AQUACULTURE III

12. WEEK

Mucosal Health in Aquaculture

WEEKLY TOPICS

Week	Topics
1. Week	Aquaculture Science and Aquaculture Engineering
2. Week	Aquaculture: Economic and Environmental
3. Week	Aquaculture: Innovation and Social Transformation
4. Week	Aquaculture: Food Ethics
5. Week	Shellfish Aquaculture and the Environment
6. Week	Advances in aquaculture hatchery technology
7. Week	Recirculating Aquaculture
8. Week	Selection and Breeding Programs in Aquaculture
9. Week	Ecological and Genetic Implications of Aquaculture Activities
10. Week	Aquaculture: Biotechnology
11. Week	Aquaculture nutrition: gut health, probiotics, and prebiotics
12. Week	Mucosal Health in Aquaculture
13. Week	Off-Flavors in Aquaculture
14. Week	Sustainable Aquaculture Techniques

- **The fish microbiome and its interactions with mucosal tissues**

- The microbiomes of fish are complex communities comprising protists, yeasts, viruses, and members of the Bacteria and Archaea. These communities inhabit the skin, gills, and gastrointestinal (GI) tract. The abundance and composition of the organisms that comprise the microbiome are affected by a range of factors including temperature, seasonality, host genetics, and diet. Despite this, the microbiome contains core components, especially within the GI tract, which are well adapted to the selection pressures associated with the host fish species and as such these core microbes are commonly found in individuals of the same species even when reared in different locations or conditions (including wild and farmed individuals).

Merrifield, D. L., & Rodiles, A. (2015). The fish microbiome and its interactions with mucosal tissues. In *Mucosal health in aquaculture* (pp. 273-295).

- **The fish microbiome and its interactions with mucosal tissues**

The microbiome is important in barrier function (i.e., excluding foreign pathogens) and germ-free experiments demonstrate that fish larvae fail to develop properly in the absence of the microbiome. This is most prominent in the GI tract where the microbiome has been implicated in GI differentiation, morphology, immunity, and nutrient absorption. The mechanisms that drive these actions are partly described and various molecules that are important in the complicated processes of host-microbe cross-talk have been identified. This chapter provides a review on the current knowledge of fish microbiomes and their interactions with the fish mucosa.

Merrifield, D. L., & Rodiles, A. (2015). The fish microbiome and its interactions with mucosal tissues. In *Mucosal health in aquaculture* (pp. 273-295).

- **Nutritional impacts on fish mucosa: immunostimulants, pre- and probiotics**

Preventive health care by dietary manipulation has been regarded as a sustainable approach in modern aquaculture. This strategy is substantiated by remarkable evidence that nutrition is an important modulator of the fish immune system. From a plethora of feed supplements that are being utilized as health promoters in aquaculture, there are three major groups that have generated considerable attention: immunostimulants, prebiotics, and probiotics. These feed supplements vary in their modes of action in fish but their ability to boost not only the innate immunity but also the mucosal immunity positioned them as significant promoters of fish health.

Caipang, C. M. A., & Lazado, C. C. (2015). Nutritional impacts on fish mucosa: immunostimulants, pre-and probiotics. In Mucosal health in aquaculture (pp. 211-272).

- **Competition for attachment of aquaculture candidate probiotic and pathogenic bacteria on fish intestinal mucus.**

Probiotics for aquaculture are generally only selected by their ability to produce antimicrobial metabolites; however, attachment to intestinal mucus is important in order to remain within the gut of its host. Five candidate probiotics (AP1–AP5), isolated from the clownfish, *Amphiprion percula* (Lacepéde), were examined for their ability to attach to fish intestinal mucus and compete with two pathogens, *Aeromonas hydrophila* and *Vibrio alginolyticus*. Two different radioactive isotopes were used to quantify competition between pathogens and probionts. Attachment of the pathogens was enhanced by the presence of the candidate probiotics. However, the addition of the candidate probiotics after the pathogens resulted in reduced pathogen attachment. Only AP5 caused lower attachment success of *V. alginolyticus* when added before the pathogen.

Vine, N. G., Leukes, W. D., Kaiser, H., Daya, S., Baxter, J., & Hecht, T. (2004). Competition for attachment of aquaculture candidate probiotic and pathogenic bacteria on fish intestinal mucus. *Journal of fish diseases*, *27*(6), 319-326.

- **Changes in immune and enzyme histochemical phenotypes of cells in the intestinal mucosa of Atlantic salmon, Salmo salar L., with soybean meal-induced enteritis.**

- Extracted soybean meal (SBM) in the diet for Atlantic salmon, Salmo salar L., causes an inflammatory response in the distal intestine.
- The morphological changes of the epithelial cells and a characterization of the inflammatory cell infiltrate of the distal intestinal mucosa were studied using a panel of enzyme and immunohistochemical markers.

- There appeared to be an increased presence of cells of monocytic lineage, including macrophages, as well as neutrophilic granulocytes and immunoglobulin (Ig) M in the lamina propria of the SBM-fed fish.

Bakke-McKellep, A. M., Press, C. M., Baeverfjord, G., Krogdahl, Å., & Landsverk, T. (2000). Changes in immune and enzyme histochemical phenotypes of cells in the intestinal mucosa of Atlantic salmon, Salmo salar L., with soybean meal-induced enteritis. *Journal of Fish Diseases*, *23*(2), 115-127.

- **Fish mucosal immunity: intestine**

- The present chapter, they provided that in-depth review of knowledge related to the intestinal mucosal immune compartment of fish.
- The anatomical and physiological makeup is described along with a comprehensive overview of the innate and adaptive cellular and molecular effectors that participate in the gastrointestinal immune response.
- Emerging tools and laboratory models for the study of mucosal immunity are highlighted.

Salinas, I., & Parra, D. (2015). Fish mucosal immunity: intestine. In *Mucosal health in aquaculture* (pp. 135-170).

- References

- Regional Review On Status And Trends In Aquaculture Development In Europe – 2015, Fao Fisheries And Aquaculture Circular No. 1135/1 Fiaa/C1135/1 (En)
- The State Of World Fisheries And Aquaculture 2016, Fao. 2016
- Advances In Aquaculture Hatchery Technology 2013, Woodhead Publishing Series In Food Science, Technology And Nutrition: Number 242
- Aquaculture: An Introductory Text, 2005, Robert R. Stickney
- Aquaculture Farming Aquatic Animals And Plants,2012, John S. Lucas