

Farm to Fork Food Safety and Food Defense

Erin Dormedy, Ph.D.
Associate Professor
Food Science Program
California State University, Fresno



Foodborne Disease in the U.S

- Only a fraction reported to CDC.
- However, it is estimated that:
 - **76 Million Illnesses Annually**
 - **5000 Fatalities**
 - **\$1 Billion to \$10 Billion Annually**
 - Industry Losses, Medical Expenses, Lost Work Time

Mead PS, Slutsker L, Dietz V, et al. 1999. Food-related illness and death in the United States.
Emerg Infect Dis 5:607--25



Foodborne Disease in the U.S

- \$10.8 Billion
 - Annual tax expenditures related to medical costs, hospitalizations and lost work time
- \$6.9 Million
 - Amount of increased funding for food safety programs requested by FDA on 2008 budget
- \$1.7 Billion
 - The amount four federal agencies, including FDA and USDA, spent on food safety activities in 2003.

Sources: Centers for Disease Control & Prevention, FDA, Government Accountability Office.

Foodborne Disease and Produce

- 190
 - Total number of outbreaks linked to produce from 1973 to 1997
- 639
 - Total from 1990 to 2004

Sources: Centers for Disease Control & Prevention.

Recent Foodborne Outbreaks

- September 2006
 - 3 deaths, 200 illnesses
 - *E. coli* O157:H7 in prepackaged spinach
- November 2006
 - 183 illnesses
 - *Salmonella* in tomatoes served in restaurants
- November – December 2006
 - 71 illnesses, *E. coli* O157:H7 on Taco Bell lettuce
 - 81 illnesses, *E. coli* O157:H7 on Taco John lettuce

Sources: Centers for Disease Control & Prevention, FDA, Government Accountability Office.

Foods Involved in Outbreaks

- CDC surveillance data for 2003:
 - The incidence of most pathogens have decreased!
Yeah!
 - HACCP is working
- **However, the incidence of foodborne illness associated with fruits and vegetables is on the rise.**

Lynch M, J Painter, R Woodruff, C Braden. 2006. Surveillance for Foodborne-Disease Outbreaks --- United States, 1998—2002. *Morbidity and Mortality Weekly Report*, 55(SS10):1-34.



Preventing Foodborne Illness

- **HACCP**

Integrate other programs:

- SSOPs
 - Sanitation SOPs
- Sanitation Best Practices
- GMPs
 - Good Manufacturing Practices
- GAPs
 - Good Agricultural Practices
- Personal Hygiene Programs
- Quality Programs
 - ISO 22000
 - Lean Manufacturing
 - FIT (Focused Improvement Teams)



Three Approaches to
Preventing Foodborne Illness:

Keep them out!

Kill Them!

Control Growth!



Keep them out!

*How do they get into
food?*



PRIMARY SOURCES OF MICROORGANISMS FOUND IN FOODS

- **FECES!**
- **Soil and Water**
- **Plants and Plant Products**
- **Animal Feeds**
- **Animal Hides**
- **Intestinal Tract of Animals**
- **Processing Plant Air and Dust**
- **Food Equipment and Utensils**
- **Intestinal Tract of Humans**
- **Food handlers**



When are humans contagious?

- *BEFORE symptoms appear*
 - for some diseases, an individual is most contagious BEFORE symptoms appear
- *AFTER symptoms disappear*
 - *Salmonella* can remain in a person's system for months after recovery
 - Hepatitis A has been found in the intestinal tract up to 5 years after the disappearance of disease symptoms.
- *Asymptomatic carriers*
 - **50% of HEALTHY food handlers are carriers of disease agents transmitted by food**





- **Humans** are the **CAUSE** *and* the **VICTIMS** in foodborne illness.
- At every step in process, from the raw commodity on the farm through to the consumer (farm to fork), employees can contaminate the food.
- Must build sanitary **BARRIER** between employees and food.



Three Approaches to
Preventing Foodborne Illness:

Keep them out!

Kill Them!

Control Growth!



Kill Them!

- Thermal processing
- Non-thermal processing
 - Irradiation, pulsed electric fields (PEF), oscillating magnetic fields (OMF), high pressure processing (HPP), pulsed light technology (PLT).
 - Antimicrobials and sanitizers
 - OZONE, chlorine, iodine, quaternary ammonia, organic acids
- Good sanitation programs: ozone
- Hurdle Technology
 - Combine intervention methods to prevent microbial growth



Three Approaches to
Preventing Foodborne Illness:

Keep them out!

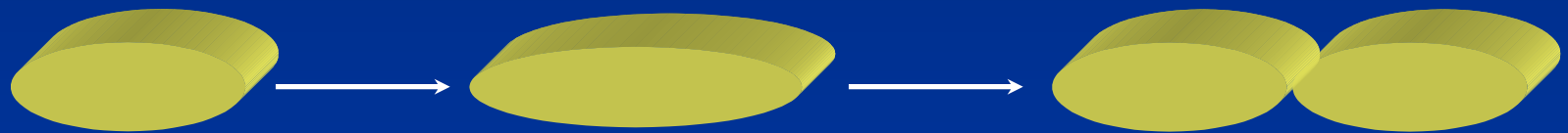
Kill Them!

Control Growth!



Control Growth!

Bacteria Reproduce by Binary Fission:



1 GENERATION TIME

With a Generation Time of 15 minutes...

Time	# of Bacteria
0:00	1
0:15	
0:30	
0:45	
1:00	
2:00	
3:00	
4:00	
5:00	



With a Generation Time of 15 minutes...

Time	# of Bacteria
0:00	1
0:15	2
0:30	
0:45	
1:00	
2:00	
3:00	
4:00	
5:00	



With a Generation Time of 15 minutes...

Time	# of Bacteria
0:00	1
0:15	2
0:30	4
0:45	
1:00	
2:00	
3:00	
4:00	
5:00	



With a Generation Time of 15 minutes...

Time	# of Bacteria
0:00	1
0:15	2
0:30	4
0:45	8
1:00	
2:00	
3:00	
4:00	
5:00	



With a Generation Time of 15 minutes...

Time	# of Bacteria
0:00	1
0:15	2
0:30	4
0:45	8
1:00	16
2:00	
3:00	
4:00	
5:00	



With a Generation Time of 15 minutes...

Time	# of Bacteria
0:00	1
0:15	2
0:30	4
0:45	8
1:00	16
2:00	246
3:00	
4:00	
5:00	



With a Generation Time of 15 minutes...

Time	# of Bacteria
0:00	1
0:15	2
0:30	4
0:45	8
1:00	16
2:00	246
3:00	4100
4:00	
5:00	



With a Generation Time of 15 minutes...

Time	# of Bacteria
0:00	1
0:15	2
0:30	4
0:45	8
1:00	16
2:00	246
3:00	4100
4:00	65,000
5:00	



With a Generation Time of 15 minutes...

Time	# of Bacteria
0:00	1
0:15	2
0:30	4
0:45	8
1:00	16
2:00	246
3:00	4100
4:00	65,000
5:00	1,000,000



What is a log Reduction?

- 1,000,000 to 100,000 = 1 log reduction
- 1×10^6 to 1×10^5 = 1 log reduction

- Canning operations: 12 log reduction
 - 1,000,000,000,000 reduced to 1
- Intervention strategies useful if:
 - Can demonstrate a 1-2 log reduction
 - Use in combination with other strategies
 - HURDLE TECHNOLOGY



Factors affecting Growth

F

Food

A

Acidity

T

-

T

Time/Temp

O

Oxygen

M

Moisture



Farm to Fork Food Safety

- Taco Bell *E. coli* O157:H7 Outbreak 2006
 - 71 customers ill
 - Executives told investors this is an “opportunity” to develop better farm safety procedures.
 - Sued by Boskovich Farms
 - Linked and then cleared in outbreak
 - Claim Taco Bell action libeled and destroyed their business.



El Pollo Loco: Farm to Fork

“The best way to avoid the carnage of a train wreck is to do everything you can do to make sure the wreck never happens.”

-Steve Lash, EPL supply chain manager
The Orange County Register



El Pollo Loco: Farm to Fork

ON THE FARM:

- Conduct extensive lab tests before packing
 - Been the practice for eight years
 - Since expanding from Mexico to U.S. in 1980, no produce related outbreaks
 - Produce accounts for 56% of menu
- Inspect fields and packing plants
- Third party audits of farms several times a year
 - Includes worker hygiene, field restroom sanitation, adjacent land use



El Pollo Loco: Farm to Fork

PRODUCE PROCESSING:

- Extensive testing on:
 - incoming products
 - random checks throughout process
 - wash water
 - end product
- Nine hour pathogen testing
 - Can pull product before it hits restaurant



Food Safety vs. Food Defense

- Food Safety : unintentional
- Food Defense: intentional
 - Biosecurity, Bioterrorism, Food Terrorism, Food Security



FDA Definitions

- **Food Security**

- the access by all people at all times to enough food for an active, healthy life.

- **Food Safety**

- Unintentional routine, and real contamination of food products



FDA Definitions

- **Food Defense Awareness**
 - Food Terrorism
 - Attacks on the food supply that are:
 - intentional, criminal, sporadic, plausible, and from unknown sources



Food Defense Awareness

- Farm to fork
- Foreign threat
- Domestic threat
- Disgruntled employee (1% of workforce)



Food Defense Awareness

- Food = \$1.24 trillion part of US economy
- Food system very complex
 - 212,800 farms
 - 29,000 food manufacturing sites
 - 224,300 retail food stores
 - 565,000 foodservice outlets
- All humans eat and drink:
 - The rapidity with which contamination could spread across the nation is astounding

Food Defense Awareness

- FDA/CFSAN have developed vulnerability assessment software
- CARVER + Shock Software
 - Criticality, Accessibility, Recuperability, Vulnerability, Effect, Recognizability
 - Shock: combines physical, psychological and economic effects



Food Defense Awareness

- CARVER + Shock Software currently being tested as it applies to the food industry
- “Available early 2007”
- Will be free to industry
 - Downloadable at FDA website



Food Defense Awareness

- The ALERT Initiative
 - Launched by FDA
 - with cooperation of CDC, USDA, state and local agencies
 - Integrates Food Safety and Food Defense
 - Assure, Look, Employees, Reports and Threat
 - Five questions designed to raise awareness within food sector



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