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Mechanism Involved in Immune Activation Towards Antigens In Different Species

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Short Communication

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DESCRIPTION

Animals respond to the enormous onslaught of potential pathogens by a huge variety of defences, ranging from cell intrinsic mechanisms to highly sophisticated cellular and molecular immune systems. Such defences require the immune systems at some point to tell the difference between self and non-self which in turn required a level of specific recognition. Such recognition works in a variety of ways, from a disruption of cellular homeostasis resulting in the presence of stress signals to recognition of essential molecular structures broadly common to a group of pathogens but different from the host to exquisitely precise recognition capable in principle of recognizing any molecule but constrained by immunological tolerance mechanisms to effective recognition of non-self molecules [1].

Decades of investigation in mammals and chickens have identified several different lymphocytes that contribute to precise recognition of molecules in jawed vertebrates from sharks to humans. For instance, B cells produce

antibodies, soluble effector molecules which recognize molecular shapes of antigens. The so called gama beta T cells use their cell surface gama beta T cell receptors generally to recognize molecular shapes on other cell surfaces. The alpha beta T cells use their alpha beta T cell receptors to recognize antigen bound to so called MHC molecules, cell surface proteins most of which are encoded in the major histocompatibility complex or similar regions. The antigen is usually in the form of a peptide derived from proteins by intracellular degradation, but in some cases can be a lipid. The antibody from B cells can be very effective against extracellular pathogens but the T cells are constrained to bind antigen on the surface of cells, in general for the detection of intracellular pathogens.

The hallmark of these lymphocyte receptors is that their genes are not present in their final forms within germ line and most somatic cells, but are created in lymphocytes by various mechanisms of DNA modification, resulting in a vast repertoire of receptors with different recognition specificities. Generally, there us a single such receptor expressed on each cell so that the receptor repertoire is distributed clonally. These clones are subject to a variety of controlling mechanisms to avoid too much recognition of self. As the first control, alpha beta T cells develop in the thymus where a vast number of thymocytes undergo positive selection to ensure that each selected thymocute binds to self–MHC molecules present with sufficient affinity to be useful later. Then the positively selected thymocytes undergo negative selection to ensure that surviving thymocytes do not interact too strongly with those same MHC molecule bund to self peptides. The processes in the thymus are intended to result in a TCR repertoire that can recognize self-MHC molecules but not when bound to self peptides. There are several other such tolerance mechanisms which operate once the T cells leave the thymus [2,3].

Some jawless fish also appear to have an adaptive immune with many similarities to the familiar adaptive immune system of jawed vertebrates. Lampreys and hagfish lack genes with the characteristics of antibodies, T cell receptors and MHC molecules but instead have variable lymphocyte receptors which are also diversified in somatic cells. Indeed, cells with transcriptomes much like B lymphocytes secrete VLR-B molecules, while cells that bear cell surface VLR-A and VLR-C molecules travel to the tips of the gill arches, spending time in the so challed thymoids which have some characteristics of the thymus of jawed vertebrates. Thus, it would appear that a cellular immune system that differentiated self and non-self molecules existed in the common ancestor of jawless fish and jawed vertebrates although the presence of molecules analogous to MHC molecules has been still under-research [4,5].

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