



With the support of
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Yeast cell wall immunomodulatory and intestinal integrity effects on broilers challenged with *Salmonella enteritidis*

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Imunova Análises Biológicas

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ICC Brazil

ICC Brazil

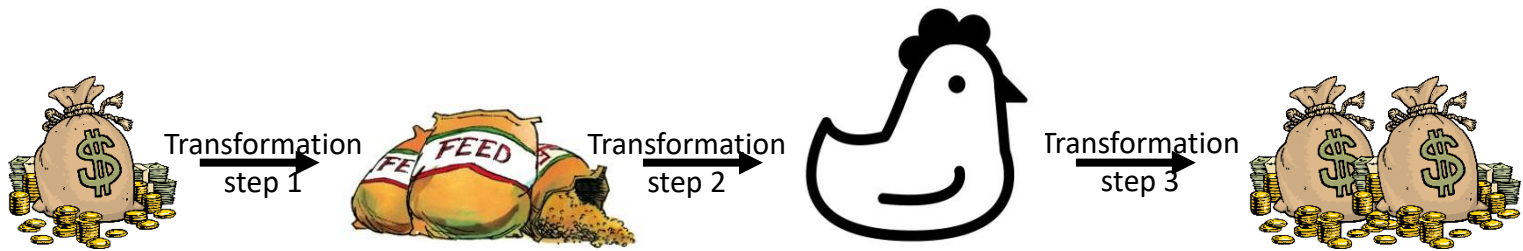
ICC Brazil



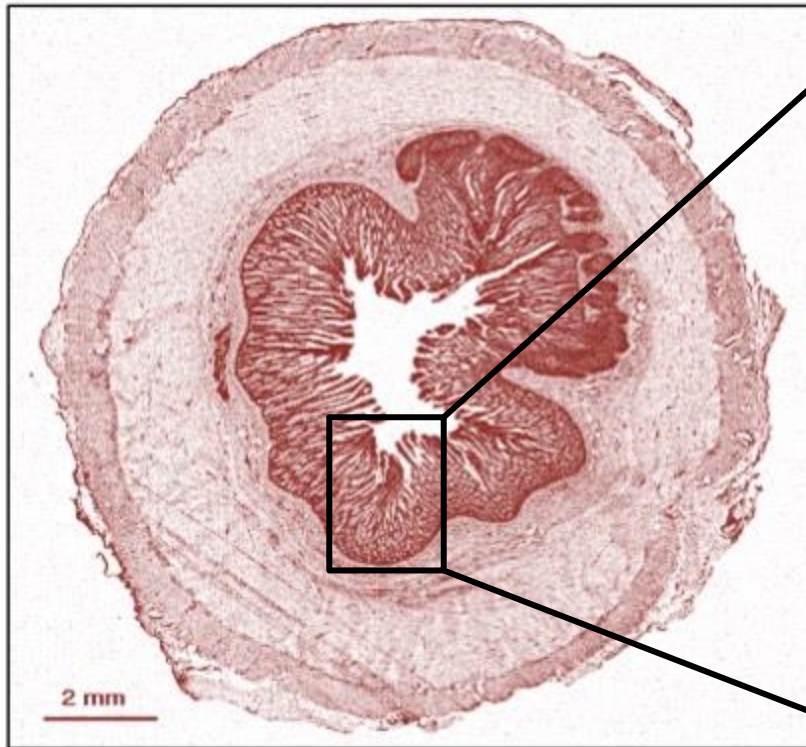
Ekachai Jenwitheesuk, PhD
Technical & Sales Manager for South East Asia
ICC Brazil



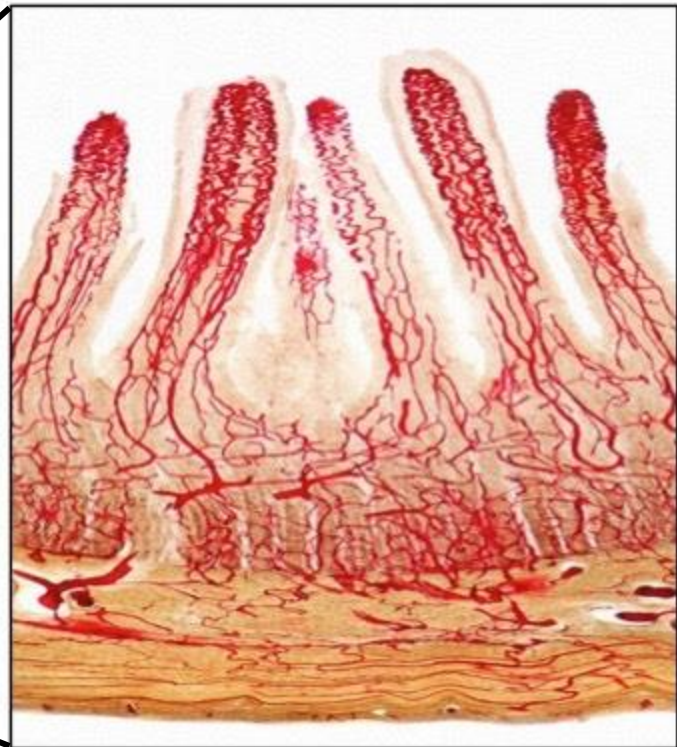
Adding value to nutrition



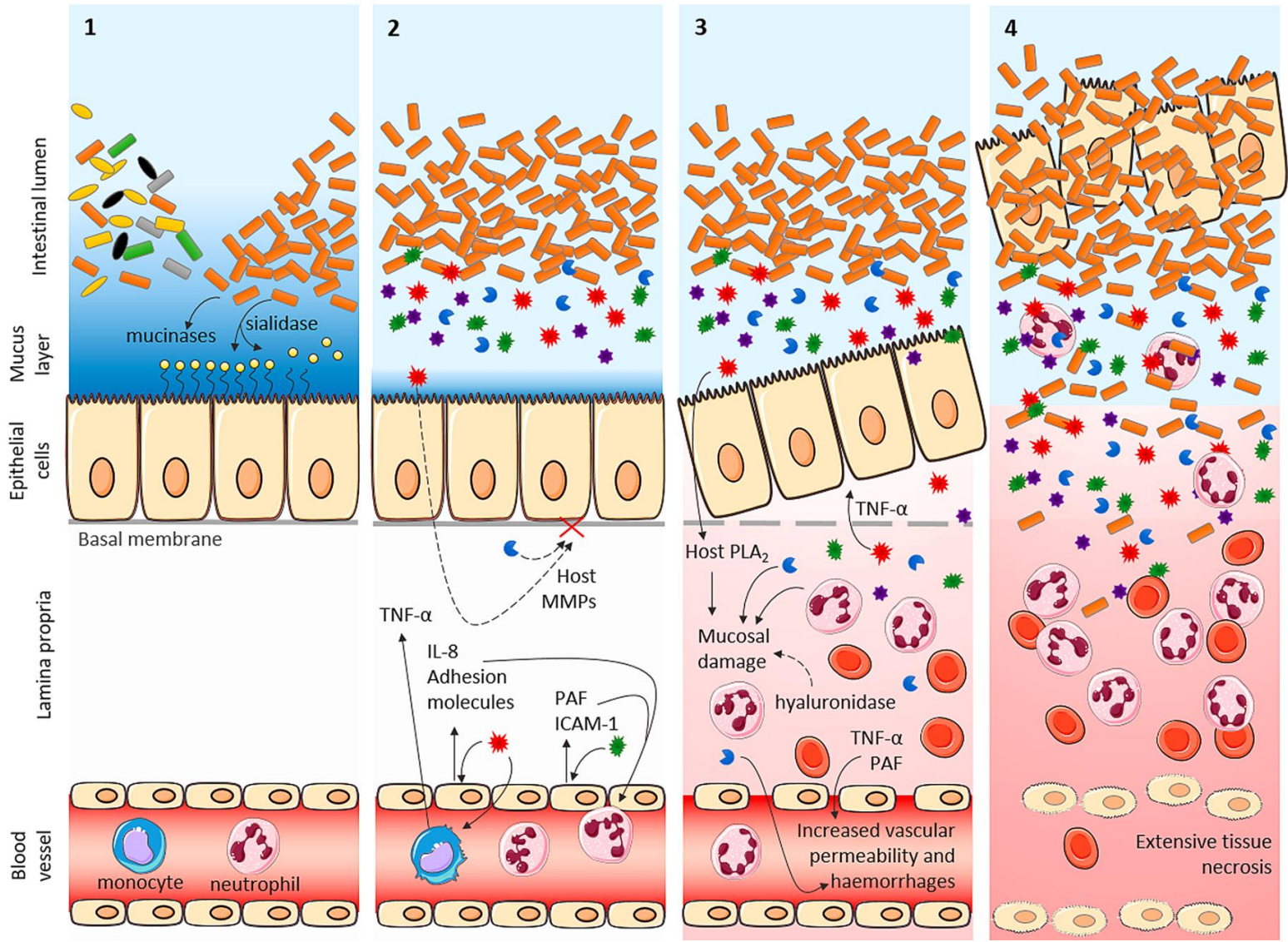
Transverse Cross Section



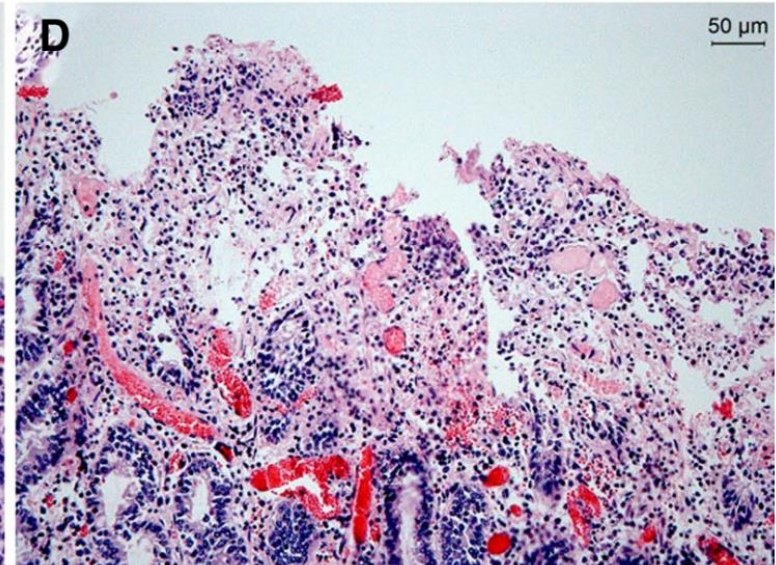
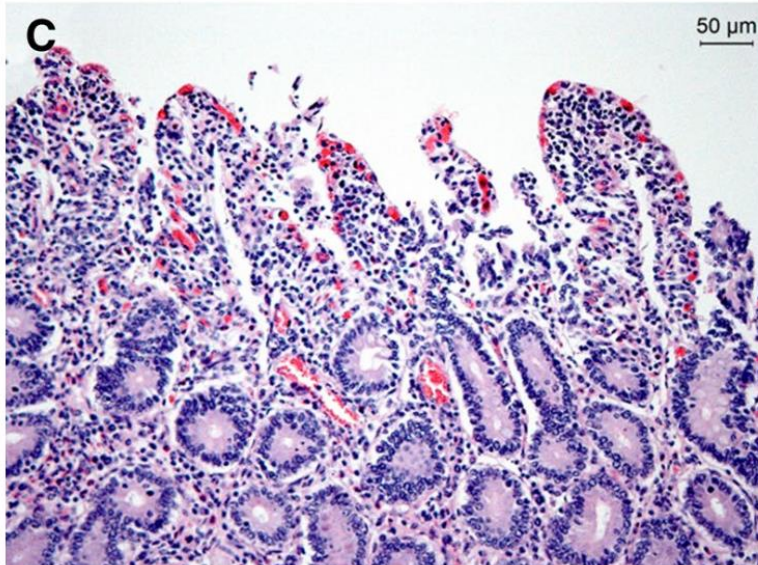
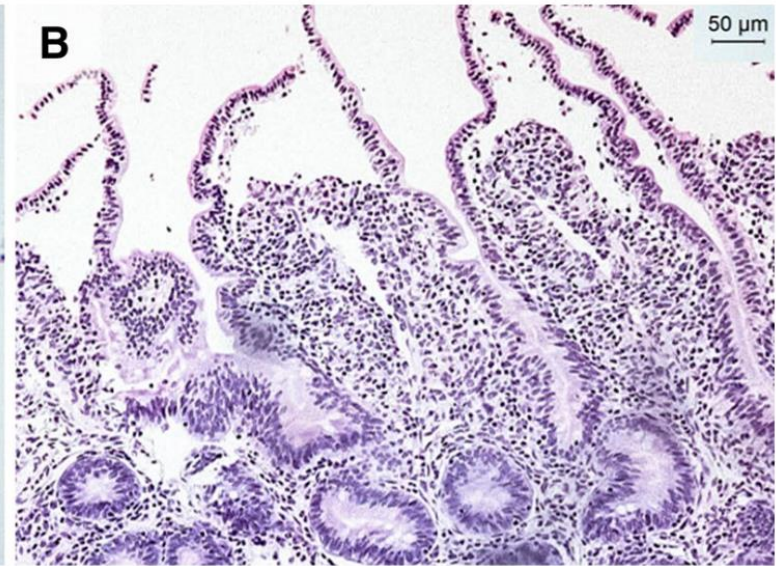
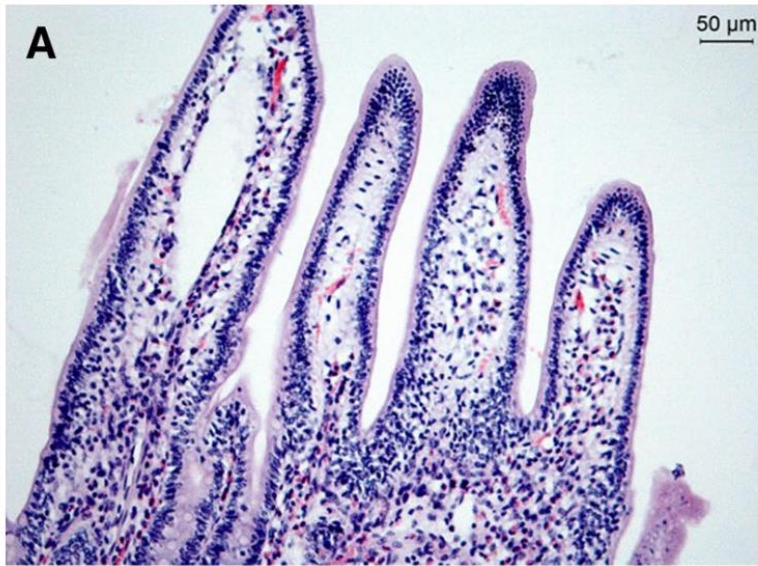
Longitudinal Cross Section



https://ib.bioninja.com.au/_Media/ileum-unlabelled_med.jpeg



Goossens E, et al. Rethinking the role of alpha toxin in Clostridium perfringens-associated enteric diseases: a review on bovine necro-haemorrhagic enteritis. Vet Res. 2017;48(1):9.



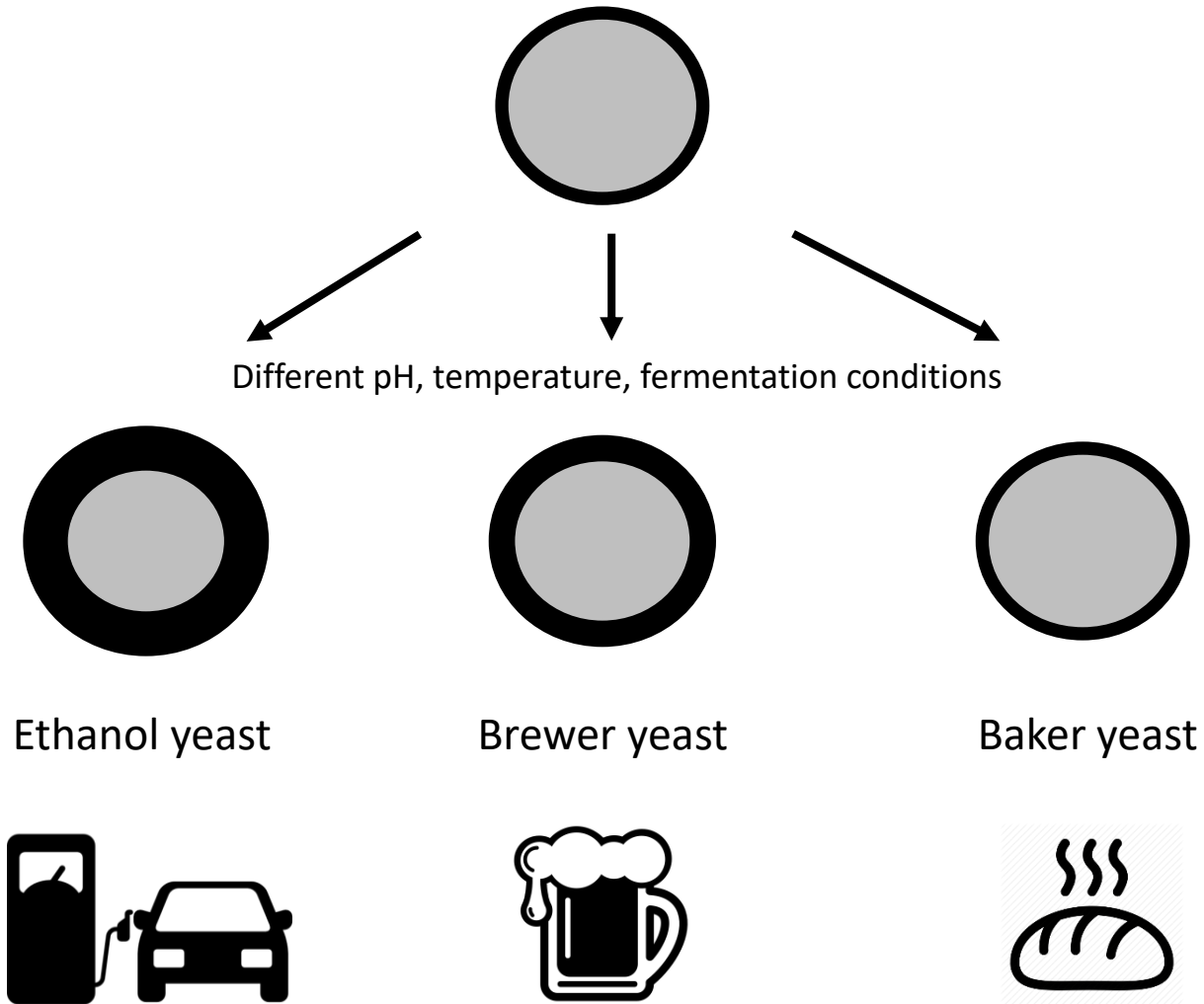
Goossens E, et al. Rethinking the role of alpha toxin in *Clostridium perfringens*-associated enteric diseases: a review on bovine necrohaemorrhagic enteritis. *Vet Res.* 2017;48(1):9.

Alternative agents to replace antibiotic to fight against bacterial pathogens

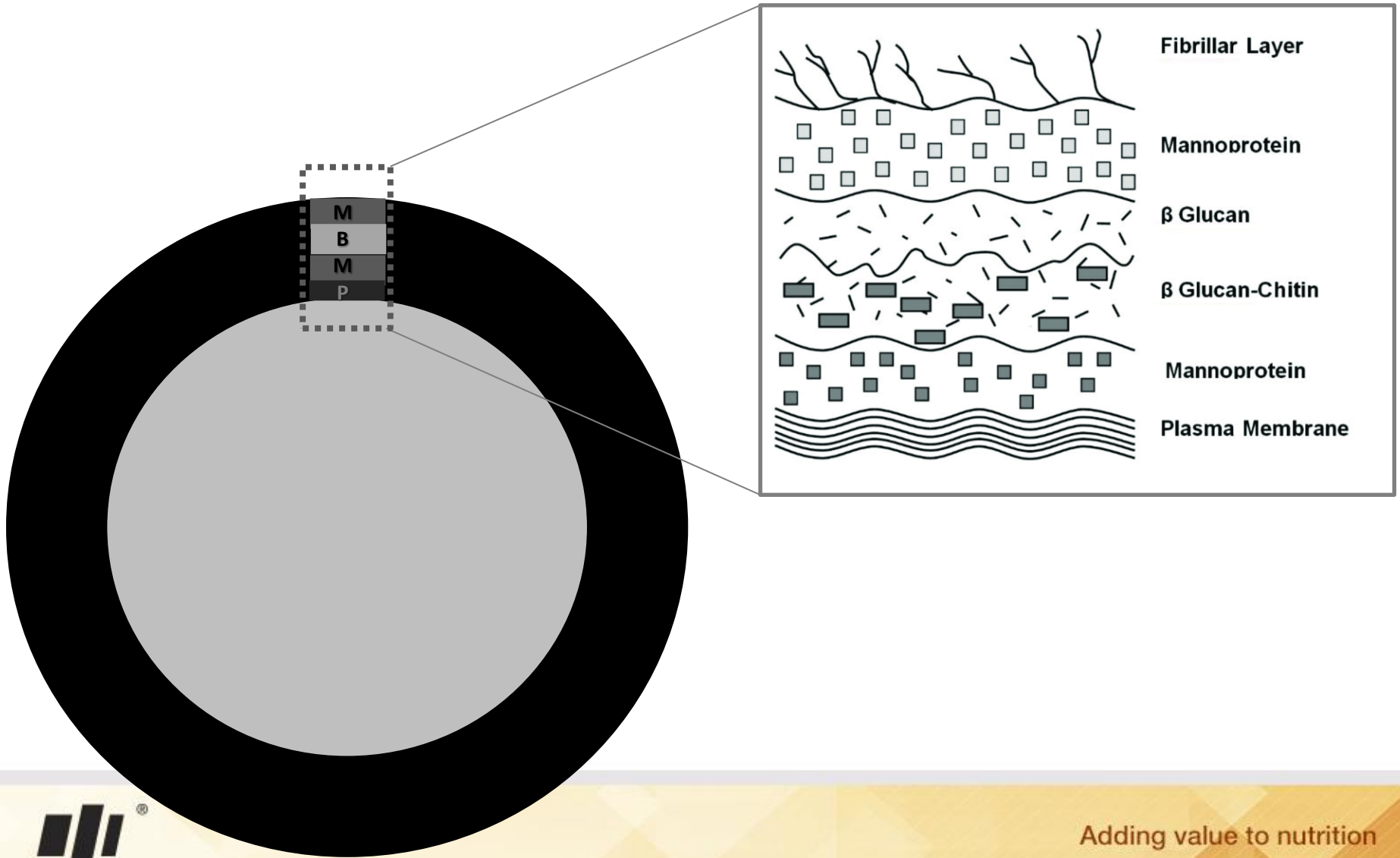
- Essential oils
- Organic acids / Acidifiers
- Phytogetic / Herbal plants
- Probiotics
- Prebiotics



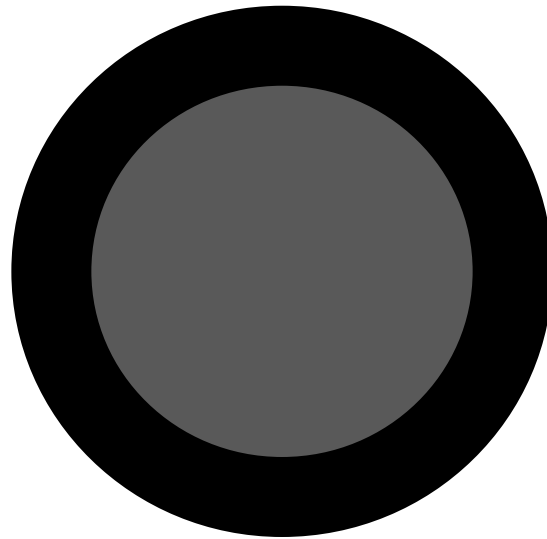
Yeast physiology



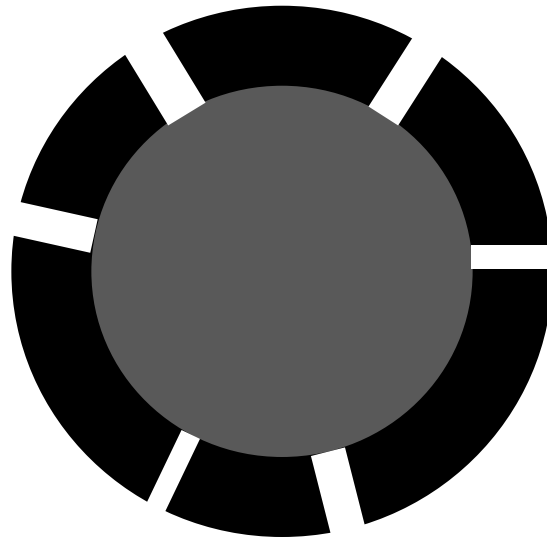
Yeast cell wall anatomy



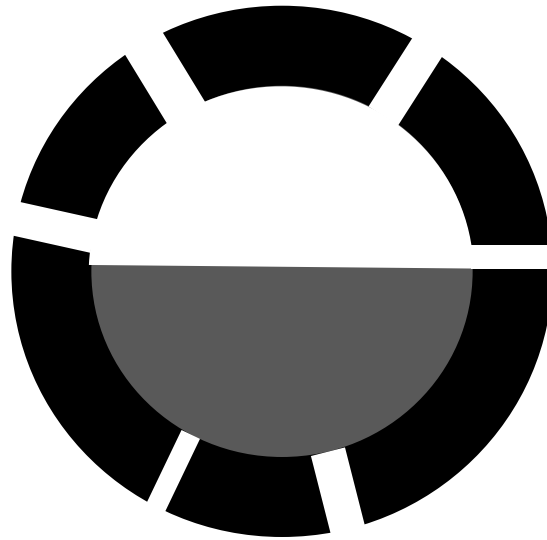
Yeast cell wall and yeast hydrolysate preparation



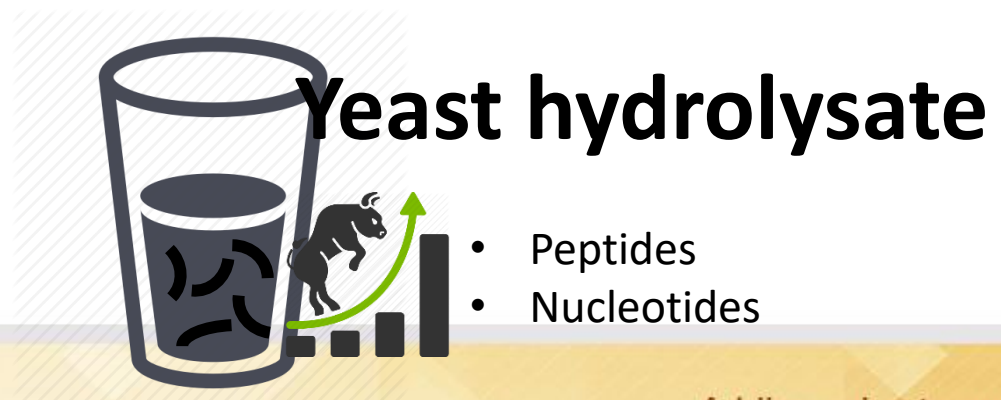
Yeast cell wall and yeast hydrolysate preparation



Yeast cell wall and yeast hydrolysate preparation



Yeast cell wall and yeast hydrolysate preparation

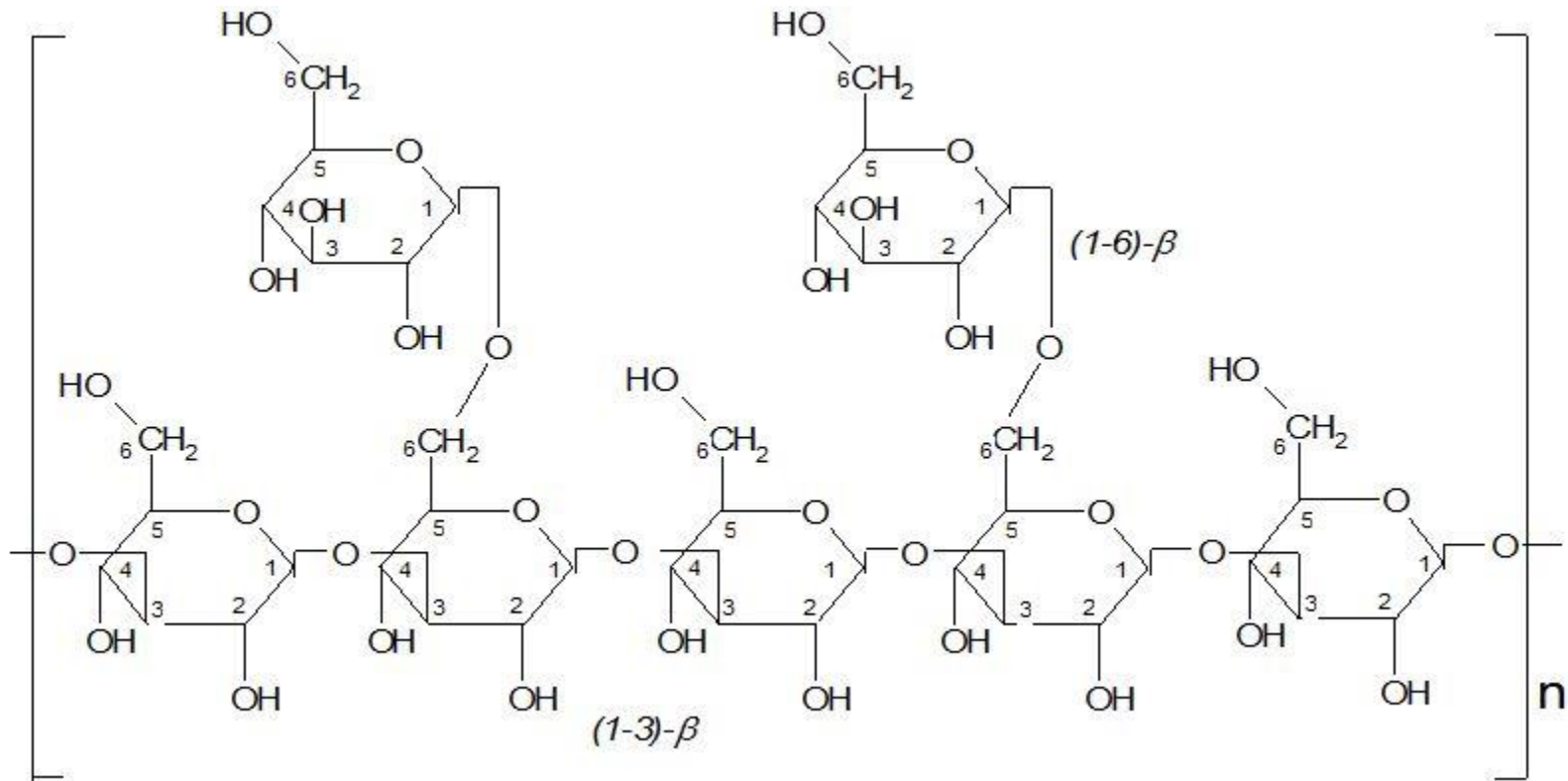


Major composition of yeast cell wall

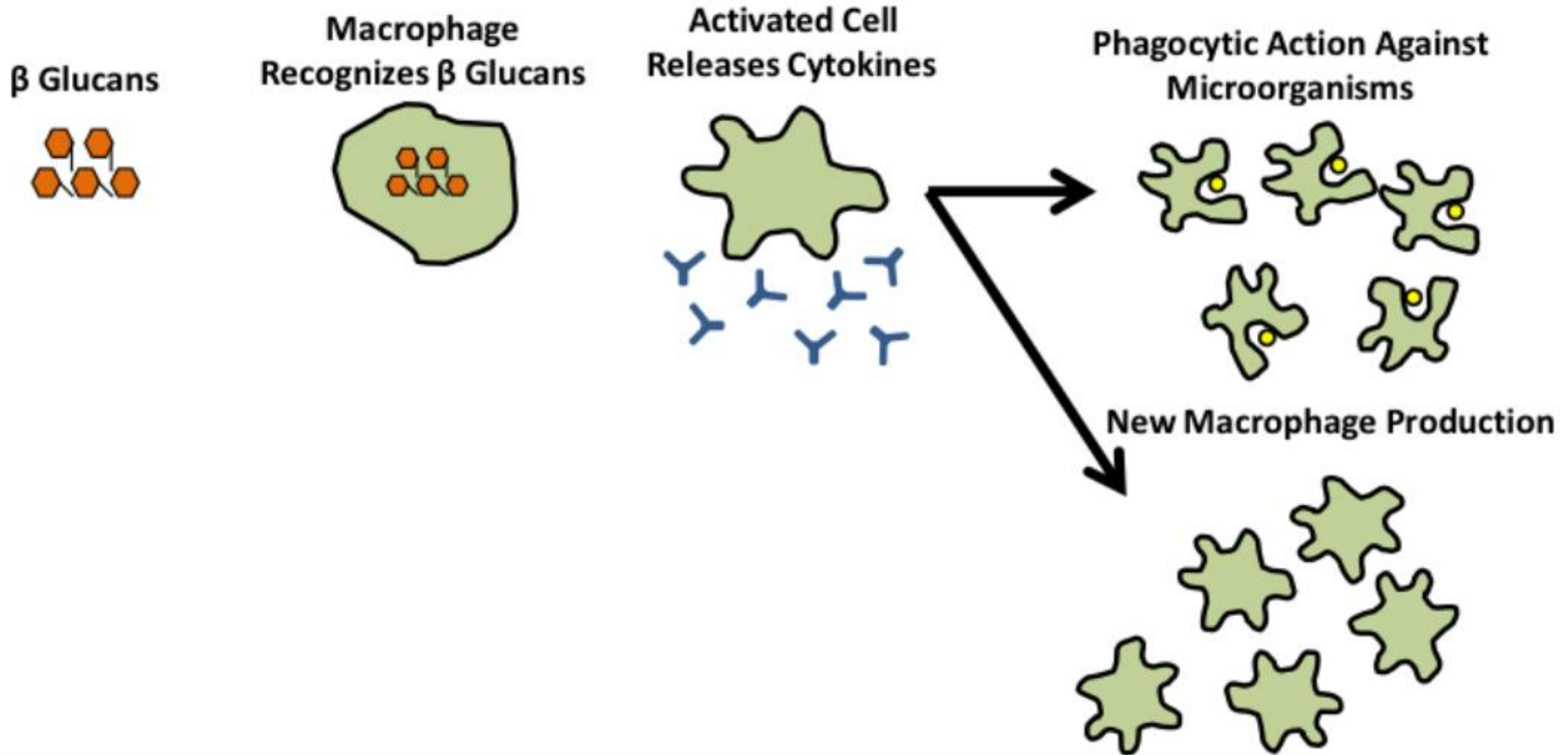
Composition	Percent
Crude protein	35.0
Beta glucan	30.0
Mannan oligosaccharide	17.0
Crude fiber	3.1



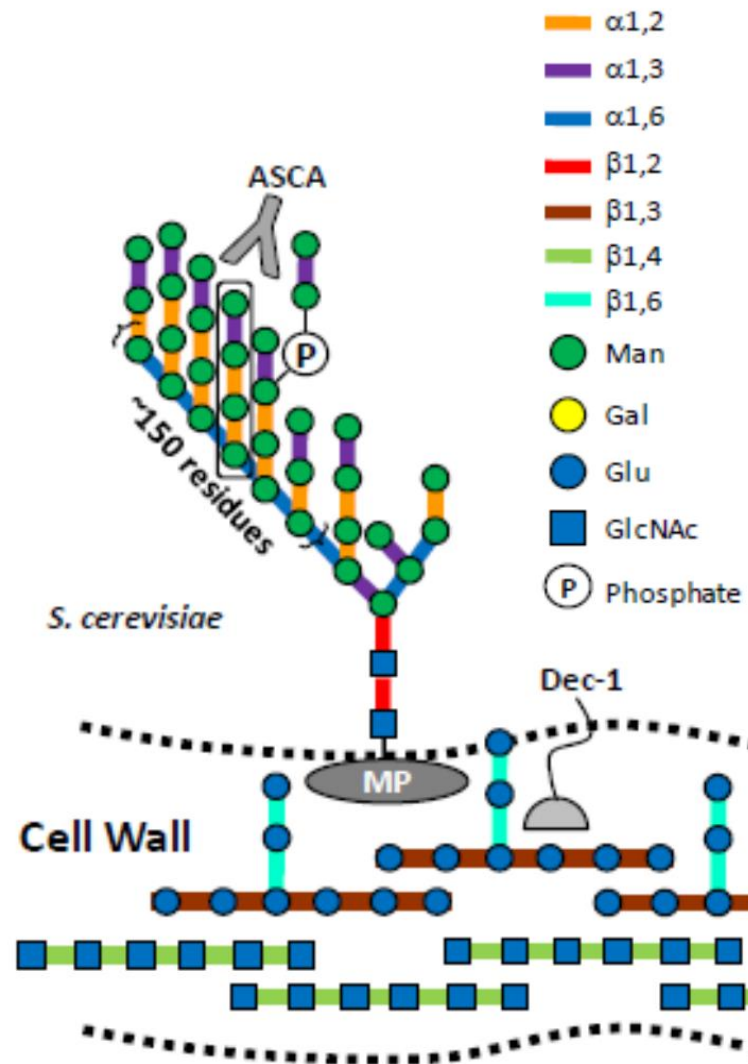
Beta-(1,3)(1,6)-D-glucan

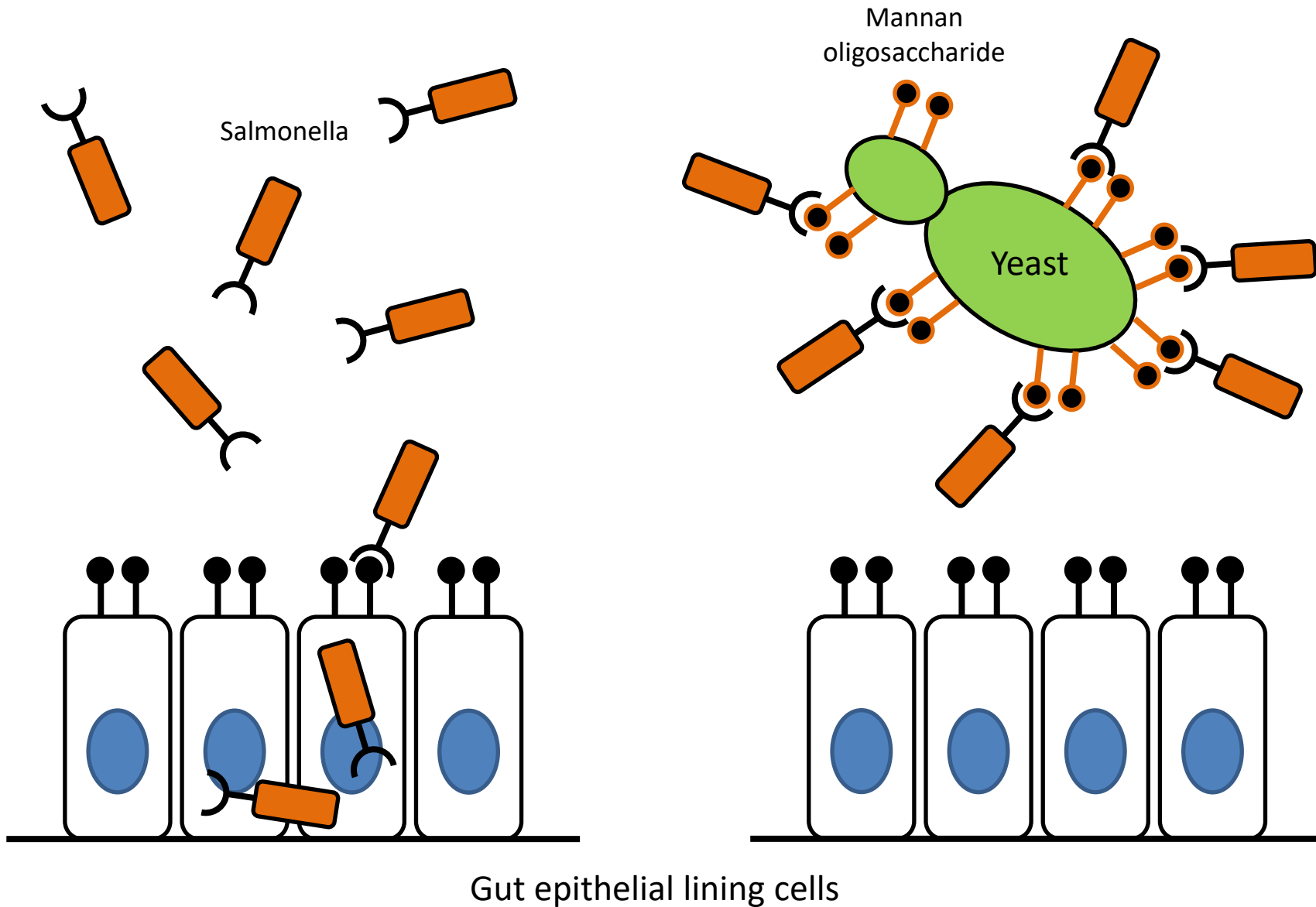


Beta-glucan enhance immune responses



Mannan oligosaccharide





Previous research findings

TABLE 1. *Screening of bacterial isolates from clinical material for mannose-binding lectin^a*

Strain	No. of strains positive	No. of strains tested
<i>Escherichia coli</i>	54	118
<i>Salmonella typhi</i>	4	6
<i>Salmonella typhimurium</i>	4	13
<i>Salmonella enteritidis</i>	4	4
<i>Proteus morgani</i>	11	11
<i>Klebsiella pneumoniae</i>	15	16
<i>Citrobacter diversus</i>	36	36
<i>Citrobacter freundii</i>	4	9
<i>Serratia marcescens</i>	12	12
<i>Aeromonas hydrophila</i>	5	7

^a Mannose-binding activity determined by agglutination of *Saccharomyces cerevisiae* yeasts.

Mirelman D, et al. Screening of bacterial isolates for mannose-specific lectin activity by agglutination of yeast. J Clin Microbiol., 1980, 11: 328-331



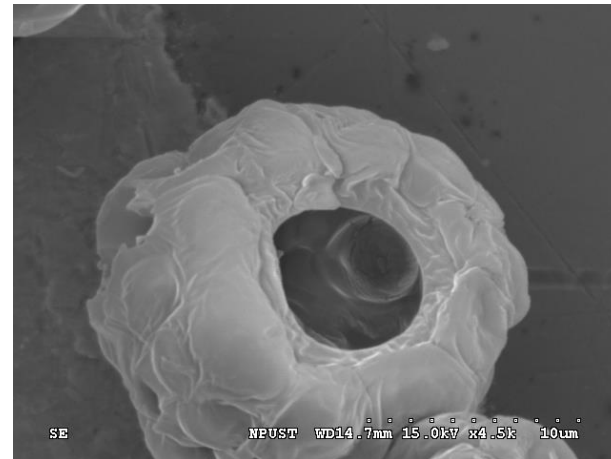
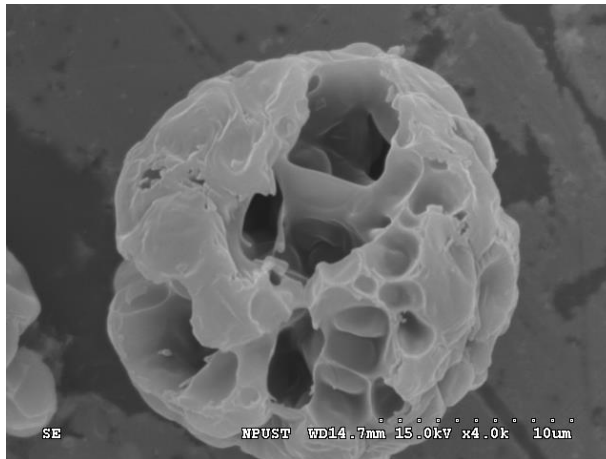
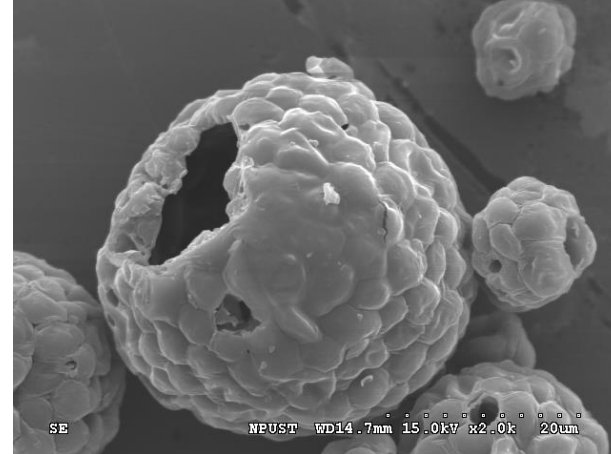
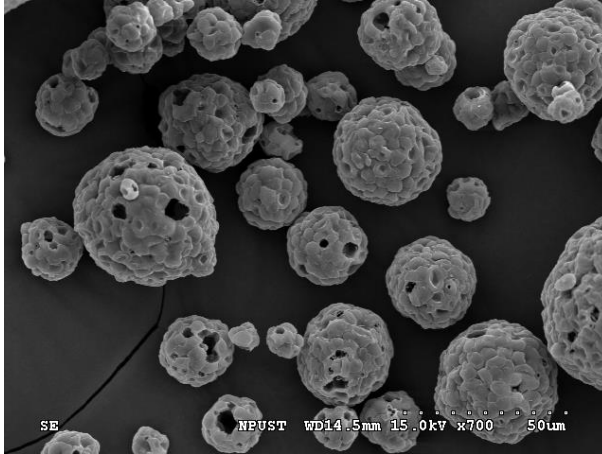
Previous research findings

Mannan oligosaccharide (MOS) significantly improved feed efficiency and performance in livestock and aquaculture, which likely were a result of bacterial (coliforms, vibrio, clostridia and salmonella) load reduction and increased total leukocyte levels.

Staykov et al., 2007; Amani Denji et al., 2015



Scanning electron micrograph of ImmunoWall

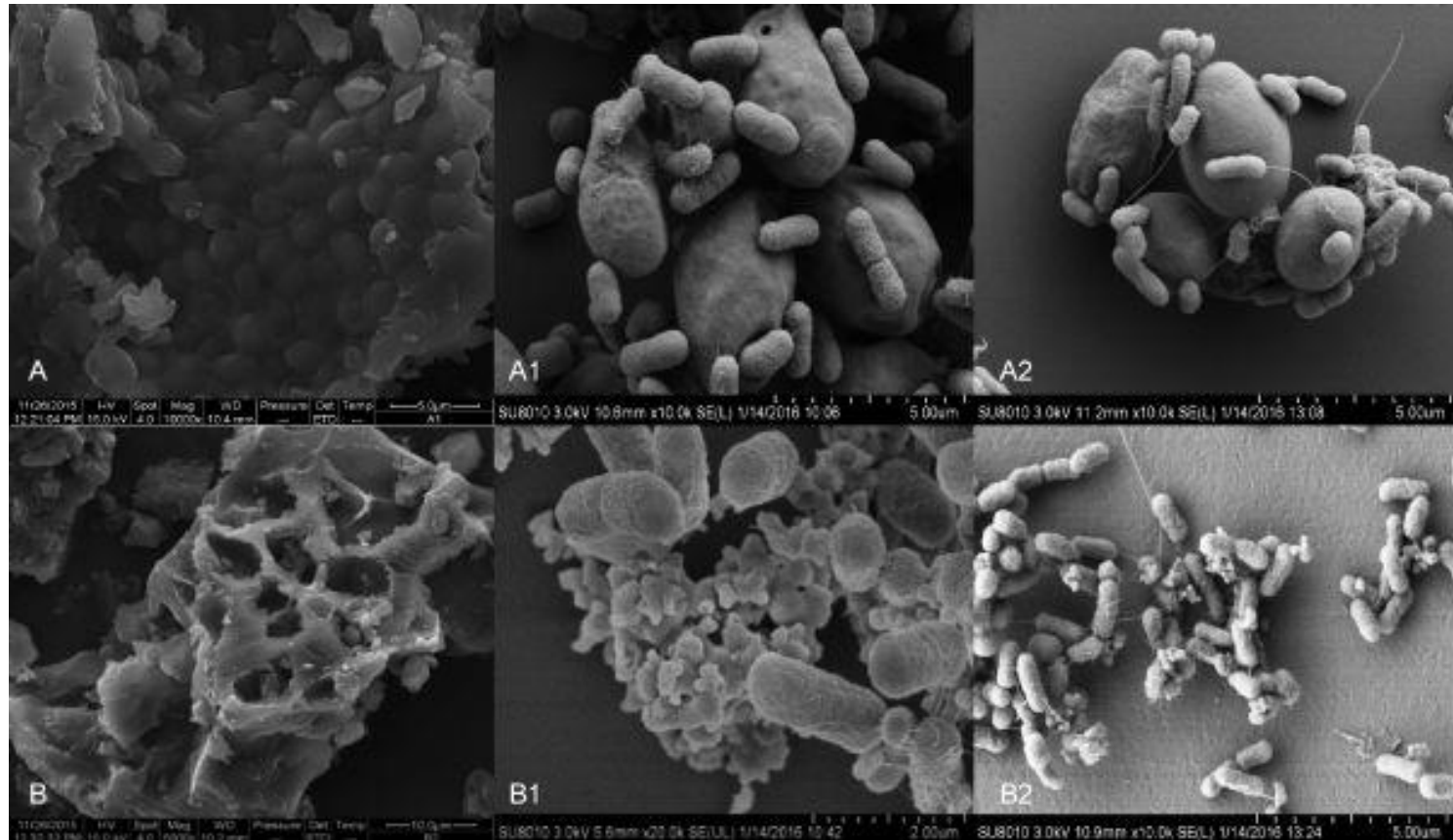


Previous research findings

Yeast cell wall and mannan oligosaccharide agglutinate bacteria with type I fimbriae appendages

E.coli

Salmonella



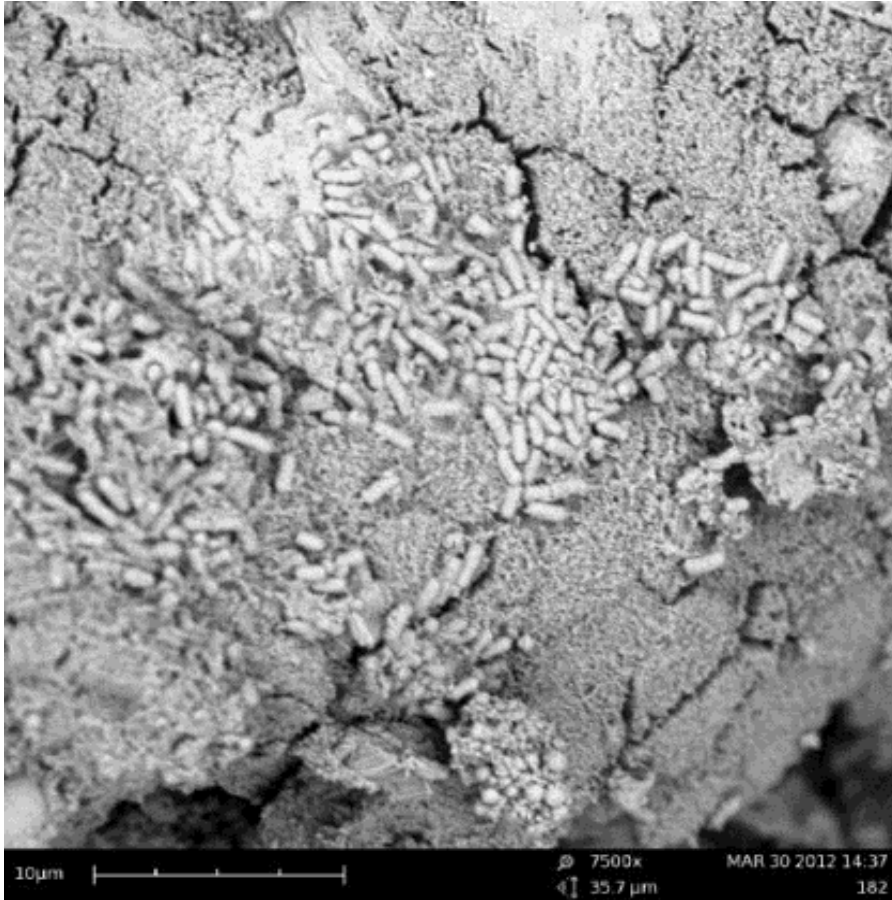
Xu Xiaoqing, et al. Inhibitory effects of YCW and MOS from *Saccharomyces cerevisiae* on *Escherichia coli* and *Salmonella pullorum* adhesion to Caco-2 cells. *Frontiers in Biology*, 2017, 12: 370-375.



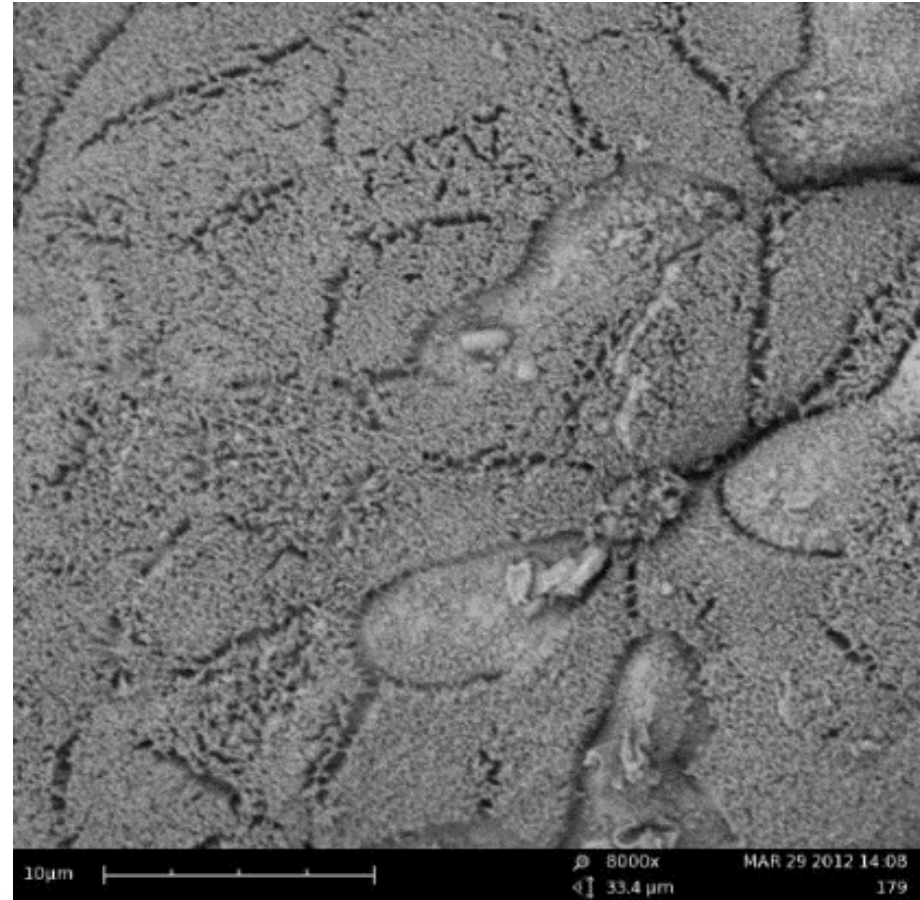
Previous research findings

Microscopic photos of the intestine 14 days post challenge with 10^8 CFU/mL E.coli

No ImmunoWall



0.2% ImmunoWall



Hypothesis of this study

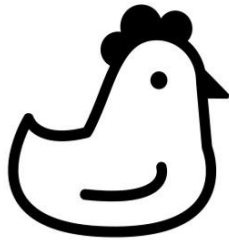
Yeast cell wall could help prevent gut leakage and promote immune response in *Salmonella* challenged chicken



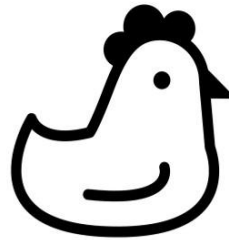
Materials and Methods



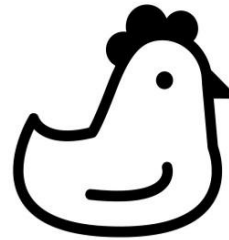
Trial setting



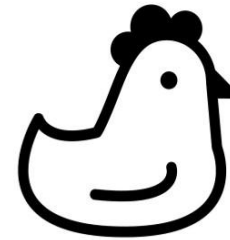
Control



ImmunoWall



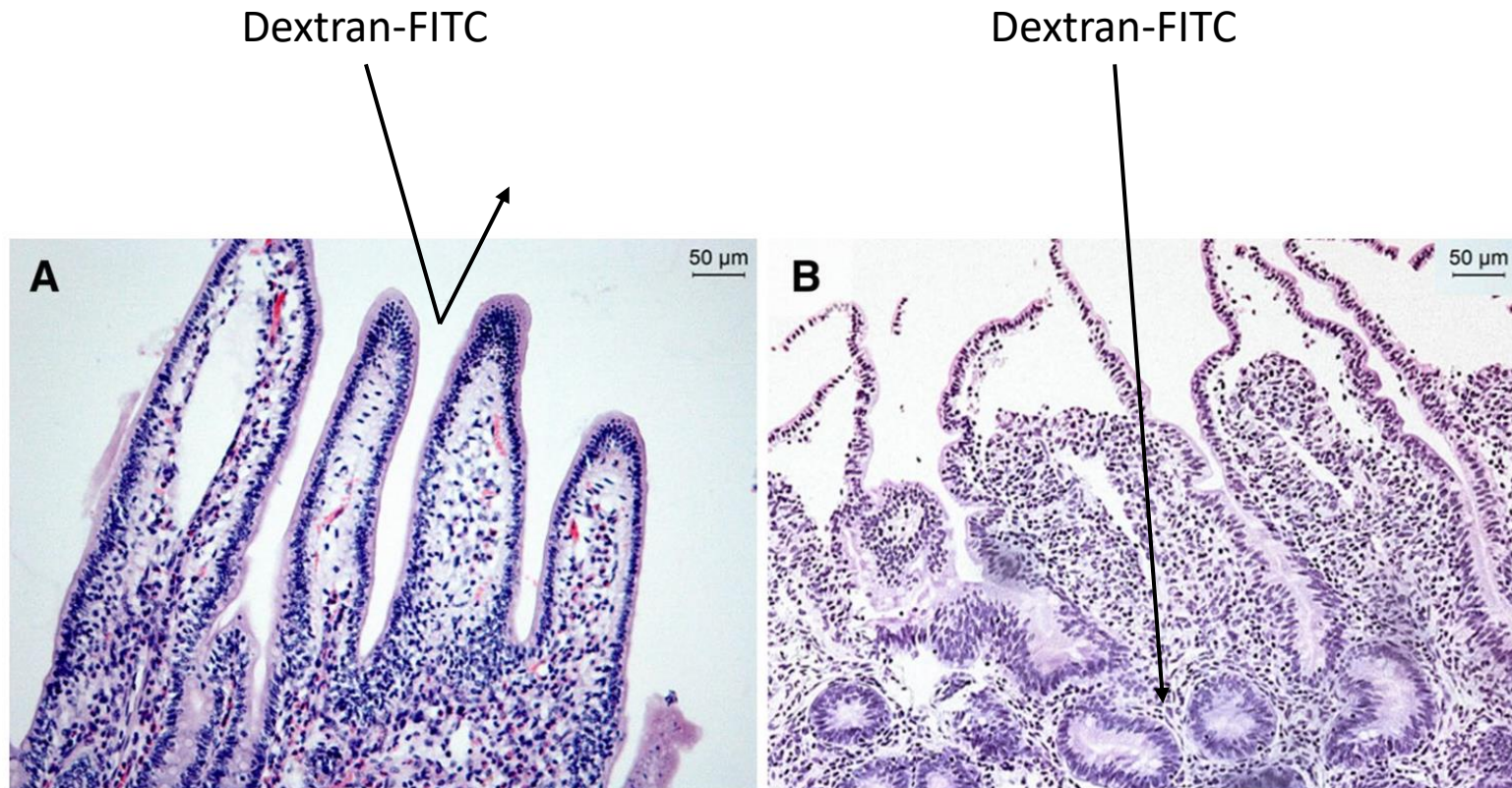
S.enteritidis



S.enteritidis
plus ImmunoWall

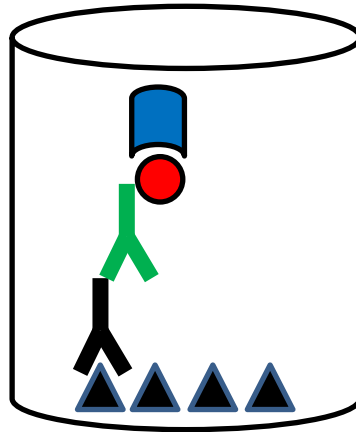
Animal	2-day-old Cobb broiler
ImmunoWall	500 g/ton of feed
S.enteritidis	10 ⁸ CFU/chick PO
Gut leakage test	4 days after challenge
Specific IgA	14 days after challenge

Gut leakage test



2 hr 30 min after PO

Salmonella specific IgA measurement



Tetra Methyl Benzidine (TMB)

Anti-chicken IgA - HRP

Salmonella-specific Ig in feces

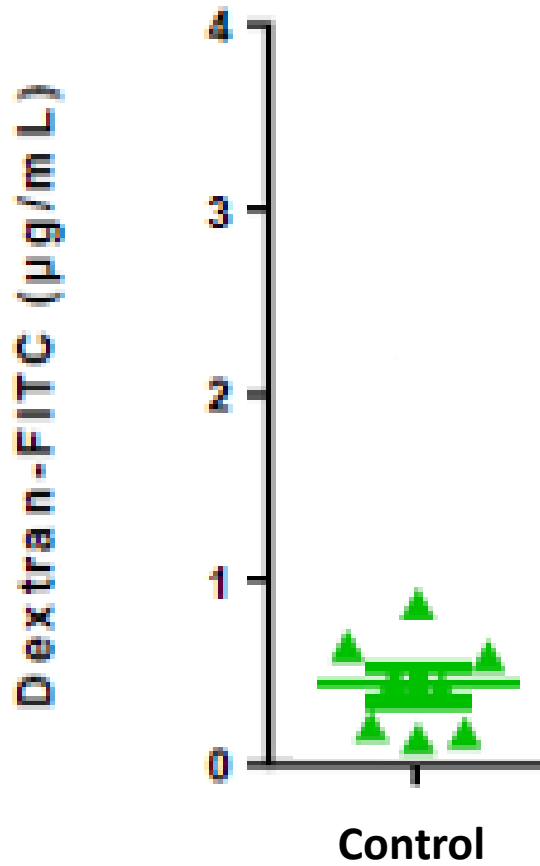
Salmonella enteritidis LPS

450 nm

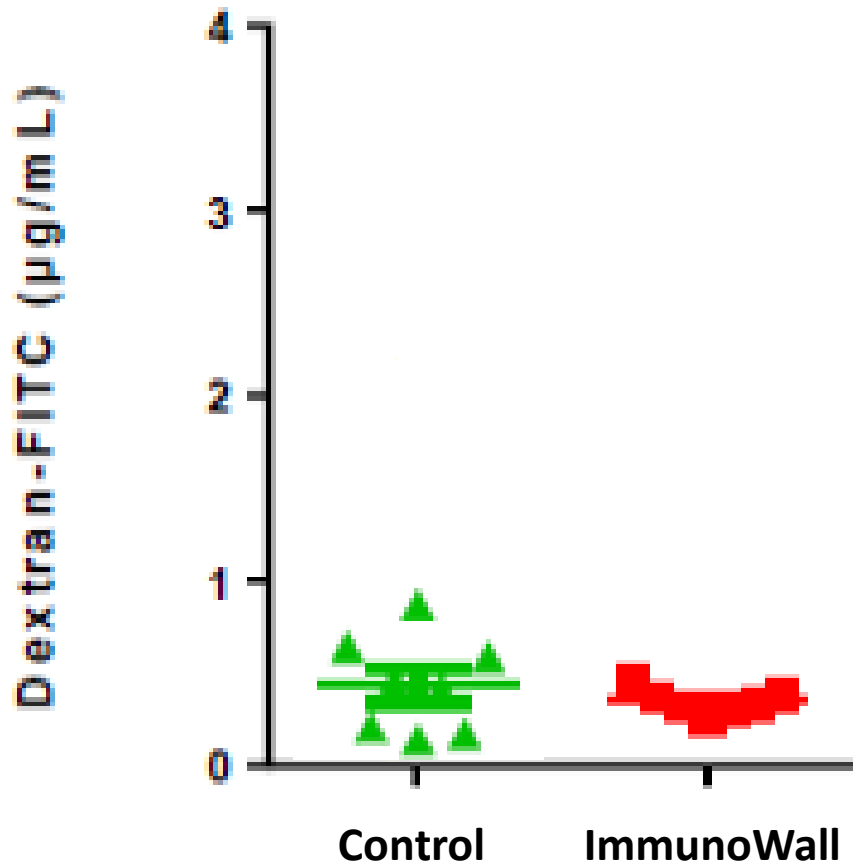
Results and Discussion



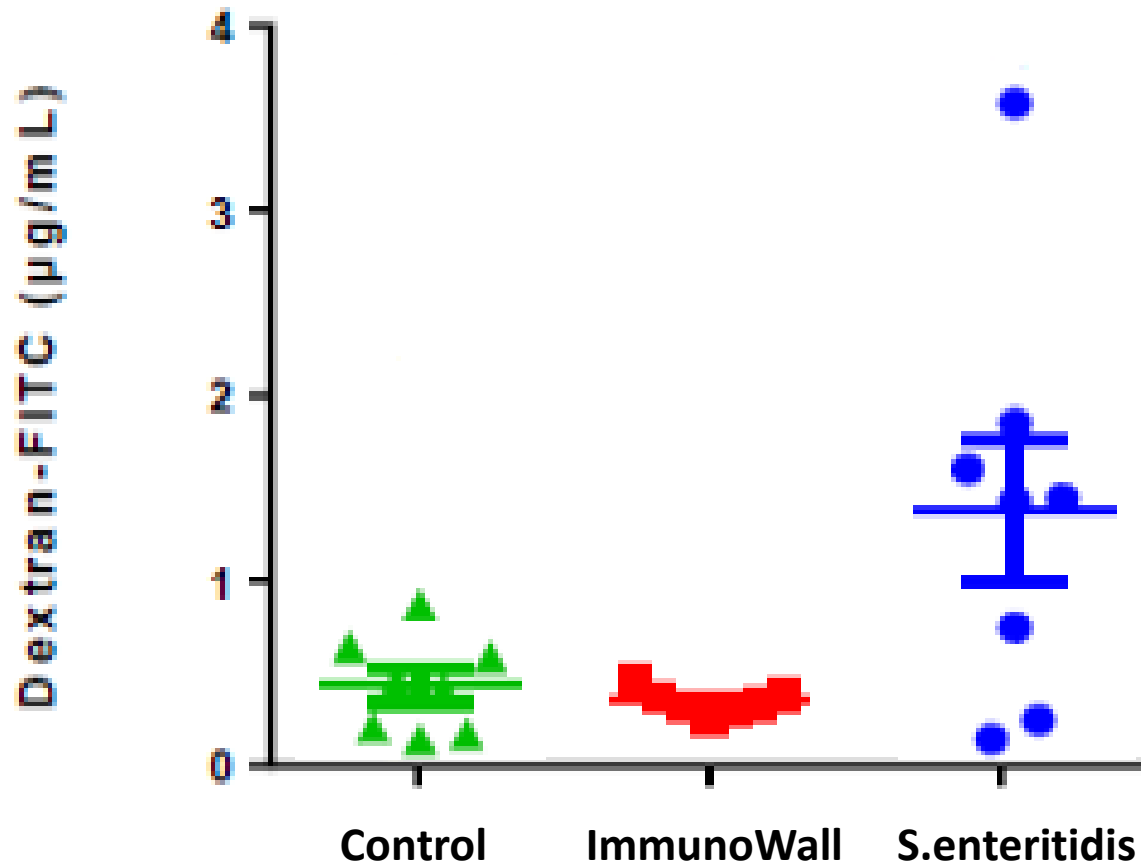
Gut leakage test in broiler on day 4
after challenge with 10^8 *Salmonella enteritidis*



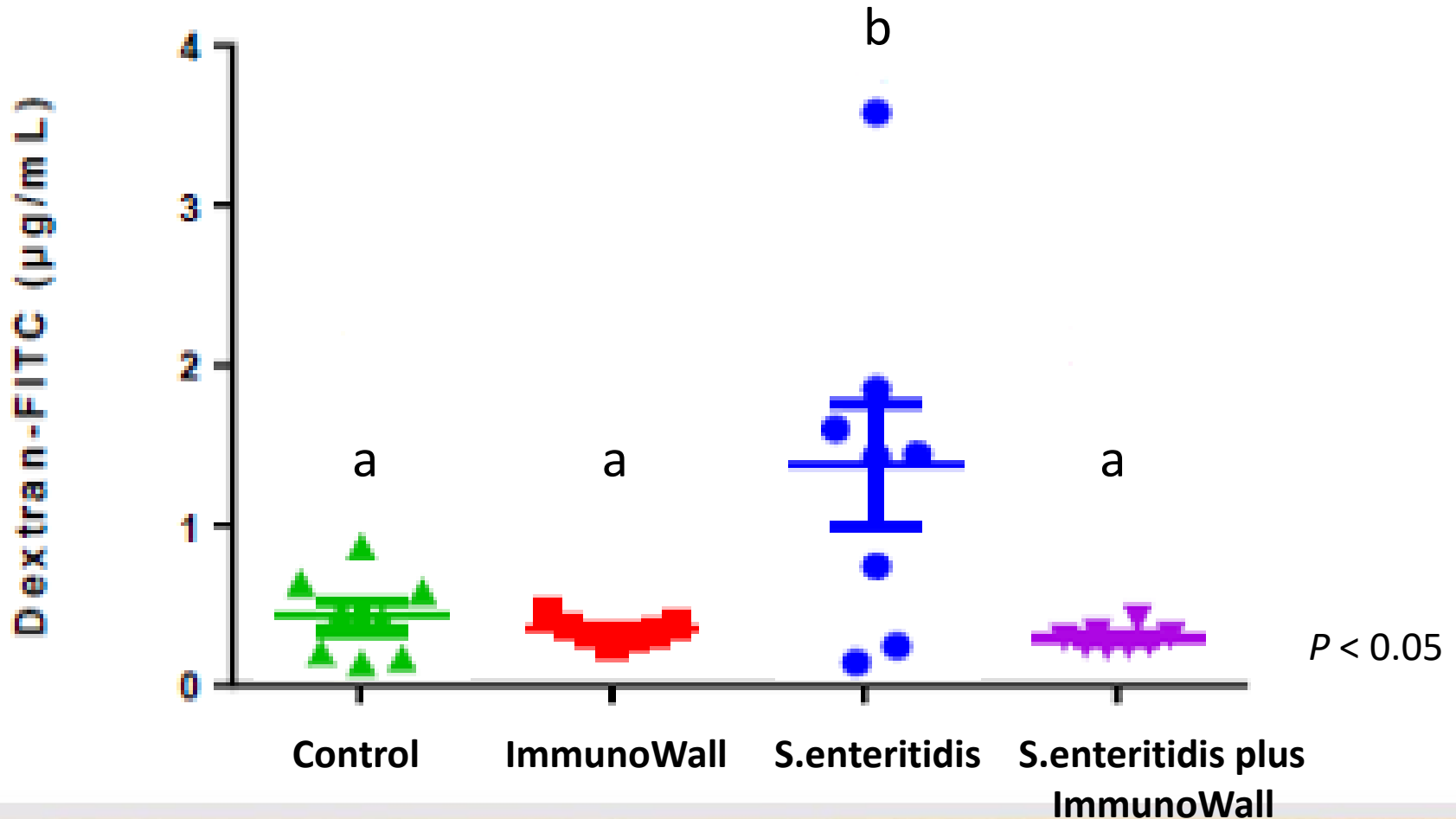
Gut leakage test in broiler on day 4
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Gut leakage test in broiler on day 4
after challenge with 10^8 *Salmonella enteritidis*

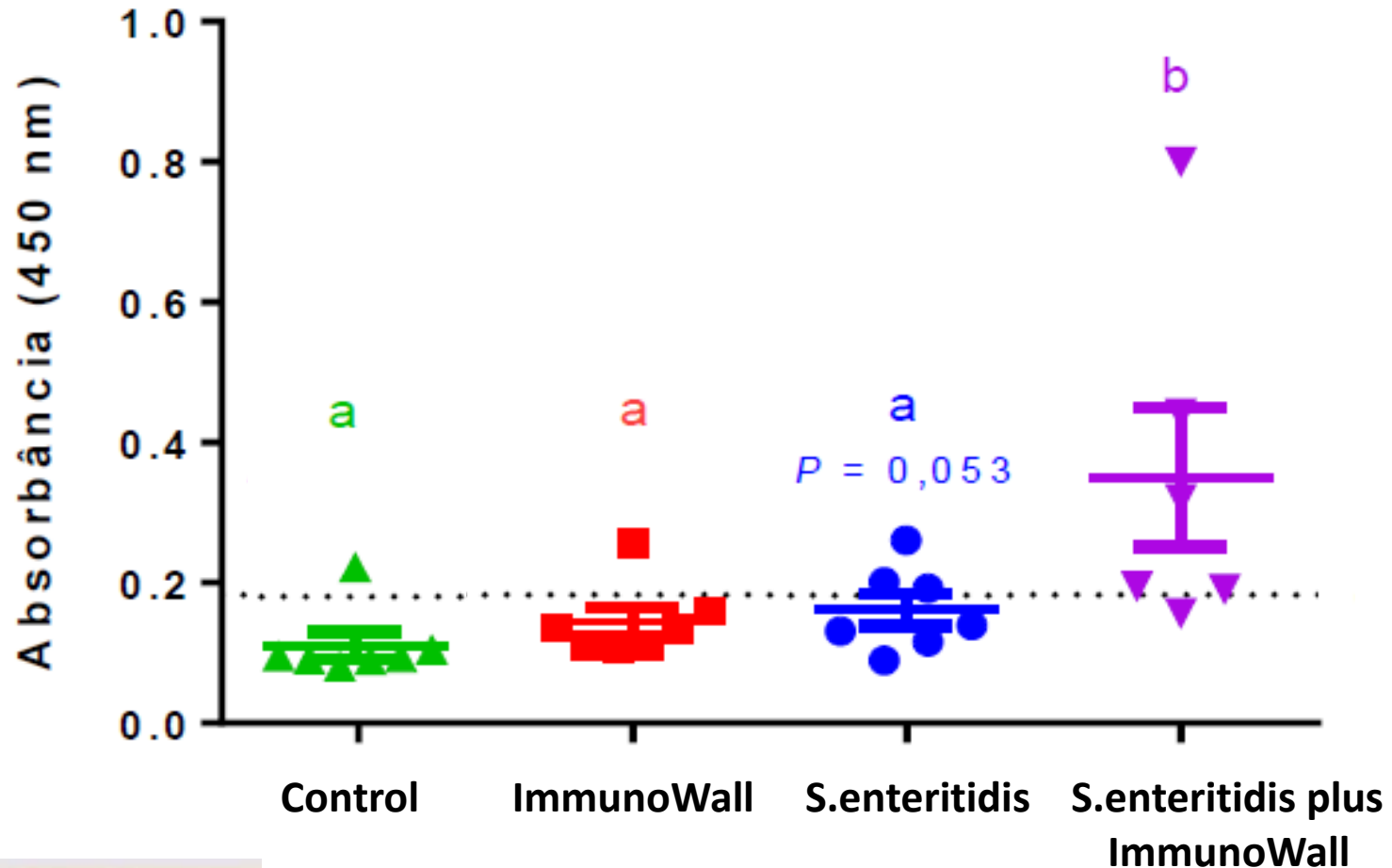


Gut leakage test in broiler on day 4
after challenge with 10^8 *Salmonella enteritidis*



Specific immune responses on day 14
after challenge with 10^8 *Salmonella enteritidis*

IgA anti-Salmonella



Conclusion

1. Gut leakage prevention

Yeast cell wall (ImmunoWall) at the inclusion rate of 500 g/ton could significantly prevent gut epithelial lining damage from *Salmonella enteritidis* infection.



Conclusion

2. Stimulation of immune response

Fecal secretory IgA is secreted by mucosal tissue and represents the first line of defense of the GI mucosa and is central to the normal function of the GI tract as an immune barrier.

Specific IgA in serum is a good predictor of the release of specific IgA at intestinal surfaces after intragastric immunization

Yeast cell wall (ImmunoWall) at 500 g/ton could significantly increase IgA level to fight against *Salmonella enteritidis* infection.



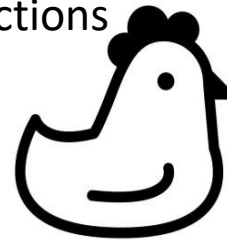
ImmunoWall



Strengthening gut lining



Efficient gut functions



Higher growth performance
Lower morbidity & mortality



Transformation
step 1



Transformation
step 2

Transformation
step 3





Thank you