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By: Vlad Tarko, Senior Editor, Sci-Tech News

The Alternative Immune System

Antibodies and T-cells on one hand, VLR proteins on the other

Some 450 million years ago, both jawed and jawless vertebrates began relying on cells called lymphocytes to support the burgeoning adaptive immune system. But within the lymphocytes from the two types of animals, very different mechanisms evolved to reach very similar ends. Researchers have recently discovered that the sea lamprey, a modern representative of ancient jawless vertebrates, fights invading pathogens by generating up to 100 trillion unique receptors. These receptors, referred to as VLRs, are proteins and function like antibodies and T-cell receptors, sentinels of the immune system in all jawed vertebrates, including humans.The researchers found that as in jawed vertebrate immune systems, the diversity of the VLR proteins occurs when thousands of genetic modules go through multiple rounds of random mixing, insertion and deletion. Each new VLR gene functions as a blueprint for the corresponding VLR protein. In case of our type of vertebrates antibodies are randomly produced, each antibody being "glued" to a certain cell, called B cell, and when a certain antibody proves to be capable of destroying a certain bacteria, the B cells multiply in great numbers; the T cells (a certain type of lymphocytes) then "eat" the B cells and the bacteria carried by the B cell. In case of lampreys the VLR proteins which are capable of destroying a certain bacteria are then produced in large numbers, and the lymphocytes then eliminate the immunized bacteria. Thus, through a mixture of chance and necessity, both jawed and jawless vertebrates stay ahead of the pathogens in their ever-evolving battle.To test the adaptability of this alternative immune mechanism, the researchers immunized lampreys with the anthrax-causing bacterium, a pathogen not normally encountered by fish of any type. Within four weeks, the lamprey immune system had recognized the spores as foreign and responded by producing anthrax-specific VLR proteins that circulated throughout its body."By understanding the development and role of the lamprey immune system we can learn about our own immune system and how it functions," said Zeev Pancer from the University of Maryland. "Comparing these two systems is an unparalleled way to look at a basic biological process and also may hold promise for novel diagnostic tools."*Photo Credit: Ulrike Klenke and Zeev Pancer, Center of Marine Biotechnology, UMBI, Baltimore, Md.*