Abstract (English)

Birds play a multitude of roles within ecosystems, functioning as predators, scavengers, pollinators and seed dispersers. With an estimated population of approximately 50 billion individuals, birds are among the most populous animal classes on Earth. They inhabit diverse ecosystems, including forests, deserts, wetlands, grasslands, savannas, and mountains. Some bird species are highly specialised in their habitats and exhibit minimal movement, while others undertake extensive migration across the globe. Notably, certain birds are synanthropic, thriving in close association with human settlements, while others remain strictly wild. Given their widespread distribution, species richness, and ecological diversity, birds are primary targets and reservoirs for various pathogens. A recent study found that birds are associated with approximately 18.4% of emerging infectious diseases in the world, and nearly half of the world's bird species are in decline. This underscores the critical need to study avian immune systems and disease mechanisms.

Similar to other vertebrates, the avian immune system also comprises innate and adaptive components. During an infection, the pathogen recognising receptors in the avian innate immune system initiates an inflammatory response to eliminate pathogens. This process involves a tightly regulated interplay of immune cells and related molecules, including cytokines, to prevent self-damage. An unchecked inflammatory response can escalate to systemic inflammation, potentially breaching the blood-brain barrier and causing neuroinflammation. Despite the importance of innate immunity, research on avian innate immune receptors is comparatively underdeveloped. It is also to be noted that most immune studies in avians are done on chicken models, which has its advantages. However, the chicken immune system does not fully represent the vast diversity of avian species. Therefore, it is imperative to extend the research to other bird groups. Passeriformes and Psittaciformes are closely related and together they constitute more than half of the total bird population. However, these orders are underrepresented in avian immunology studies.

This PhD thesis aims to bridge the research gap in the innate immune responses of birds during inflammation and extend our understanding of the avian immune system beyond poultry. The thesis work begins with a comprehensive overview of vertebrate virus-sensing innate immune receptors, highlighting the significant research gap in birds. The next part of the thesis covers the experiments where my colleagues and I investigated the effect of sterile viral peripheral inflammation in budgerigars and sterile bacterial peripheral inflammation in both budgerigars and zebra finches and tested their effects on the central nervous system. Our study showed that peripheral inflammation can induce neuroinflammation. We also found that parrots are highly susceptible to neuroinflammation. In the later parts of my thesis, my colleagues and I used the host-pathogen system of house finches (*Haemorhous mexicanus*) and *Mycoplasma gallisepticum* to investigate the role of evolutionary history in the immune response during pathogen infection. In this study, we found that evolutionary history indeed plays an important role in the host immune response to the pathogen. To conclude our experiments, we analysed differential expression patterns of the immune-related genes to understand the underlying inflammatory response, employing an interdisciplinary approach for this analysis.