ULST Timisoara
Multidisciplinary Conference on Sustainable Development
15-16 May 2025

INSIGHTS INTO THE AVIAN IMMUNE SYSTEM

Robert Capotă [1], Andra-Cristina Bostănaru-Iliescu [1], Dana Ciaușu-Sliwa [1], Valentin Năstasă [1]

[1] *"Ion Ionescu de la Brad" Iasi University of Life Sciences, Faculty of Veterinary Medicine, 700489, 8 Mihail Sadoveanu Alley, Iasi, Romania*

Abstract: *The avian immune system shares core principles with mammalian immunity but presents unique adaptations shaped by avian physiology. This review outlines the structure and function of key immune organs, emphasizing the roles of primary and secondary lymphoid tissues and the dynamics of innate and adaptive immunity, focusing on major cell types and immune molecules. Special attention is given to immunoglobulin Y, due to its role in maternal immunity and therapeutic potential through efficient egg yolk extraction. These insights support advances in disease control, vaccine development, and immunoglobulin Y-based therapies.*

• Introduction

Birds differ greatly from mammals in physiology and immune function. Studying the chicken immune system reveals key aspects of avian health, aids disease control, and offers insights for both veterinary science and comparative immunology.

• Structure of the avian immune system

While functionally similar, the avian immune system is structurally distinct from that of mammals, featuring specialized organs and organizational differences:

Thymus: Consists of multiple lobes along each side of the neck. Produces T cells essential for cell-mediated immunity. T cells undergo selection here to ensure immune tolerance and functionality.

- **Bursa of Fabricius**: Located near the cloaca. A primary lymphoid organ unique to birds. Responsible for B cell development and shaping the antibody repertoire;
- Absence of **lymph nodes**: Unlike mammals, immune surveillance is carried out by other organized lymphoid tissues instead;
- **Spleen**: A secondary lymphoid organ involved in blood filtration and immune activation. Contains white and red pulp that support both adaptive and innate immunity;
- **Mucosa-associated lymphoid tissue (MALT)**: Found in mucosal areas like the gut, respiratory tract, and eyes. Includes structures such as cecal tonsils and the Harderian gland. Crucial for first-line defense.

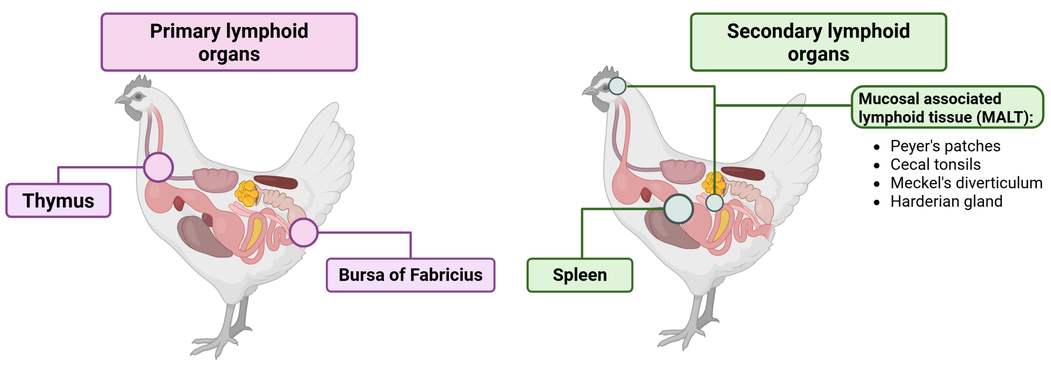

Fig. 1 The anatomical location of the primary and secondary lymphoid organs and structures.

• Functioning of the avian immune system

Birds possess both innate and adaptive immunity. The innate response is rapid and includes phagocytes (e.g., heterophils), antimicrobial peptides, cytokines, and pattern recognition receptors.

The adaptive response is slower but specific. T cells mediate cellular immunity, while B cells produce antibodies and generate memory. Birds produce three types of immunoglobulins:

- **IgM** – first response antibody;
- **IgY** – main serum and yolk antibody; functionally similar to IgG;
- **IgA** – protects mucosal surfaces.

IgY is transferred from hen to chick via the yolk, providing passive immunity and is widely used in diagnostics and therapeutics.

• Conclusions

The avian immune system shares core features with mammals but has unique organs, antibody mechanisms, and immunoglobulin types. Deeper understanding supports better disease control, vaccine development, and IgY-based therapies. Future research should explore its molecular basis and cross-species applications