

Evolution is a most fascinating feature of all living things in our world. The means of organismal evolution are diverse, comprising mainly of natural and sexual selection. Both of these phenomena may contribute to evolutionary adaptations in health and disease. The questions of immunity impact on the process of sexual selection and sexual selection for increased anti-parasite resistance are wide issues of the present research in natural sciences. Their clarification requires multidisciplinary-based investigation combining a variety of partial results into a single united paradigm. My co-workers and I have chosen several specific issues to study, in order to fill some of the important gaps of the current knowledge. We proposed the Carotenoid maintenance handicap hypothesis to point out that optimisation instead of maximisation of the carotenoid intake and ornamental display may be physiologically convenient for the individual. In Scarlet rosetfinch (*Carpodacus erythrinus*) we confirmed the role of the carotenoid-based ornamental colouration in the process of sexual selection and investigated several partial aspects of the association between immunogenetics, immune function, health and the ornament expression and mate choice. In Zebra finch (*Taeniopygia guttata*) we have shown that the present way of interpretation of results of the phytohaemagglutinin skin-swelling test is erroneous. Moreover, we highlighted that the current ecological terminology using general 'immunocompetence' as a value for measuring the anti-parasite resistance is far too simplistic and should be replaced by more exact descriptions of the immune responsiveness. Finally, we have attempted to propose a novel direction of investigation in the wildlife immunogenetics starting with the description of Zebra finch Toll-like receptor 4 as a model molecule of an innate immunity receptor essential for antibacterial defence.