Mucosal Immunity prospects in farmed fish

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Introduction:

The increased production and quality of fish production systems is related to the health of these. That's why, over the lasts years, research related to immune characteristics in fish and their stimulation methods had been increased a lot in the field of aquaculture. For that reason, we want to do a review over how fish's immune system works, both systemic and mucosal ways, as well as discuss the progress in the principal stimulation methods.

The immune system:

It is defined as a system composed of various molecules and cells by which an organism can protect himself against a range of external threats more or less wide. This system has two distinct responses, and it creates an immunological memory against the antigen or pathogen that has entered inside the body.

Systemic Immunity: Fish vs Mammal

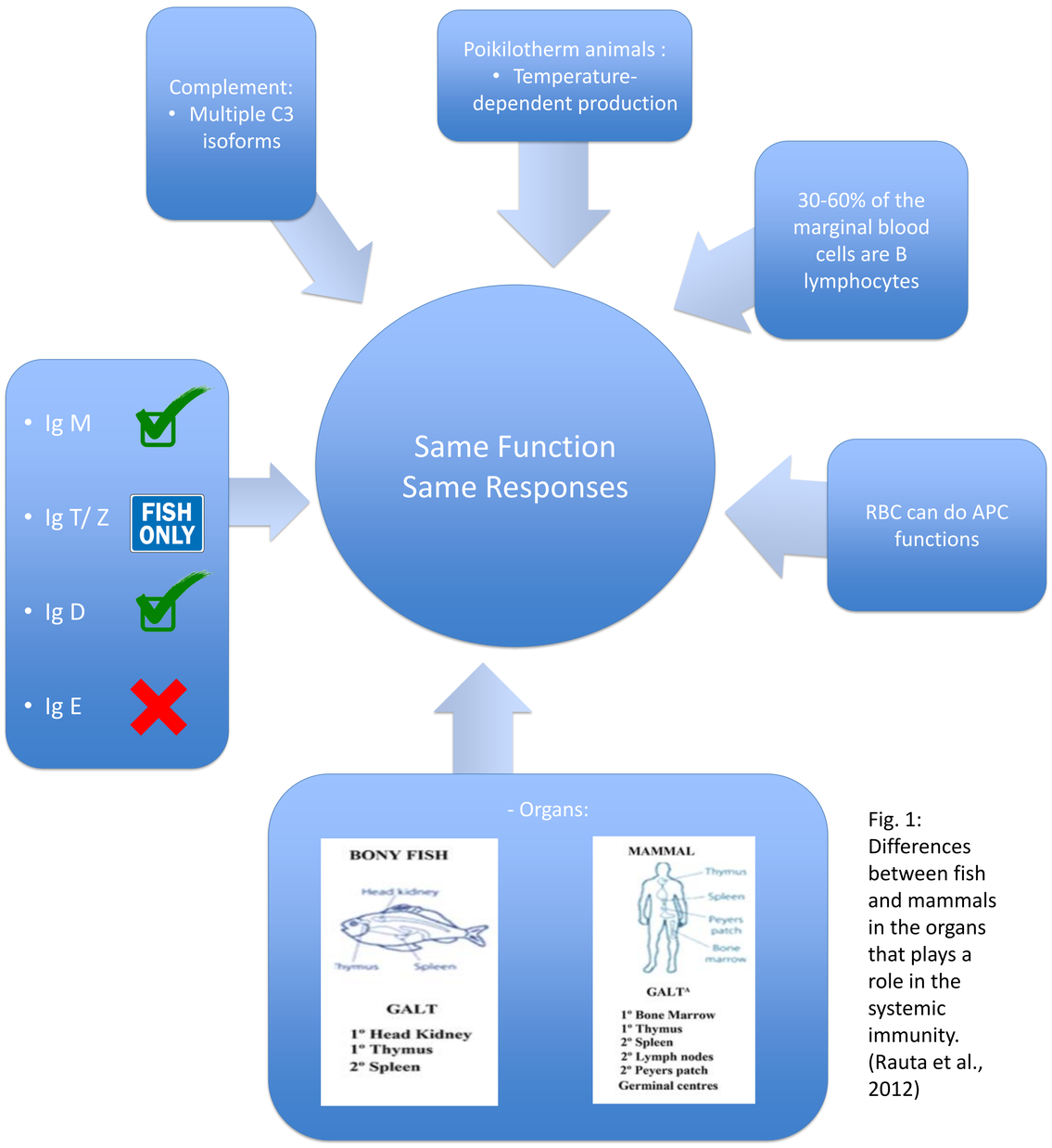

Fig. 1: Differences between fish and mammals in the organs that plays a role in the systemic immunity. (Rauta et al., 2012)

Mucosal Immunity:

The mucosal surfaces in fish perform a number of vital functions to their survival in the aquatic environment. These ones include physical and immune protections against the external pathogens in that aquatic environment. That last one, which until recently was mostly unknown, aims to keep out pathogens within the body.

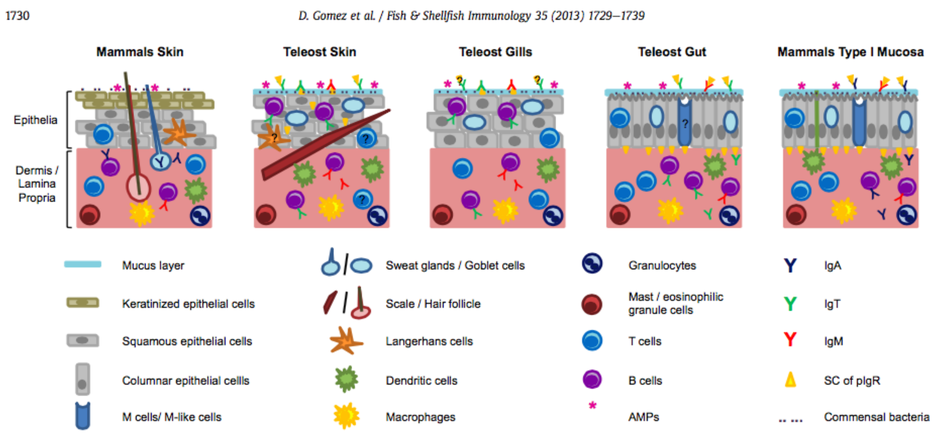

Fig. 2: There is the main distribution of cells and molecules of the immune system in the principal mucosal surfaces of the fish. Also, there is a comparison in some of the mucosal surfaces of mammals. (Gomez, Sunyer, & Salinas, 2013)

The innate response is most ways exactly as the one acting in the systemic immunity, but the specific one has some adaptations.

- **Gut**
- **Skin**

→ In this mucosal surfaces, it's remarkable the role of mucus and adaptive humoral factors such as Ig. They work together, Ig immobilizing the pathogen microorganism and the mucus letting them out. Ig covers the commensal micro flora in these mucosal surfaces as a method to protect it from external colonizations.

- **Grills**

→ The only one with organized lymphoid tissue. It's the less studied mucosal surface and his immunological functions seems similar as the first ones. More studies about the real immunological functions of this mucosal surface are needed.

Mucosal immunity stimulation methods

The way of administration of the immune stimulants is key in the stimulation of one or another immunity. Oral, intraperitoneal and bath are the current ones.

- **Vaccines**: - Oral and bath vaccination are the ones with more future in production fish immunization.
  - Advances like the dual response in the mucosal immunity stimulation or the possibility to specifically select on type of specific response put vaccines in a great future of new developments

- **Probiotics and prebiotics**: The easy administration of these products and the lack of whole vaccine protection against all the pathogens in the aquatic environment makes probiotics and prebiotics a key factor in the supplementation of fish immunization

- **Immunostimulants**: More than their addition in the fish diet as a stimulants of the immune system, their role as vaccine adjuvants is the future for this molecules.

Conclusions

- The systemic immunity has few differences between fish and mammals or birds. However, the evolutionary direction and the environmental conditions where that first ones live make some differences in the kind of molecules and dynamics of these. At the cellular level, tissue and anatomical organs doing functions in that immunity are adapted to it.
- The mucosal surfaces in fish have vital functions for the survival of these on the aquatic environment. These features highlights the immune function, which is awakening a special interest in the field of immunological research in aquaculture.
- This mucosal immunity in fish plays an important role and is complemented by the action of systemic immunity. Its operation is based on the same responses that systemic one have, but specifically adapted to its primary function, which is to limit the pathogens do not penetrate into the body.
- Currently immunization is based in vaccines. However, there is no vaccine for the whole range of diseases existing in the different species of fish and their effectiveness is not always expected under certain circumstances. Therefore the addition of probiotics, prebiotics and immunostimulant are key to improve such protection. New studies on the characteristics of the mucosal immune response and the development of new molecules and new ways of administration can provide new information about how to enable the better protection of species production.

Bibliography

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