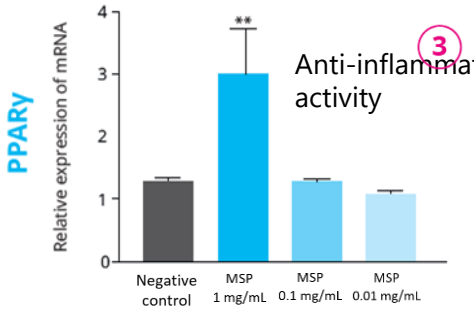
(3) Activation of immune cells



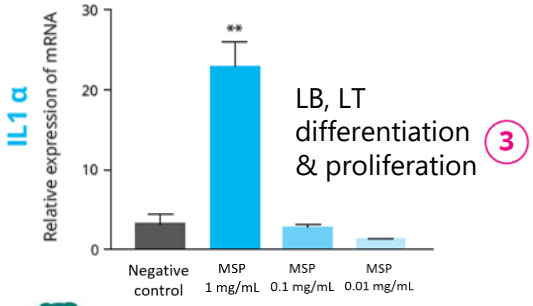
Neutrophil recruitment (3)



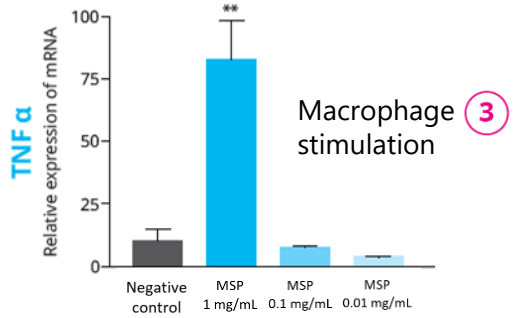
DC, LB, LT recruitment (3)



Anti-inflammatory activity (3)



LB, LT differentiation & proliferation (3)



Macrophage stimulation (3)

The expression of targeted genes was calculated as fold change relative to controls.
Data are expressed as mean value ± S.E.M. of triplicate assays.
***P<0.01*

DC = Dendritic Cell
LB = Lymphocyte B
LT = Lymphocyte T

→ **MSP® IMMUNITY** modulates cellular and humoral response, as well as immune tolerance

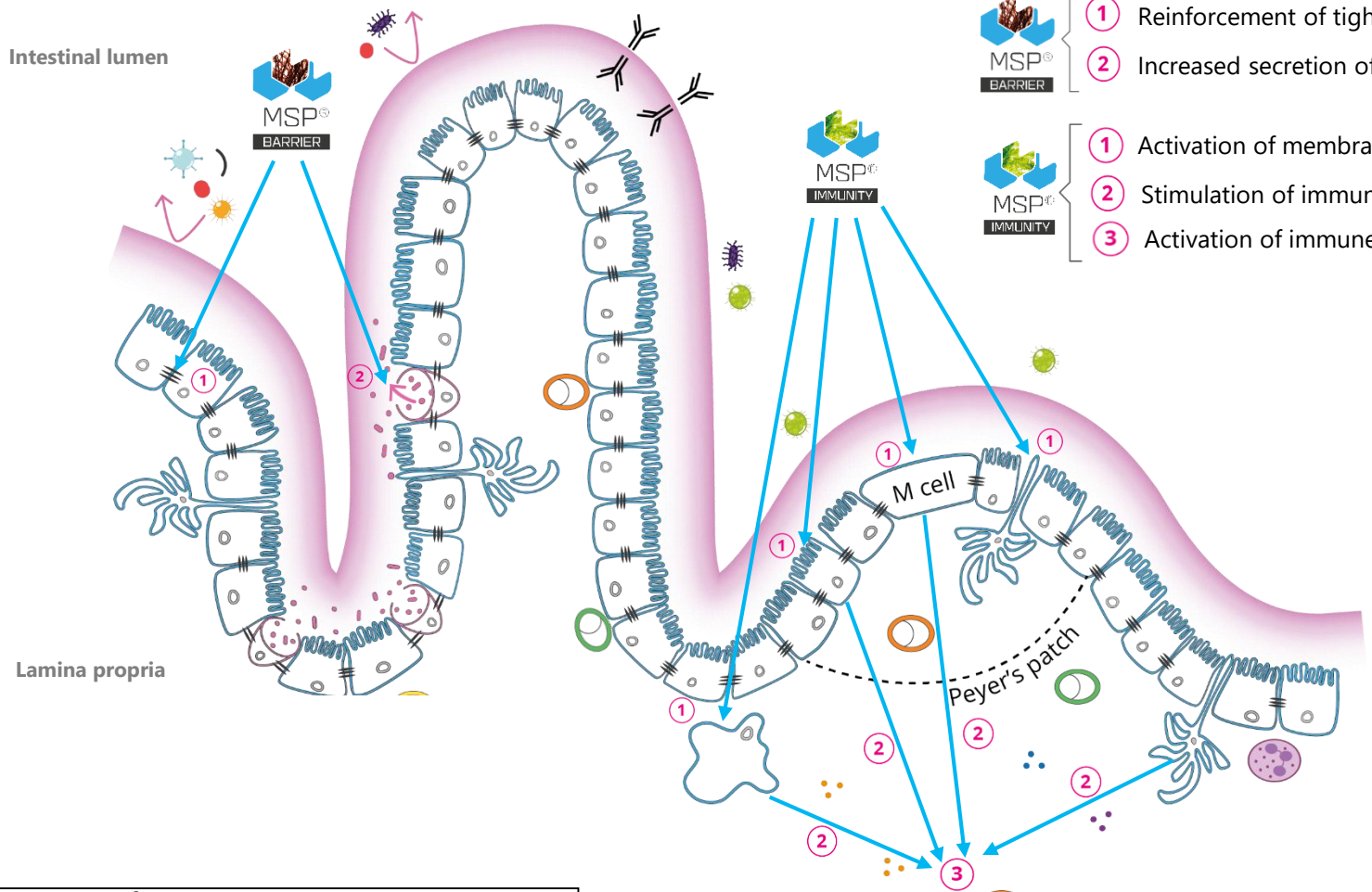
Adapted from Berri et al., *2016.*

Algimun®

MODE OF ACTION

MSP Barrier + MSP Immunity

ALGIMUN® MODE OF ACTION

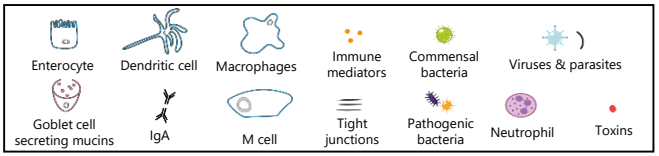


MSP BARRIER

1. Reinforcement of tight junctions
2. Increased secretion of mucins

MSP IMMUNITY

1. Activation of membrane receptors TLR4/TLR2
2. Stimulation of immune mediators synthesis
3. Activation of immune cells



- T-lymphocyte → cytotoxic activity and macrophage stimulation
- B-lymphocyte → antibody production
- Regulatory T-lymphocyte → immune tolerance
- Induction of neutrophil recruitment

ALGIMUN® MODE OF ACTION
SUMMARY: BOOST ANIMALS' NATURAL DEFENSES

MSP® BARRIER

- **GUT INTEGRITY** (first line of defense)
  - Stronger tight junctions
  - Functional mucus layer

Prevention of pathogens and toxins translocation

→ **Gut Health**

→ **Stronger healthy pets**

MSP® IMMUNITY

- **IMMUNITY** (innate and adaptive)
  - Modulation of cell-mediated and humoral immune responses as well as immune tolerance

Better response to agressions by pathogens

→ **Higher ability to face challenges**

ALGIMUN®
RECOMMENDATIONS AND DOSAGE

→ Recommended for **young animals** (starter and grower phases)

→ Dosage to be **adapted according to the specie, stage and sanitary status** in the farm

ANIMAL SPECIE	PHYSIOLOGICAL STATE	DOSAGE
PET FOOD		2-3 kg/T

TAKE HOME MESSAGE

- **Goal : Boost animal's defenses** for optimized and secured performance
- **How :** Association of **2 biologically active macroalgal extracts**

MSP® BARRIER — Intestinal integrity

MSP® IMMUNITY — Immune function

- **When :** All cycle but more particularly **young/senior/repro**
- **Dosage : 2 to 3 kg/T** of feed according to specie and stage
- **For who :** Home-mixers, feed millers, pre-mixers

MSP®

Strengths :

- **100% natural algae based / Renewable**
- **Unique technology / Patented**
- **Stable to heat and EXTRUSION**
- **Proven mode of action (published)**

Petfood Forum China

PetfoodIndustry WATT GLOBAL MEDIA

Thank you

for your attention!

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for a better life
olmix Group