Biological Hazards

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Origin of HACCP

- Development of foods for the space program
- NASA had two principal safety issues:
  - Potential problems with food particles in zero gravity
  - Absolute assurance of freedom from pathogens and biological toxins

Biological Hazards

- Types of food-borne disease can be classified as either infection or intoxications.
- Codex classifies feed biological hazards as:
  - Bacterial (*Salmonella, Brucella*)
  - Endoparasites (Toxoplasma and Taenia spp.)
  - Prions

Zoonotic Diseases

- Diseases transmissible from animal to humans

Food-borne Diseases (CDC)

- In 1999
  - 76 million cases per year
  - 325,000 hospitalizations
  - 5,000 deaths
- Current statistics by FDA
  - 48 million cases
  - 128,000 hospitalizations
  - 3,000 deaths

(Source: http://www.fda.gov/Food/ResourcesForYou/Consumers/ucm103263.htm)

Hazard Guide

- Elements include:
  - Disease, symptoms and onset
  - Source
  - Transmission
  - Characteristics of microorganism
  - Control

Zoonotic Pathogens in Feed

- Bacteria
  - *Salmonella spp*
  - *Brucella*
  - *Listeria monocytogenes*
- Endoparasites
  - *Toxoplasmosis*
  - *Taenia*
  - *Trichinellosis*
- BSE

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Food-borne Illness Associated with Animal Feed

- Numerous examples of outbreaks of *Salmonella* infections in animals that were traced to contaminated feeds including cattle, pigs, chickens, turkeys, and mice
- Although it is less well documented, bacteria that cause humans infections but may not cause illness in animals can also be readily transmitted to food animal via contaminated feed and appear on animal carcasses destined for human consumption

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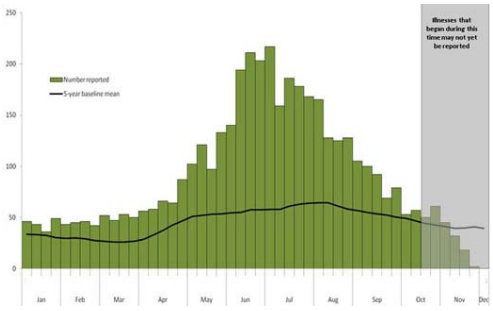
Investigation Update: Multistate Outbreak of Human *Salmonella* Enteritidis Infections Associated with Shell Eggs

- July 2010, CDC identified a nationwide sustained increase in the number of *Salmonella* Enteritidis isolates with PFGE pattern JEGX01.0004
- Wright County Egg in Iowa was found as the common source of the shell eggs associated with four of the clusters. Through traceback and FDA investigational findings, Hillandale Farms of Iowa
- The feed was provided to pullets (young female chickens or hens) raised at Wright County Egg facilities in Iowa
- Number of *Salmonella* Enteritidis cases matching PFGE pattern JEGX01.0004 reported to PulseNet, United States, 2010



(Source: http://www.cdc.gov/salmonella/enteritidis/)

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FDA Guidance Documents

Guidance for FDA Staff

Compliance Policy Guide
Sec. 690.800 *Salmonella* in Food for Animals

This guidance represents the Food and Drug Administration's (FDA's) current thinking on this topic. It does not create or confer any rights for or on any person and does not operate to bind FDA or the public. You can use an alternative approach if the approach satisfies the requirements of the applicable statutes and regulations. If you want to discuss an alternative approach, contact the FDA staff responsible for implementing this guidance. If you cannot identify the appropriate FDA staff, contact the Office of Regulatory Affairs at the address listed on the title page of this guidance.

(Source: http://www.fda.gov/downloads/iceci/compliancemanuals/compliancepolicyguidancemanual/ucm361105.pdf)

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Salmonella-Contaminated Animal Feed – Serotypes Pathogenic to Animals

The following are some examples of animal feeds and the pathogenic *Salmonella* serotypes that have been associated with disease in the particular animal species consuming these feeds:

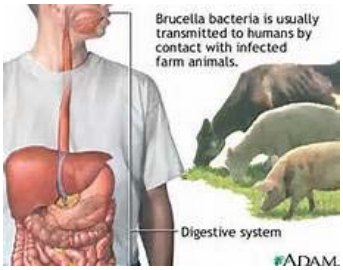
- Poultry feed with *Salmonella* Pullorum, *Salmonella* Gallinarum, or *Salmonella* Enteritidis
- Swine feed with *Salmonella* Choleraesuis
- Sheep feed with *Salmonella* Abortusovis
- Horse feed with *Salmonella* Abortusequi
- Dairy and beef feed(s) with *Salmonella* Newport or *Salmonella* Dublin

Salmonellosis

Brucella

Brucella spp. are small, Gram-negative, short, non-sporeforming coccobacilli. Members of the genus *Brucella*, of which there are six recognized species, belong to a class of Proteobacteria.

In countries where *Brucella* is endemic, pasture may be contaminated by ruminants which deliver or abort offspring there, because the placentas of infected animals contain high levels of these microorganisms. Milk-producing animals may become infected by eating forage from contaminated pastures and excrete the microorganisms in their milk. This milk may be a risk to human health if not pasteurized prior to use.



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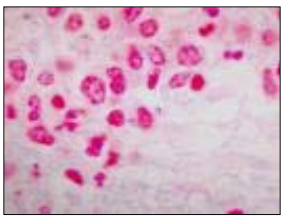
Listeriosis



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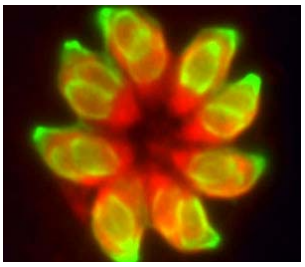
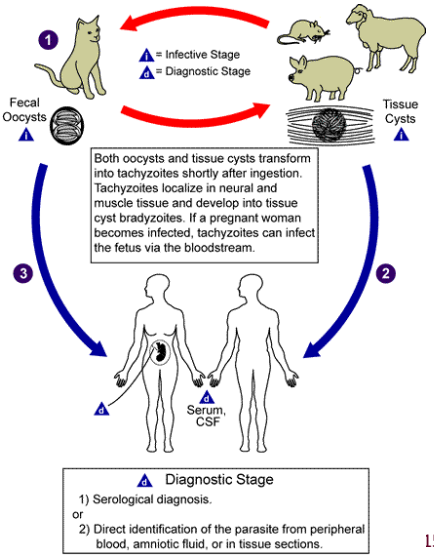
Toxoplasmosis





Diagnostic Stage
1) Serological diagnosis.
or
2) Direct identification of the parasite from peripheral blood, amniotic fluid, or in tissue sections.

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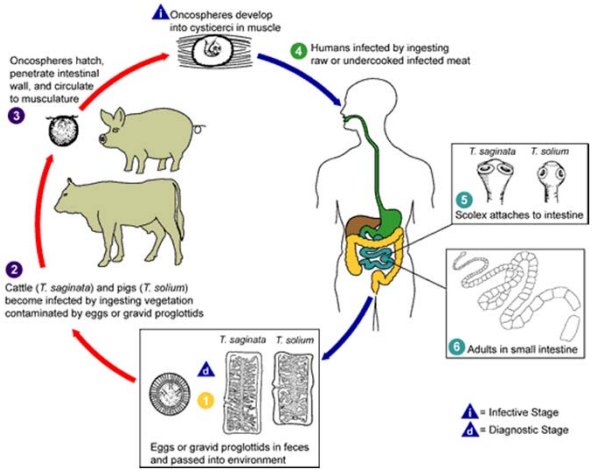
Taeniasis



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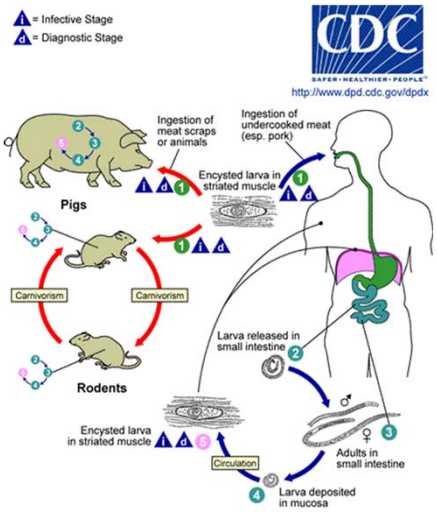
Trichinellosis



Bovine Spongiform Encephalopathy (BSE)

(Source: http://www.aphis.usda.gov/lpa/issues/bse/bse_photogallery.html)

Control of Pathogenic Organisms

- Prevent contamination of feed
  (keep it out)
- Destroy food-borne disease agent
  (kill it)
- Prevent multiplication of food-borne disease agents
  (control it)

Control Measures

- Conditioning temperature and time
- Application of microbial control agents
- Receiving (serological test)

Resistance of Bacteria

- Non-sporeformers
  - Sensitive to heat, chemicals, and other treatments
- Examples:
  - *Salmonella*
  - *L. monocytogenes*
  - *E. coli 0157:H7*
- Sporeformers
  - Resistant to heat, chemicals, and other treatments
- Examples:
  - *C. botulinum*
  - *C. perfringens*

Summary

- HACCP originated as a part of the US space program and this effort focused on controlling the entire process of manufacturing food to eliminate biological hazards
- There are an estimated 48 million cases of food-borne disease annually in the US
- Hazard guides for many HACCP regulated products

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