Defending Against Influenza
How our Body Protects Itself

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Avian Flu: Are we at risk?
- Occurs naturally among birds (eg: chickens, ducks)
- Contagious among birds as the virus is shed in saliva, nasal secretions and feces
- Influenza strain H5N1, currently in the news, is lethal to birds
- Human infection with H5N1 has occurred (in China, Turkey)
- These persons were in direct contact with infected birds
- At present, person-to-person infection has not occurred
- However, the virus is constantly mutating, so cross-species transfer is possible in the future
- There is currently no vaccine available for the virus, but scientists are working to develop one

H3N1 to H5N1: What Makes Flu Viruses Different?
- Flu has Hemagglutinin protein, which fits into MHC II to alert T-Cells
- Hemagglutinin can mutate so it no longer fits into MHC II
- New names are assigned given enough mutation, such as the H3 (common flu) and H5 (Avian flu) shown below

H3 - PRO LYS TYR VAL LYS GLN ASN THR LEU LYS
H5 - PRO LYS TYR VAL LYS SER GLY ARG LEU VAL

Influenza Virus

The Immune Response System

Step 1
The influenza virus, Orthomyxoviridae, approaches a macrophage and docks onto the cell surface, causing the macrophage to endocytose the virus into a vesicle.

Step 2
The virus's proteins are divided into smaller peptides by enzymes contained within the vesicle.

Step 3
A peptide from these digested proteins fits into the peptide docking site of a MHC II protein.

Step 4
The vesicle membrane rejoins with the cell membrane, embedding the MHC II protein and peptide on the cell surface.

Step 5
As a T cell makes contact with the macrophage, a T Cell Receptor (TCR) may bind to the MHC II protein, identifying the virus and initiating an immune response.

Abstract
T cells play a vital role in immune responses. Each T cell has a unique receptor (TCR) that can recognize a fragment of a pathogen such as a virus or bacteria. Class II Major Histocompatibility Complex (MHCII) proteins, antigen presenting cells (APC), and B cells are also integral to the immune response. In the first step of this immune response, the APC "swallows" the pathogen through endocytosis and digests it. Next, the MHC II accepts a digested peptide fragment of the pathogen and carries it to the surface of the APC, where the MHCII displays the antigen, which will be examined by the TCR. If the T cell receptor is able to bind to the antigen containing MHCII, the T cell responds to the foreign substance by generating growth and maturation signals stimulating B cells to become antibody factories to fight the pathogen.

Conclusion
As a recurrent theme of the recent news media, Avian Flu is the focus of much current scientific research. The 1918 Flu (H1N1) and the Hong Kong Flu (H3N2) are just a few of the many pandemics that occurred because the MHC II molecule was unable to bind to the peptide and MHC II complex, resulting in no immune response. A difference of just a few side chains may trigger massive consequences for humans. Hopefully, through better understanding of our body's immune response we can keep Avian Flu from unleashing the massive destructive power a few mutations could provide.