

The Innate Immune System

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The innate immune system is found in nearly all organisms. It is a non-specific reaction to pathogens and chemicals. In birds and mammals it also initiates and helps presents pathogens to the acquired immune system. The acquired immune system is the system that produces antibodies and maintains a memory of the pathogen for possible future infections.

The innate immune system is quite complex though. It involves things like starting the inflammation process from damaged cells which will bring in other immune cells including those of the acquired system. It also involves non-specific chemicals that can kill pathogens, RNAi in a cell that can stop DNA expression in a virus infected cells, immune cells that literally attack and consume pathogens, genetic expression of mutant genes that inhibit pathogens like in sickle cell anemia and a mutation that prevents pathogens from entering a cell because of a different structure to the cell membrane.

In jawed animals with an acquired immune system the innate system is the way that antigens (pathogens or parts of pathogens) are presented to the acquired system so it can start things like the antibody cascade.

Inflammation is cause primarily by parts of damage cells. When cells are invaded or damaged they release a class of lipid (fatty) compound called prostaglandins. Some of those bring in mast cells which release histamines (causing the burning sensation in inflammation) and directly swell and open blood vessels to bring fluids into the area along with quite a few other processes part of inflammation. Non-steroidal anti-inflammatories like aspirin bind to prostaglandins which in turn slows down the inflammation process and reduces symptoms like pain. Tylenol acts on a different group of prostaglandins to reduce pain. But they don't stop things like fluid and histamine release like the line of prostaglandins that non-steroidal work on. Once the chemistry like prostaglandins are released other things like macrophages, dendritic cells along with a number of other immune cells are attached to the area.

These non-specific immune cells have receptors on their cell membranes that recognize foreign substances and pathogens and some like macrophages release compounds like cytokines that are used as signaling chemicals to start other immune responses. Some of these cells actually will present antigens to the acquired immune system.

These chemical signals will turn on the compliment system which triggers things like the liver to make chemicals to kill pathogens to triggering other immune cells to turn on and help start up the acquired system. The compliment system is quite broad and compliments the normal innate immune system and aquired system. One of the main parts to this is to help clear the host of the dead pathogens. It is a non-specific reaction and is there for part of the innate system.

The classes of innate immune cells are leukocytes (which include mast cells, natural killer cells, eosinophils and cells that eat other cells like macrophages and dendritic cells. They are also called white blood cells. They are produced in the bone marrow and are independent cells that are free floating in the blood ready to react to any pathogen. Dendritic cells main function is to present antigens to the acquired system.

Actually the clotting mechanisms in an organism are part of the innate immune system. They start the barrier system back up again and are no-specific. Plus in platelet aggregation there is a chemical

released that is cytotoxic to some bacteria.

There are many other minor parts to the innate system like I mentioned about i-RNA. i-RNA is mainly used by a cell to regulate DNA expression. They are very short to short base pair RNA (2 to around 20 base pairs) It is thought they can be helpful with virus infections and cancers. Virus infect individual cells and turn the cell into making copies of themselves. Normally when the virus has reached enough copies they break the cell membrane of the host cell and kill it. There are a class of virus' that are called retrovirus'. They can make a DNA copy of themselves and insert themselves into the host DNA chain. When there are the right chemical in the cell such as some that are produced from cellular stress the virus cuts itself from the DNA and cause an infection. Shingles and cold sore virus' are examples of these.

Many pathogens have developed methods to get around the innate system. Some can release chemicals to kill cells of the innate system. Some will release chemicals that make the innate system cells think the pathogen is part of the host and like fungus can do sometimes they produce a biofilm around themselves that prevent any further action by the immune system. Some types of bacteria like salmonella can insert themselves in host cells and hide from the immune system. I believe that vaccines can help in these kinds of cases because it doesn't rely on the innate system to be turned on first.

Again, all of these processes take a lot of energy. So proper diet and such are again very important part of healthy birds.