September 28, 2011
How to spot a virus: The origins of an immune response

Introduction:

Throughout our lives we have been trained to avoid germs. We use antibacterial soaps, cook meat to a specific temperature and try to avoid being sneezed on while riding the T. Even so, our bodies are exposed to plenty of bacteria and viruses that could make us sick every day. So why aren't we sick all the time? We have our remarkable immune system to thank! This lecture will explore how our immune system is able to sense when we have been exposed to foreign invaders and how it responds by mounting an attack using our immune cells. We will then talk about how vaccines work and discuss some of the ways scientists used their knowledge of the immune system to design new types of vaccines to fight cancer.

Topics and Speakers:

The eyes of the immune system:
Kevin Bonham is a fourth year student in Harvard's Immunology PhD program and studies the interface between microbes and the mammalian immune system. Specifically, he studies a class of receptors on the surface of immune cells that are able to detect the presence of bacteria, viruses and fungi. When not doing science, he is typically climbing rocks, hiking trails, or blogging about science at scienceblogs.com/webeasties.

Different pathogens, different responses:
Sky Brubaker is a fourth year PhD student in the Biological and Biomedical Sciences Program. His research focuses on innate immunity, and how a cell determines that it has become infected with a virus. Sky grew up in California and earned his bachelor's degree from UC Berkeley. When he is not in the lab, Sky enjoys cooking, running, and sailing (simultaneously).

Instructing the innate immune system to make better vaccines:
Jillian Astarita is a third year student in Harvard's Immunology PhD program. She studies the structural cells that make up the lymph nodes and spleen and how they interact with immune cells. Jillian is originally from New Jersey and attended Swarthmore College for her undergraduate studies. When she's not working in the lab, Jillian enjoys biking, playing ultimate frisbee, and hiking.

Join us for a tour of an immunology laboratory following the lecture

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Thank you for attending our fall lecture series! We hope to see you in the future!
http://sitn.hms.harvard.edu

Glossary:

Immune system – The network of cells and organs within our body that works together to identify and fight foreign invaders such as viruses, bacteria and large parasites like worms.

Pathogen – Like the "germs" you've heard so much about, this refers to an infectious agent that can cause disease in an infected animal.

Immunity – The state of having enough biological defenses to avoid disease.

Cell membrane – This is essentially the "skin" of a cell. It is a barrier between the environment outside of the cell and the inside of the cell.

Vesicle – A small compartment within a cell that is surrounded by a membrane.

Receptor – A protein found within a membrane that is able to sense specific molecules on one side of the membrane and send information to the other side of the membrane.

DNA (deoxyribonucleic acid) – A molecule located within the nucleus of a cell that stores genetic information and codes instructions for how to build proteins.

Gene – A segment of DNA that has all of the information to make one protein.

RNA (ribonucleic acid) – A molecule that is made from copying the DNA in the nucleus and then sent as a message into the cytoplasm where proteins are made.

Protein – A molecule, encoded by DNA and made up of amino acid building blocks, that is the molecular machinery that carries out a particular function within a cell.

Cytokines – Proteins that are released from a cell that detects a pathogen to signal to other cells within the immune system.

Innate immune system – The first response portion of the immune system that detects general features of pathogens to alert the rest of the immune system of an attack.

Adaptive immune system – The part of the immune system containing cells that are customized during an infection to specifically fight the invading pathogen. Cells in this system make antibodies that help fight off the infection and are responsible for giving us long-term immunity so we do not become infected in the future.

Phagocyte – An immune cell with the ability to internalize and kill bacteria and harmful foreign particles.

Antigen – A molecule on a pathogen that triggers the production of specific antibodies by the immune system.

Antibody – A Y-shaped protein that is specific for binding one antigen and can neutralize the pathogen so it cannot infect cells or mark it for efficient killing by cells of the immune system.

Vaccine – A mixture of biological material that triggers the immune system to develop immunity to a disease.

Adjuvant – A type of molecule that is included in vaccines to stimulate the innate immune system that can then trigger the adaptive immune system to make cells that will result in long-term immunity to the disease.

Dendritic cell – A type of cell that is part of the innate immune system and is good at detecting a foreign antigen and alerting cells of the adaptive immune system to respond. Scientists are developing vaccines using these cells to train the immune system to fight certain types of cancer.

For more information:

- Understanding science: http://undsci.berkeley.edu/
- Overview of the immune system: http://www.cancer.gov/cancertopics/understandingcancer/immunesystem
- Pathogens that cause common infectious diseases: http://medicalcenter.osu.edu/patientcare/healthcare_services/infectious_diseases/immunesystem/Pages/index.aspx
- Immune System Defender Game: http://www.nobelprize.org/educational/medicine/immunity/
- History of vaccines: http://www.historyofvaccines.org
- Research news in immunology: http://www.sciencedaily.com/news/health_medicine/immune_system/