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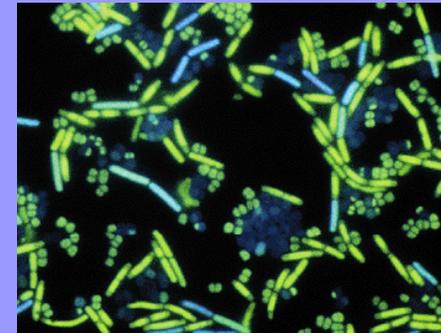
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BIOLOGICAL AGENTS AND TOXINS

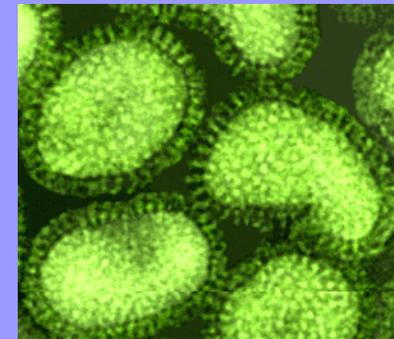


Types of Biological Agents

- Bacteria
 - *B. anthracis*
 - *Y. pestis*
- Viruses
 - Influenza virus
- Toxins
 - Ricin toxin
 - Botulinum toxin



Bacterial cells



Influenza virus



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Bacteria

- Most can reproduce without a host
- Found in the environment
- Not all bacteria cause disease
- Treated with antibiotics



B. anthracis



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Viruses



Ebola Virus

- Require host to replicate
- Infect animals, plants, insects, and bacteria
- Cannot be treated with antibiotics
- Vaccines are available for some viruses
- Limited antiviral therapies



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Biological Toxins

- Protein
 - Can be produced by bacteria, animals, insects, plants
- More toxic by weight than many chemical agents
- Can not replicate
- Not transmissible
- Cannot be treated with antibiotics
- Few anti-toxins are available



Ricinus communis



Castor beans



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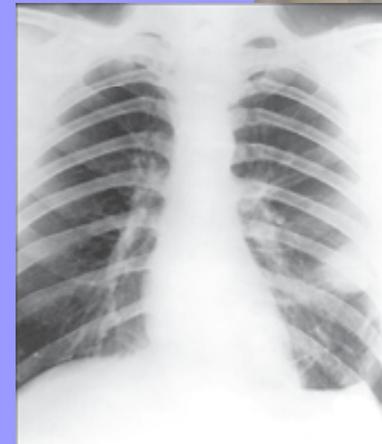
Sources of Biological Agents

- Pharmaceutical industry
- Hospitals
- Clinics
- Veterinary hospitals
- Research laboratories in universities
- Disease outbreaks
- Environment



Bacteria: *Francisella tularensis*

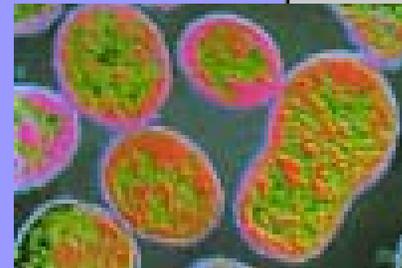
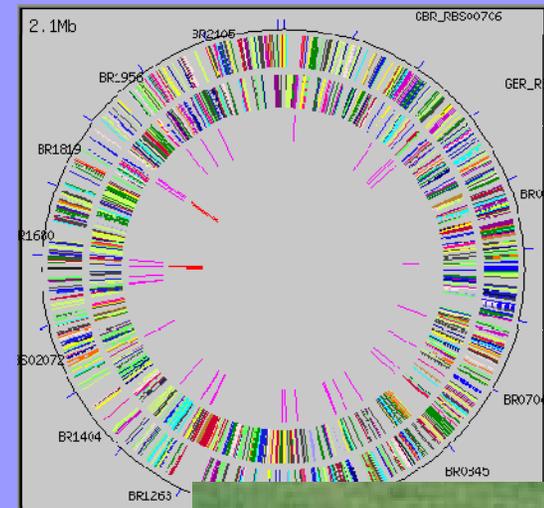
- Tularemia (“rabbit fever”)
 - Ulceroglandular
 - Gastrointestinal
 - Pulmonary
- Zoonotic
- Distribution
 - North America, Europe, Middle East, Russia, and Japan
 - Rare in UK, Africa, Central and South America
- Persists in water but sensitive to UV radiation and oxidation
- ID₅₀: 10 – 25 organisms by respiratory routes
- Mortality rate: less than 20%
- Antibiotics





Bacteria: *Brucella* spp.

- Brucellosis
- Zoonotic
- Wide distribution
 - South America, Central America, Eastern Europe, Asia, Africa, Middle East
- Stable
- 6 species; 4 cause disease in humans
- ID₅₀: 10 – 100 organisms
- Low mortality
- Treatment: Antibiotics





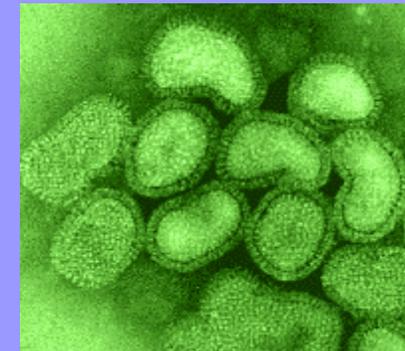
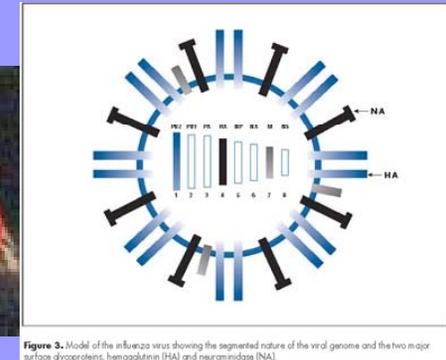
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Viruses: Avian Influenza H5N1 Virus

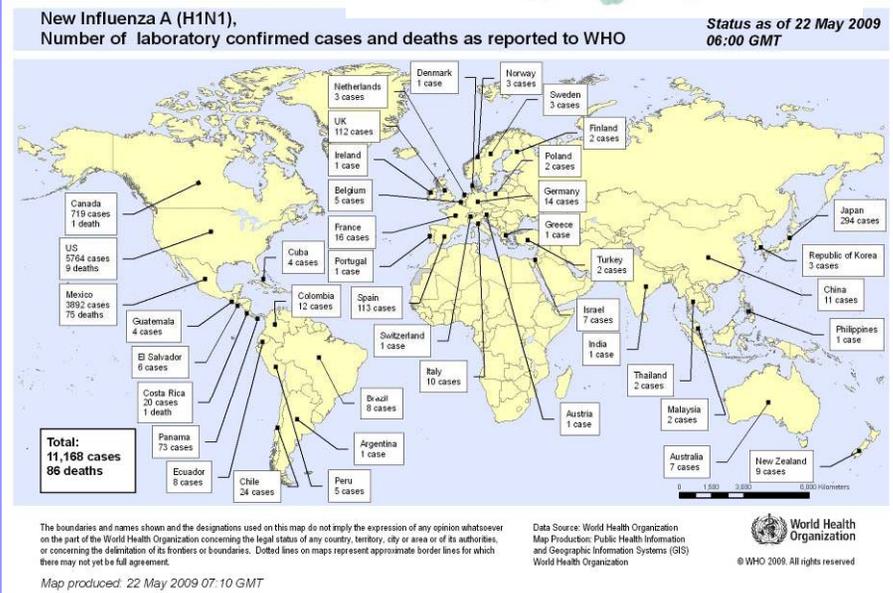
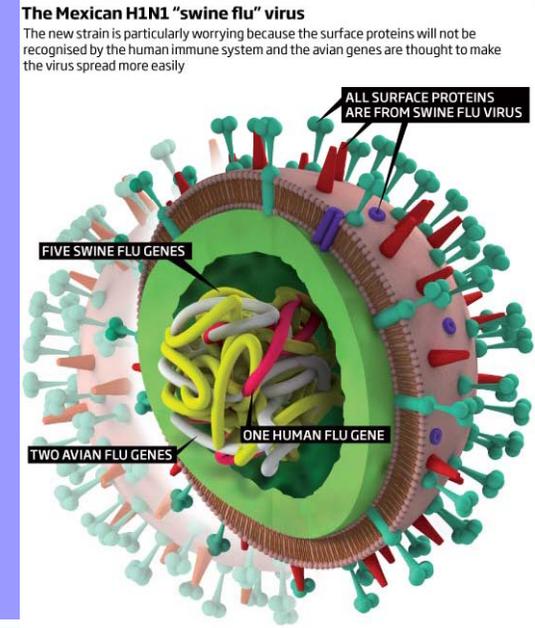
- Highly Pathogenic Avian Influenza (HPAI)
- Zoonotic
- Distribution
 - Spreading rapidly in environment
- Relatively unstable
- Highly infectious in poultry; currently limited infectivity in humans
- Vaccine for animals available; human vaccine under development
- Treatment for humans:
 - Oseltamivir
 - Zanamavir





Viruses: "Swine Flu Virus"

- Novel influenza A (H1N1) virus
 - "Swine flu" (of swine origin)
- Zoonotic: Swine
- Distribution
 - Global distribution
- Relatively unstable
- Human to human transmission
 - 0.8-1.0% mortality (05/22/09)
- Vaccine: No
- Treatment for humans:
 - Oseltamivir
 - Zanamavir





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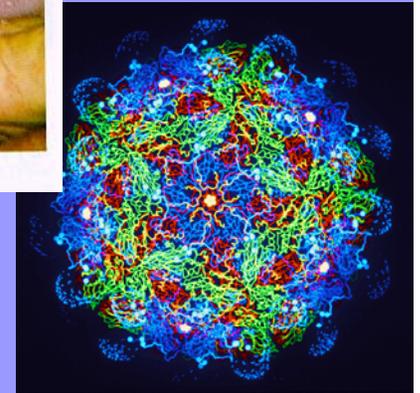
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Viruses: Foot-and-Mouth Disease Virus

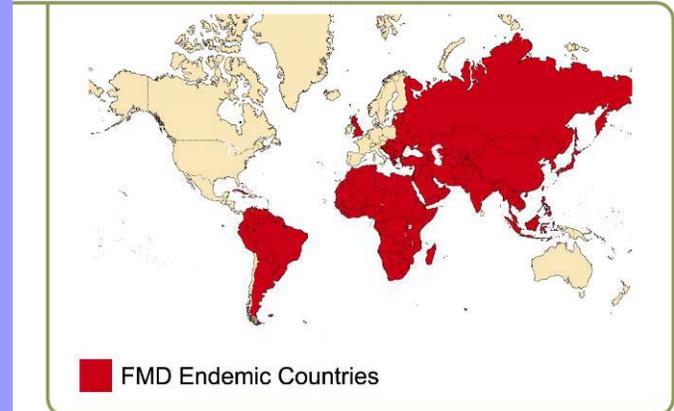
- Foot-and-mouth disease
- Animals primarily
- Wide distribution
 - South America, Europe, Asia, and Africa
- Very stable
- Highly infectious for cattle
 - $ID_{50} < 10$ virions
- High morbidity; low mortality for adult animals (< 5%)
- Vaccine



18 Ruptured vesicle on bovine tongue.



Foot and Mouth Disease





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Proteins: Botulinum toxin

- Botulism
- Produced by *Clostridium botulinum*, *C. baratii*, and *C. butyricum*
 - Multiple types of toxin: A, B, C, D, E, F, G
 - Only A, B, E, and F produce human disease
- Zoonotic
- Degraded by heat and humidity – relatively stable for a protein
- LD₅₀: 0.001 µg/kg
- Treatment
 - Antitoxin (limited supplies)
 - Supportive care

