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Tracing the evolutionary footprints of toll-like receptors and their relevance in vaccine development

All organisms including plants and animals invest their resources in orchestrating defense mechanisms for protection and survival. The sophistication and organization of these immune responses vary depending on the individual's organismal complexity as well as the pathogen profile in their niche. Hence, both internal selections within an evolutionary unit (e.g. order/class/phylum) as well as co-evolution with exogenous factors are responsible for shaping the immunity of an organism. Along vertebrate immune evolution, defense mechanisms have become more specialized and specific and the diversion between innate and adaptive branches of immunity has become distinct. Between the two, innate immunity is more ancient and involves activation of robust cellular and enzymatic pathways in response to a pathogenic infection across vertebrates and invertebrates. The TLRs are a part of the innate arm of the immune system and apart from armoring the innate immunity, they also play an essential role in establishing a link between innate and acquired immune system via their immune effector functions. They are also the only family of PRRs to recognize a versatile range of PAMPS from Gram-positive and Gram-negative bacteria, *mycobacteria*, RNA and DNA viruses, fungi and protozoans unlike NLRs and RLRs which only detect bacteria and viruses, respectively. Apart from microbial motifs, the TLRs are also known to detect endogenous ligands and trigger inflammatory responses. It's a well-known fact that vaccines incorporate ligands for TLRs which not only protect against infectious diseases but are also used in therapeutic immunization. The TLR signaling pathways trigger an adaptive immune response after immunization via activation of dendritic cells. Their ligand specificity, structure and signaling pathway have been avidly investigated by researchers and yet many aspects of TLRs remain to be unveiled, especially when it comes to comparative studies across various phyla. The nuances of strategies employed by these PRRs to armour the innate immune system may vary across the phylogeny and this study would lead our way towards unravelling the evolutionary origins of immune system and understand the strategies for future vaccine development. Reptiles hold a critical position in the vertebrate phylogeny being the sauropsids out group to both aves and mammals and the only connect between endothermic amniotic aves and mammals and ectothermic amniotic pisces and amphibians. Nothing is known about the structure and function of TLRs in reptiles but an insight into the early sentinels of these molecules can unravel the engagement of TLR in boosting vaccine responses, and help us answer many questions of its efficacy, feasibility and safety as vaccine analogues.

Biography

Soma Mondal Ghorai has completed her PhD from University of Delhi and is currently working as Associate Professor in the Department of Zoology, Hindu College, University of Delhi, India. She has publications in many reputed journals and has been actively involved in research in Comparative Immunology.