How your Body Defends against the Avian Flu Virus

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How to become resistant to getting Flu

- Actually getting sick
  - No fun
- Getting vaccinated
  - Live/attenuated virus (grown in chicken eggs)
    - Allergy responses to chicken proteins
    - Chance of getting sick
  - Dead virus (whole)- safe
  - Parts of virus-safe

H5N1 Avian Virus- showing spikes (antigens) **H**emagglutinin (5) and **N**euraminidase (1)

World Health Organization

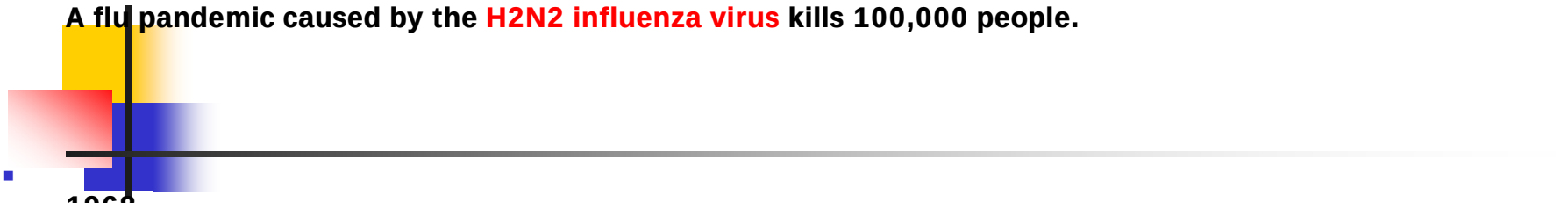
Cumulative Number of Confirmed Human Cases of Avian Influenza A/(H5N1) Reported to WHO

29 November 2006

Country	2003		2004		2005		2006		Total	
	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	death
Azerbaijan	0	0	0	0	0	0	8	5	8	5
Cambodia	0	0	0	0	4	4	2	2	6	6
China	1	1	0	0	8	5	12	8	21	14
Djibouti	0	0	0	0	0	0	1	0	1	0
Egypt	0	0	0	0	0	0	15	7	15	7
Indonesia	0	0	0	0	19	12	55	45	74	57
Iraq	0	0	0	0	0	0	3	2	3	2
Thailand	0	0	17	12	5	2	3	3	25	17
Turkey	0	0	0	0	0	0	12	4	12	4
Viet Nam	3	3	29	20	61	19	0	0	93	42
Total	4	4	46	32	97	42	111	76	258	154

- **1918**
  The Spanish Flu pandemic, caused by the H1N1 influenza virus, also an avian strain, kills an estimated 20 million to 50 million people worldwide, including roughly 550,000 in the United States.

  1957
  A flu pandemic caused by the H2N2 influenza virus kills 100,000 people.



- **1968**
  A flu pandemic caused by the H3N2 influenza virus kills 700,000 people. Both H2N2, which caused the 1957 pandemic, and H3N2 are likely to have arisen after an exchange of genes between avian and human flu viruses.

  May 1997
  The bird flu virus known as H5N1 is isolated for the first time in a human patient in Hong Kong. The virus infects 18 patients who had close contact with poultry, resulting in six deaths. Fortunately, the virus does not spread from person to person. Within three days, Hong Kong's entire chicken population is slaughtered to prevent further outbreak.

  Sept. 1998
  Positive trial results are announced for two new drugs, Relenza and Tamiflu, that target the influenza virus.

  Jan. 1999
  Relenza and Tamiflu are licensed for sale in the United States and Europe.

  March 1999
  Two children in Hong Kong are diagnosed with avian influenza caused by the strain H9N2, a milder strain than H5N1. Both patients recover and no other cases in Hong Kong are confirmed. Mainland China reports several additional cases caused by H9N2 during the same time frame.

  Jan. 2001
  The World Health organization outlines a new global plan to improve the range, speed and quality of influenza virus surveillance.
- **Sources: CDC; WHO**

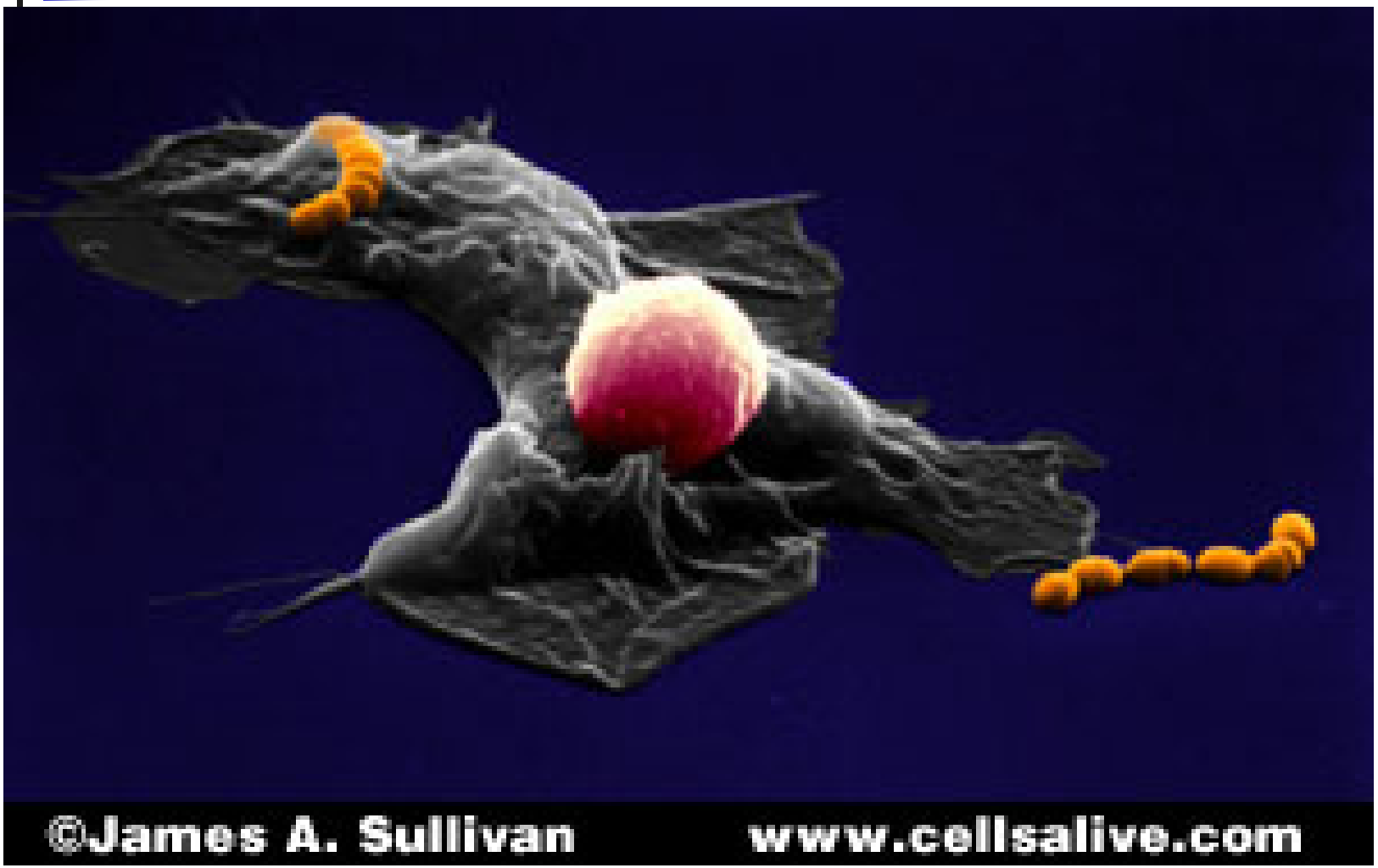
Immune System Response

- Two types of responses
  - B lymphocytes (humoral response)
    - Make antibodies that are able to block infectivity of virus
  - T lymphocytes (cellular response)
    - Are able to attack virally infected cells and kill the host factories that make more viruses
      - T helper cells- cytokine production (IL-2)
      - T cytotoxic cells- killer cells

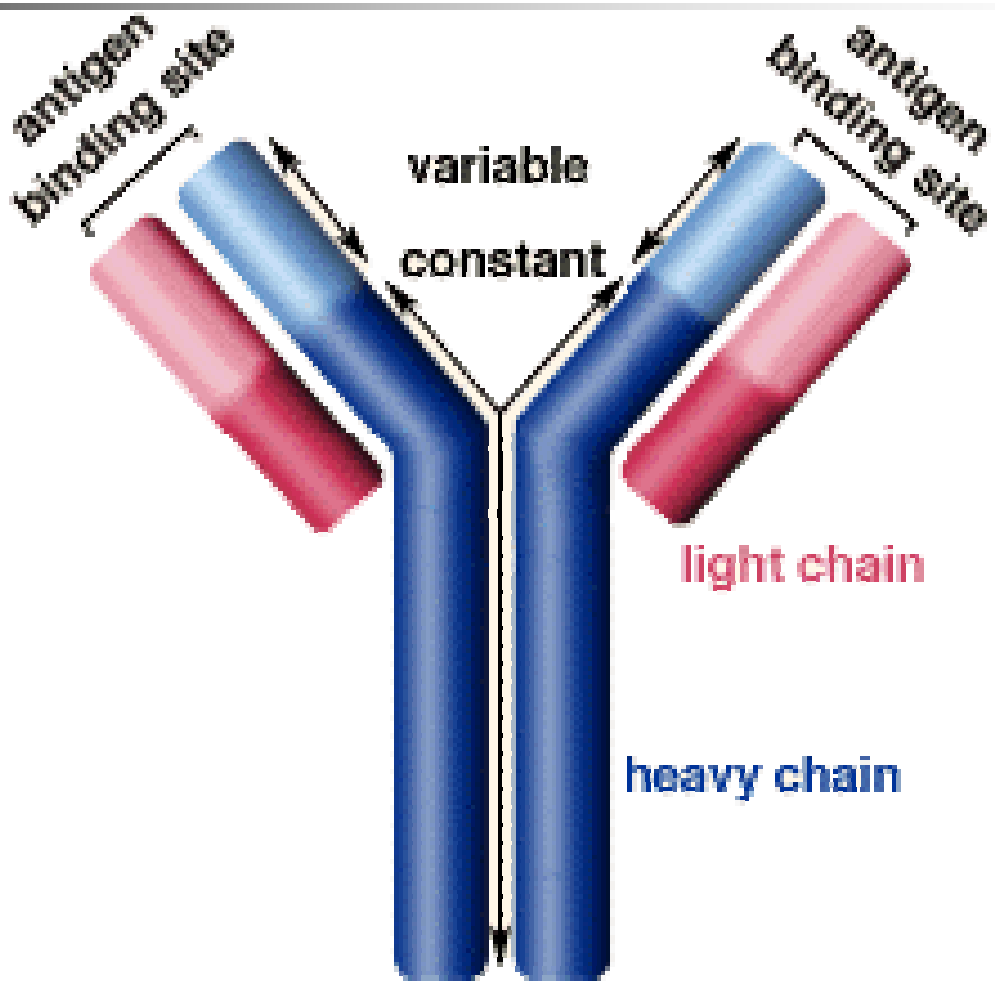
How T cytotoxic cells kill

- http://www.maxanim.com/immunology/Cytotoxic%20T%20Cell/Cytotoxic%20T%20Cell.htm

Macrophage/Lymphocyte/ and Bacteria



Structure of an Antibody (Ig)



Viral Neutralization by Antibody

- http://student.ccbcmd.edu/courses/bio141/lecguide/unit5/humoral/abydefense/neutvirus/nvir.html

Vaccine

- There is currently no vaccine to the Human H5N1 influenza virus or to the H9N2 strain
  - This is being worked on
  - Need to get strain that is infectious for human-to-human transfer to be most effective at fighting potential pandemic
  - Can vaccinate against bird-to-human, but will not prevent pandemic
    - May be beneficial in places where there is a high level of bird-to-human illness

Things to do to prevent spread human-to-human

- *1. To plan for a pandemic:*
- **Store a supply of water and food. During a pandemic, if you cannot get to a store, or if stores**
- **are out of supplies, it will be important for you to have extra supplies on hand. This can be**
- **useful in other types of emergencies, such as power outages and disasters. Enough to last about 3 weeks.**
- **Have any nonprescription drugs and other health supplies on hand, including pain relievers,**
- **stomach remedies, cough and cold medicines, fluids with electrolytes, and vitamins.**
- **Talk with family members and loved ones about how they would be cared for if they got sick,**
- **or what will be needed to care for them in your home.**

- ***2. To limit the spread of germs and prevent infection:***
- **Teach your children to wash hands frequently with soap and water, and model the correct**
- **behavior.**
- **Teach your children to cover coughs and sneezes with tissues, and be sure to model**
- **that behavior.**

Items to have on hand for an extended stay at home:

- Ready-to-eat canned meats, fruits, vegetables, and soups
- Protein or fruit bars
- Dry cereal or granola
- Peanut butter or nuts
- Dried fruit
- Crackers
- Canned juices
- Bottled water
- Canned or jarred baby food and formula
- Pet food
- Prescribed medical supplies such as glucose and blood-pressure monitoring equipment
- Soap and water, or alcohol-based hand wash
- Medicines for fever, such as acetaminophen or ibuprofen
- Thermometer
- Anti-diarrheal medication
- Vitamins
- Fluids with electrolytes
- Cleansing agent/soap
- Flashlight
- Batteries
- Portable radio
- Manual can opener
- Garbage bags
- Tissues, toilet paper, disposable diapers

- **Vaccines and Antiviral Drugs in Pandemic Preparedness**
- **Arnold S. Monto***
*University of Michigan School of Public Health, Ann Arbor, Michigan, USA

- While measures such as closing schools and social distancing may slow the effects of pandemic influenza, **only vaccines and antiviral drugs are clearly efficacious in preventing infection or treating illness. Unless the pandemic strain closely resembles one already recognized, vaccine will not be available early**. However, studies can be conducted beforehand to address questions concerning vaccine dose, frequency of inoculation, and need for adjuvants. **In contrast, antiviral drugs, particularly the neuraminidase inhibitors,** will be effective for treatment and available if stockpiling takes place. Special questions need to be answered if a highly lethal virus, such as influenza A (H5N1), produces the pandemic. Both vaccines and antiviral drugs will be required for a coordinated strategy.

Vaccine Production in Cells

- For decades, vaccines have provided effective protection from influenza for Americans. While they have traditionally been produced in chicken eggs, a new technology-cell-based vaccine production-could save hundreds of thousands of lives in the event of an outbreak of pandemic influenza, or some other infectious disease.

- The new approach would use mammalian cells (kidney cells are often used) to grow the influenza viruses. Cell-based vaccine production could more easily meet "surge capacity needs" because cells could be frozen and stored in advance of an epidemic or developed rapidly in response to an epidemic. Cell-based vaccine production dramatically reduces the possibility for contamination and promises to be more reliable, flexible, and expandable than egg-based methods.

Influenza drugs- Possible resistance to drugs

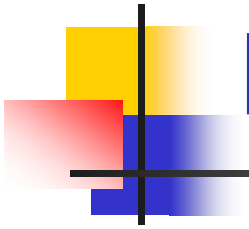
- Amantadine is approved for treating and preventing uncomplicated influenza A virus infection in adults and children who are 1 year of age or older.
- Rimantadine is approved for treating and preventing uncomplicated influenza virus A infection in adults and for preventing, but not treating, such infections in children.
- Zanamivir is approved for preventing influenza A and B virus infections in people 5 years of age and older and for treating uncomplicated influenza virus infection in people 7 years of age and older who have not had symptoms for more than 2 days.
- Oseltamivir is approved for treating uncomplicated influenza virus infection in people 1 year of age or older who have not had symptoms for more than 2 days. A pediatric liquid formulation is available for oseltamivir. Oseltamivir also is approved for preventing influenza A and B in people 1 year of age and older.

Influenza drugs- do they help?

- Studies have shown that all four drugs can reduce the duration of flu symptoms by 1 day if taken within 2 days of the onset of the illness. There is no information about how effective these drugs are if treatment is started more than 2 days after onset of flu symptoms.

- When taken as directed to prevent the flu, oseltamivir can significantly reduce your chance of getting the disease if there is a flu outbreak in your family or community.

- Amantadine and rimantadine have been reported to prevent the spread of influenza A outbreaks primarily in nursing homes. If someone in your family is diagnosed with influenza, taking one of these drugs may reduce your chances of getting the disease.



Presentation on the web:

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