Food Borne Illness

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Potluck Panic

Within 24 h of church potluck -> multiple ED visits Diplopia, ptosis, CN deficits, weakness→ resp failure
>20 ultimately w/ symptoms within a week
One death, multiple intubated, many milder
Botulism confirmed on toxin assay of serum and stool
Health Department and CDC coordination
Potato salad from home canned potatoes implicated

Nehrams2020

Botulism

Recently Attributed Sources

Pruno (in prisoners), fish (or seal) oil/blubber, fermented fish heads, turshi (pickled vegetables)

Management

Toxin removal: Emetics and laxatives/enemas

Timely antitoxin administration

Antibiotics: no role in foodborne botulism

Discard leftovers (No tasting!)

Food Net

- **Foodborne Diseases Active Surveillance Network**
- **9 pathogens tracked in 10 regions**
- **15% of US population**
- **CDC, 10 state health depts, USDA-FSIS, FDA**
- **2020 Goals**

CDC/Amanda Mills

Cade Martin

Food Net

- Campylobacter
- Cryptosporidium
- Cyclospora
- Listeria
- Salmonella
- STEC 0157 and non-0157
- Shigella
- Vibrio
- Yersinia

2014 Food Net Trends

MMWR 64(18);495-499

19542 infections, 4445 admissions, 71 deaths

Top incidences: Salmonella & Campylobacter

Greatest increases:

- Vibrio (52%)
- Campylobacter (13%)

CDC/Amanda Mills

Eric Grafman

2014 Food Net Trends

Shifts among Salmonella strains

***Salmonella typhimurium* decreased**

- **USDA standards for poultry industry**
- **Decreased contamination of whole chickens**
- **Increased salmonella vaccination- breeder poultry flocks**
- **Remains the highest incidence strain**

Others strains on the rise:

S. javiana* and *S. infantis

2014 Food Net Trends

Shiga-toxin Producing E coli (STEC)

0157 incidence declined 32%

- **Portion of decline could be artifact of increased non-culture diagnostic testing**
- **16% of 0157 cases associated with outbreaks**

Non-0157 strains – increased incidence now higher than 0157

Culture-Independent Diagnostic Tests for Bacterial Enteric Infections MMWR 64 (09); 252-257

- **Rapid, potentially cost effective tests**
- **Most are commercial/ some are from local lab**
- **Were only test used for 19% STEC and 10% Campylobacter 2012-2014**
- **Lack of culture confirmation limits strain and outbreak tracing and susceptibility testing**
- **Public health may fill gap left by local labs**

Clinical Course

Clues	Likely Suspects
Onset N/V in a few hours	Bacillus cereus or Staph aureus preformed toxin
Onset diarrhea in a few hours	Bacillus cereus or Clostridium perfringens
Diarrhea within 1-2 days, N/V	Norovirus
Watery diarrhea that can persist	Giardia, Cryptosporidium
Bloody diarrhea +/- fever, cramping	Shigella, Salmonella, Campylobacter, Shiga- Ecoli
Appendicitis-like syndrome, Chitterlings Consumption	Yersinia
Seafood consumption	Vibrio

Was it something I ate?

44 yo male pediatrician on vacation in Germany/Austria
Stayed at conference hotel; Visited zoo/monkeys
After 1 week (Day 1) – Fever/rigors/sweats – 36 hours
Day 2 Watery Diarrhea began, later blood streaked
Day 11 ED Visit in US – Continued Diarrhea, Nausea, Cramping, Bilateral ankle pain with red rash
WBC 10.5
Stool leukocytes, Protozoal Ags, Shiga toxin All Negative

Diarrhea on European Vacation

Stool culture positive *Salmonella* Stanley
Prompt clinical response to levofloxacin
Common serovar in SE Asia, not in Europe
Domestic outbreaks in Europe

- **In 2011-12 >700 cases**
- **Most European cases - eating turkey**
- **Product recall for raw cashew-based cheeses**

Foodborne Illness – in Travelers

Pre-travel: CDC Geography-based Travel Advice

Assess risk for Enterotoxigenic Ecoli

- **Prophylaxis with Bismuth Subsalicylate or other**
- **Presumptive therapy to shorten course**
  - **Usually Flouroquinolone**
  - **Azithromycin in children, pregnancy, SE Asia**

(Very) Vulnerable Patients

Condition	Pathogen	Consideration
Primary Immunodeficiencies	Giardia, Campylobacter, Salmonella	
Transplant/Autoimmune Ds	Norovirus	Chronic gastroenteritis
	Salmonella enteritis	Rare, but more bacteremia
	Listeria	Serious, but less when on tmp/smz
	Toxoplasma	As with Listeria
HIV/AIDS	SSC, Giardia, Listeria, Cryptosporidia, Cyclospora	Low CD4+ Lymphocyte count
Fe Overload, Liver disease	SSYC, Vibrio	

BM Lund SJ O'Brien, Foodborne Pathogens and Disease 2011, 1-13.

(Almost as) Vulnerable Patients

Condition	Pathogen	Consideration
Neonates	Most enteric pathogens, infant botulism < 1 year old	Avoid honey and contaminated formula
Pregnant Women	Listeria	Despite mild disease, fetal impact can be devastating
Elderly	Salmonella	More aortic seedings
	Shiga toxin E coli, Norovirus	Higher mortality
	Listeria	Empiric coverage for meningitis if > age 50
Diabetes mellitus	Salmonella, Campylobacter, Listeria	Decreased gastric acid, autonomic dysmotility may contribute
Reduced Stomach Acidity	SSC, E coli 0157, Listeria, Vibrio	

BM Lund SJ O'Brien, Foodborne Pathogens and Disease 2011, 1-13.

Safeguarding Vulnerable Patients

Possible Intervention	Patient Populations	Consideration
Low microbial diets	Stem cell transplants> Solid Organ Transplants	Data is lacking, so variably applied
Safer Food Choices	All vulnerable populations	
Boiling/cooling water	Those vulnerable to cryptosporidia and other water contaminants	Can't trust all bottled or filtered water
Antimicrobial Prophylaxis	When otherwise indicated	Primarily this is tmpsmz

BM Lund SJ O'Brien, Foodborne Pathogens and Disease 2011, 1-13.

Cade Martin

Safer Food Choices

- **Pasteurized eggs for raw egg recipes**
- **Pasteurized milk and cheeses (watch brie, feta, blue-veined)**
- **Smoked or precooked seafood reheated to 165F**
- **Washed salad and fresh vegetables**
- **Cooked sprouts**
- **Reheated hotdogs and lunch meats**

CDC/Amanda Mills

Antibiotic Resistance Serious Threats
CDC 2013

Pathogen	Antimicrobial	Estimated Annual Cases	Estimated Annual Deaths
Campylobacter	Azithromycin 2% or Ciprofloxacin 23%	310,000	28
Non-typhoidal Salmonella	Multiple agents, Ceftriaxone 3%, Ciprofloxacin 3%	100,000	40
Salmonella typhi	Ciprofloxacin 70%	3,800	<5
Shigella	Azithromycin 3% or Ciprofloxacin 2% Tmp/smz UP Ampicillin DOWN	27,000	<5

Surveillance of enteric pathogens by National Antimicrobial Resistance Monitoring System (NARMS)

First Line Antimicrobial Therapy

	Recommended	AVOID
Campylobacter	Erythromycin or Azithromycin	Flouroquinolone
Salmonella (non-Typhoidal)	**None** for mild/moderate disease in healthy adult hosts. Severe disease or other populations: Flouroquinolone, ceftriaxone	
Shigella	Check Susceptibilities Flouroquinolone Azithromycin	Amoxicillin
Yersinia	None or Flouroquinolone Tmp/smz in children	

2015 Multistate Foodborne Outbreaks

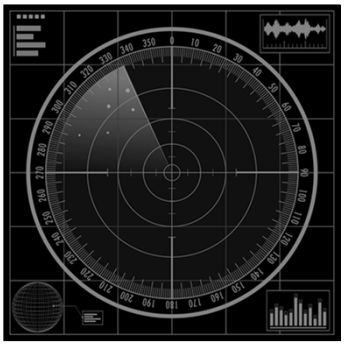
Example CDC Investigations

Listeria	Soft Cheeses
	Blue Bell Ice Cream
Salmonella Poona	Cucumbers
Other Salmonella strains	Pork
	Raw, Frozen, Stuffed Chicken Entrees
	Frozen Raw Tuna
Cyclospora	Unknown source (Cilantro in 2014)

Food-Borne Diseases

Jeffrey T. LeJeune, DVM, PhD
Professor and Head
Food Animal Health Research Program
Ohio Agricultural Research and Development Center
The Ohio State University

Food Safety Radar



COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES
COLLEGE OF VETERINARY MEDICINE

Food Safety Radar

Fruits and Vegetables:
A safe choice?

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Fruits and Vegetables:
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STEC
Where's the beef?

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Food Safety Radar

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Antibiotic Resistance

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Food Safety Radar

Foodborne
(poultry)
UTI's?

Fruits and Vegetables:
A safe choice?

STEC
Where's the beef?

Antibiotic Resistance

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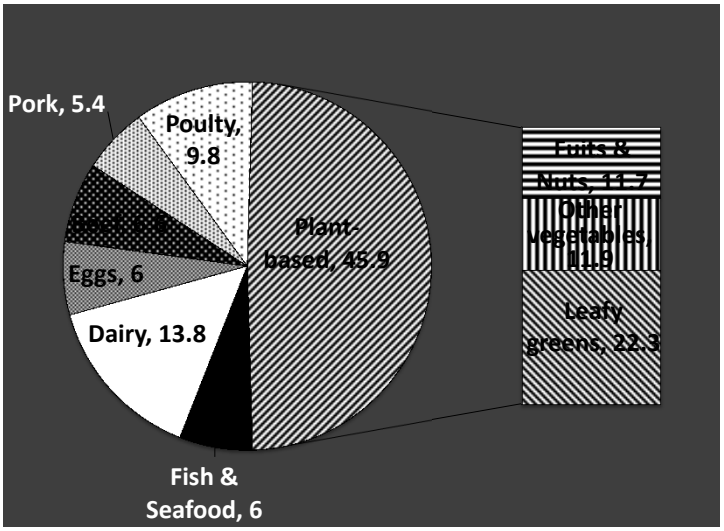
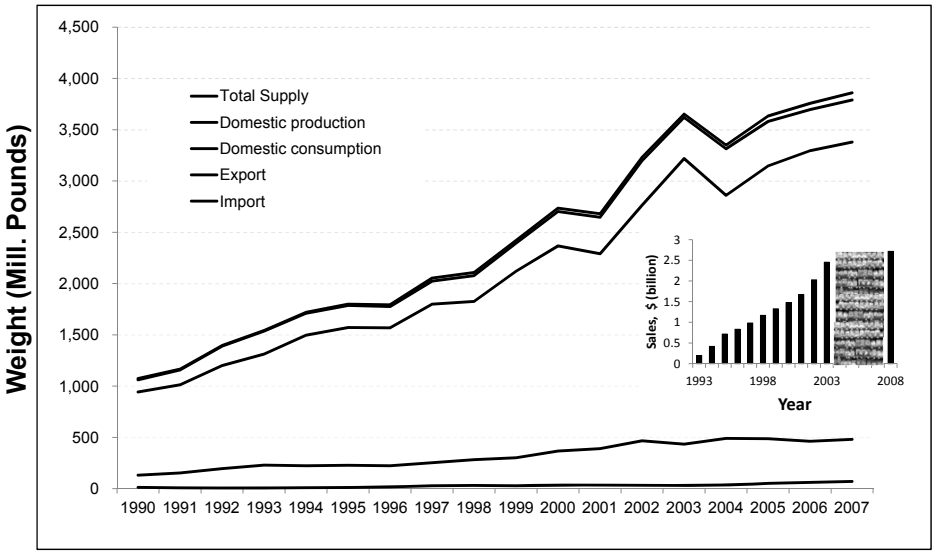
Fruits and Vegetables

Sources of Disease Outbreaks



EID 19, (2013)

Production and consumption of lettuce in US, 1990-2007

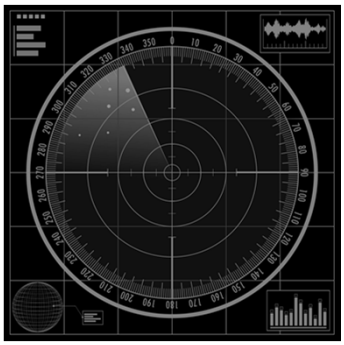


Source: Prepared form data provided and calculated by USDA, Economic Research Service; **http://www.ers.usda.gov/Publications/VGS/**

Changes to protect food

- **Food Safety Modernization Act (FSMA)**
  - **Produce Safety**
  - **Preventive Controls**
  - **Foreign Supplier Verification**
  - **Preventive Control for Animal Food**

Shiga toxin-producing *E. coli*



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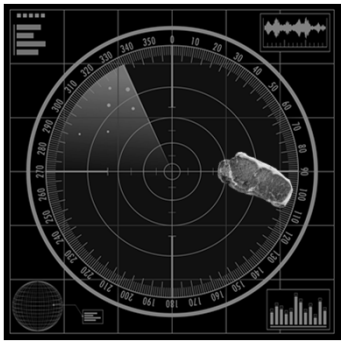
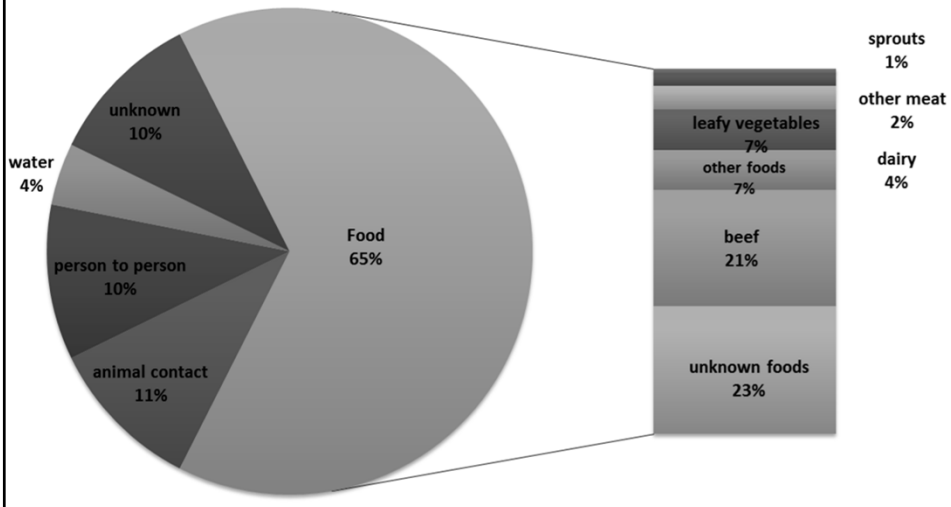


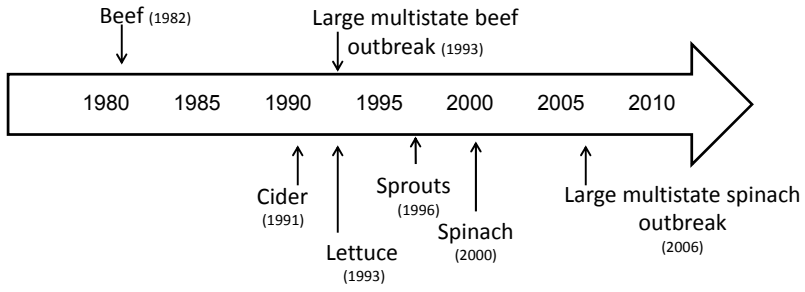
STEC
Where's the beef?

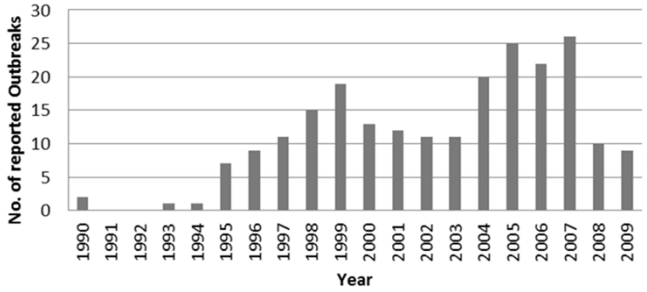
Sources of *E. coli* O157, USA, 2003-2012



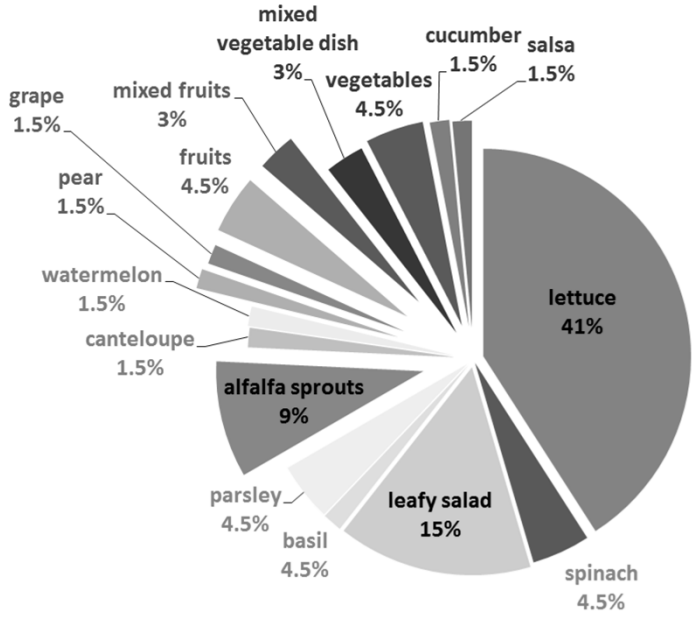
EID 21,8 (2015)

O157 milestones





Produce associated *E. coli* O157 Outbreaks USA/Canada, 1998-2008 (n=66)



Non-O157 STEC

- **Less severe infections than O157**
- **Difficult to diagnosis in laboratory**
- **Sources not completely understood**

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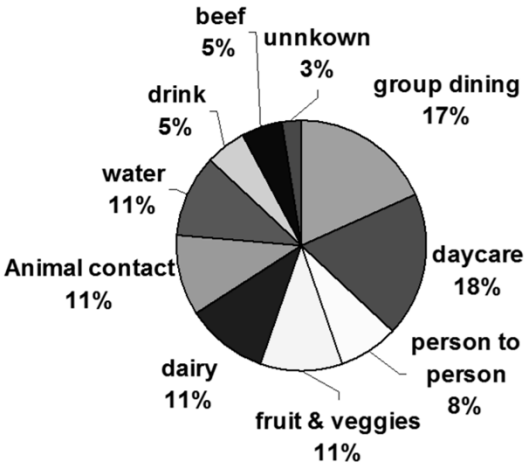
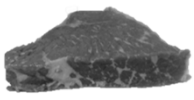
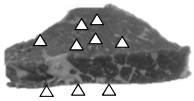
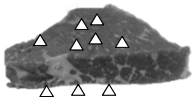
Sources of non-O157 STEC Outbreaks 1990-2010, USA









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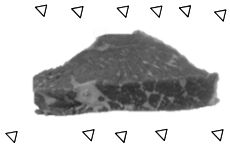

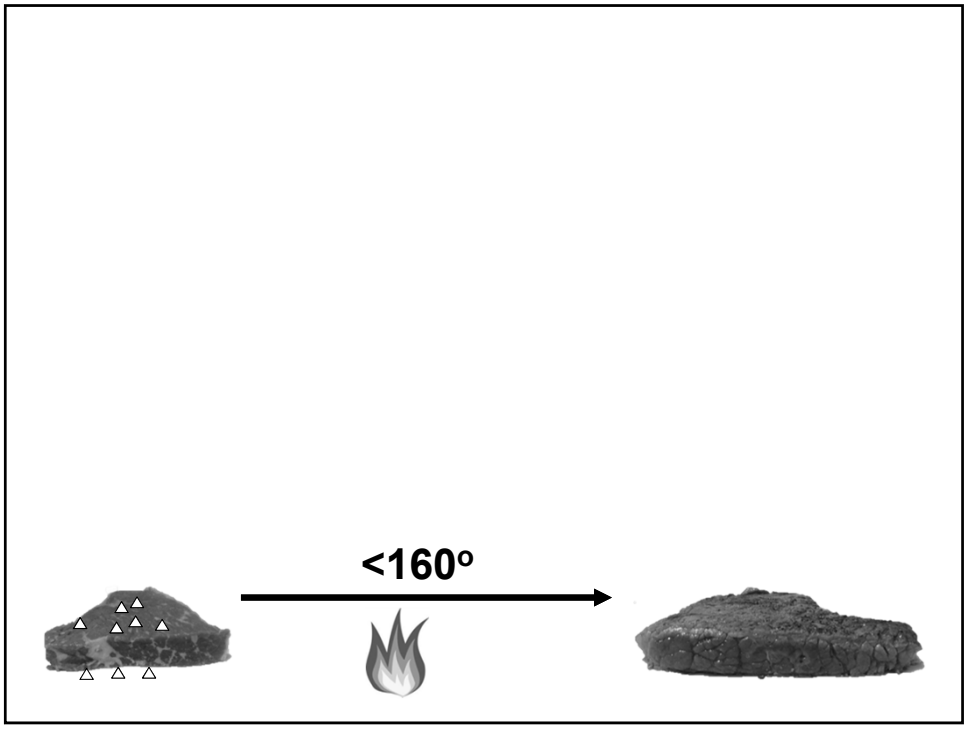
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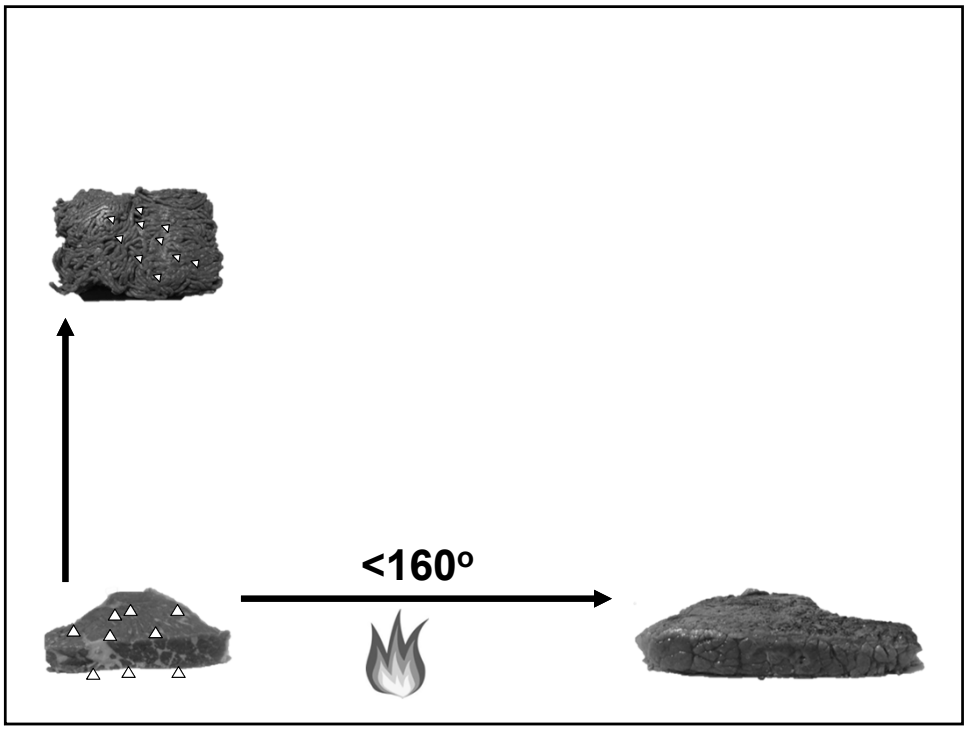
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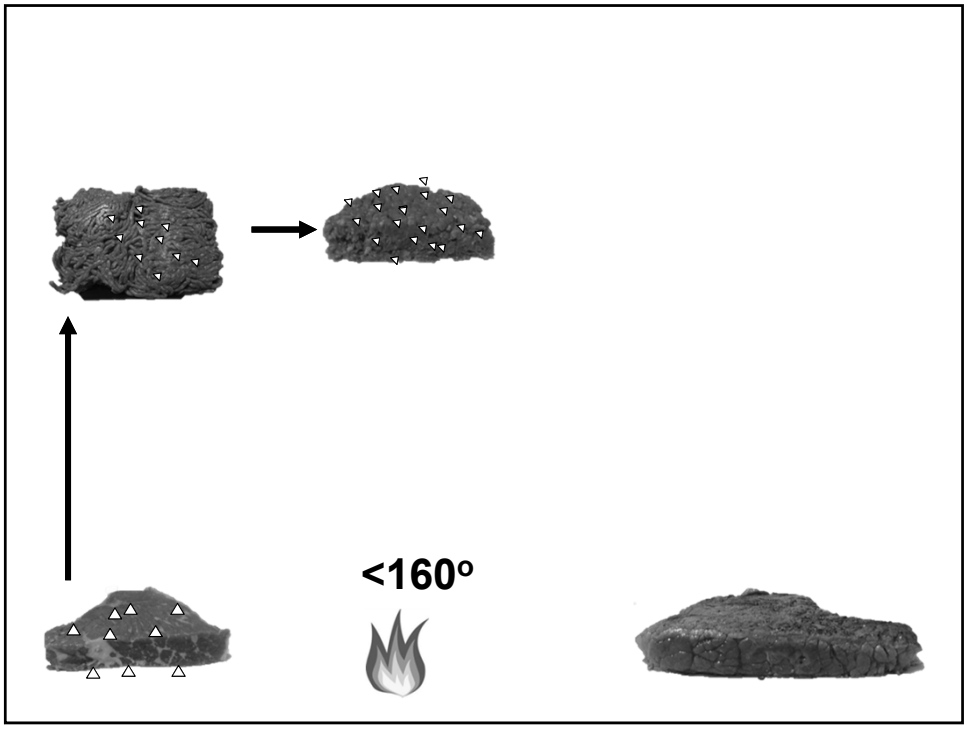
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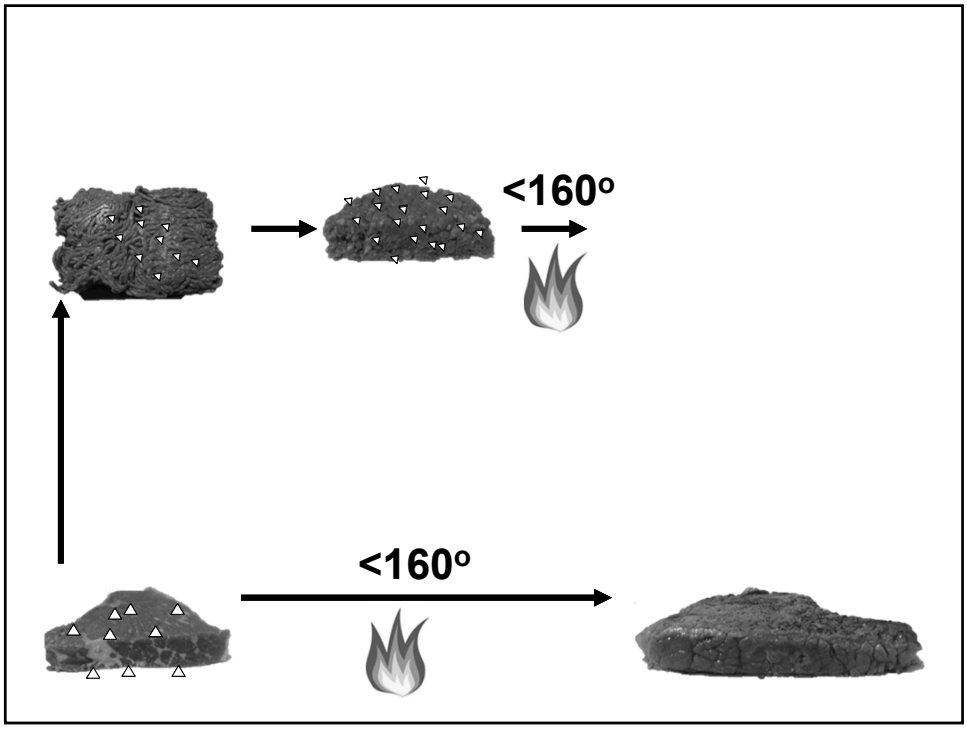
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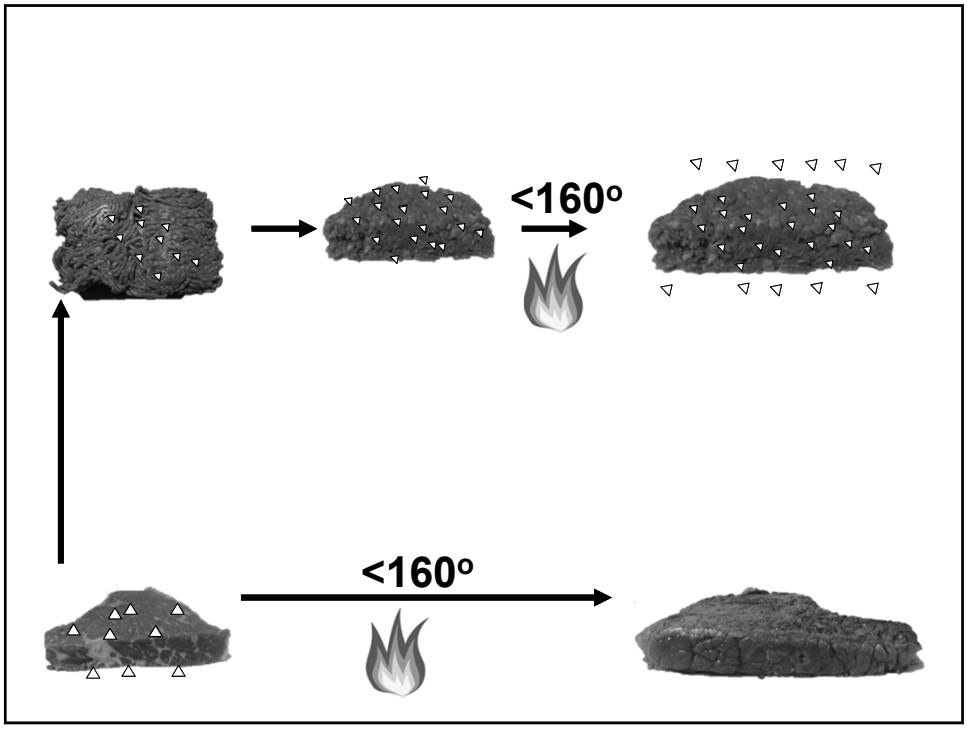
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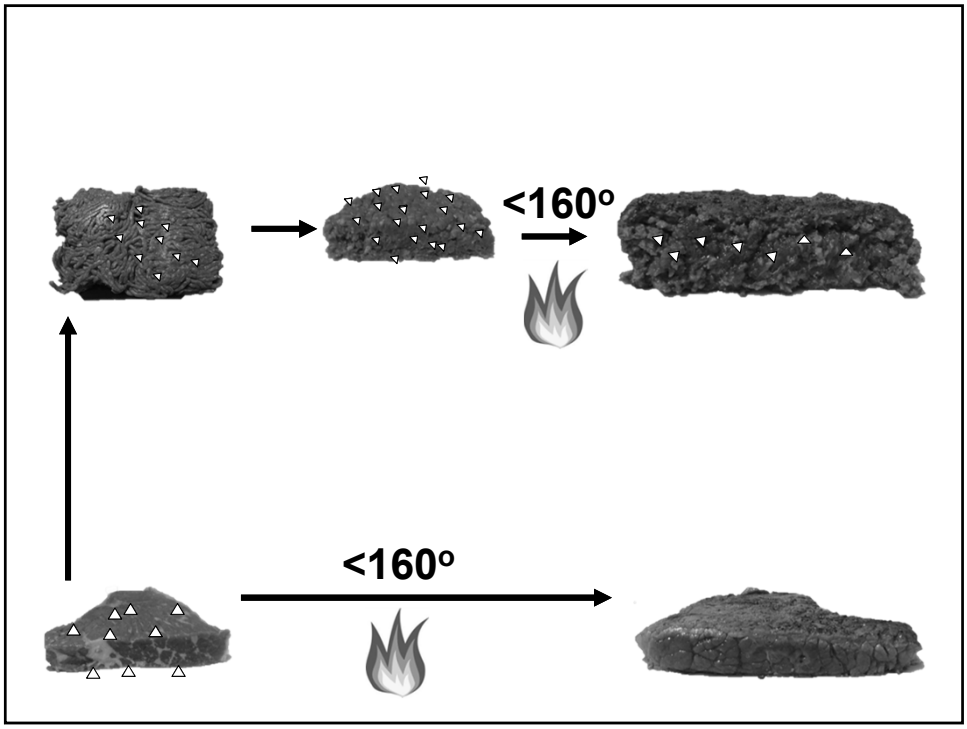
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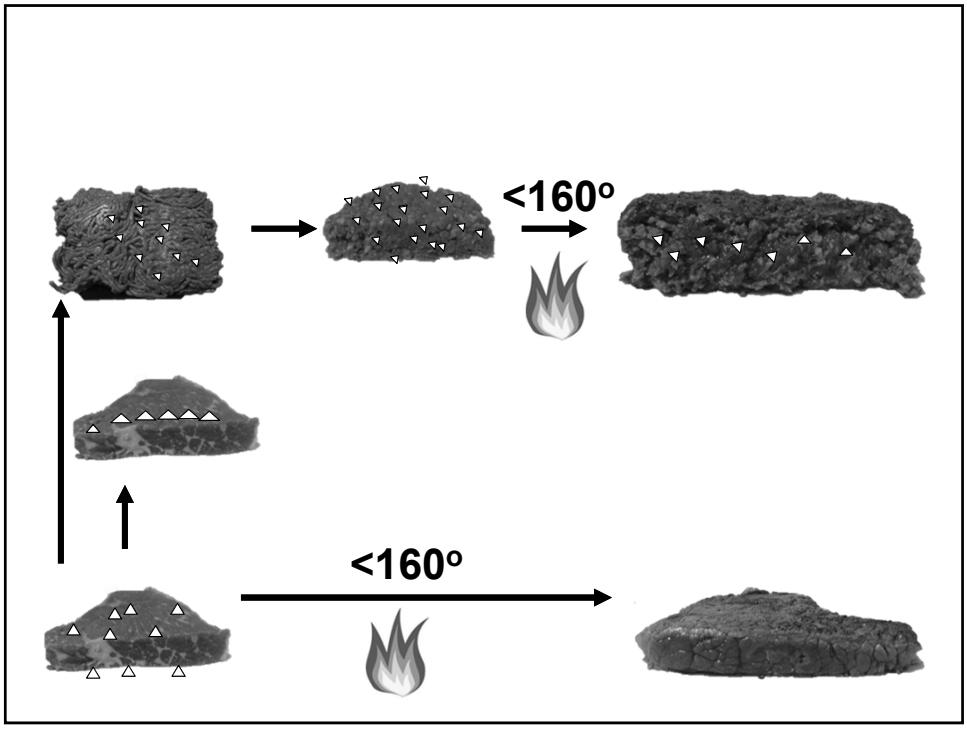
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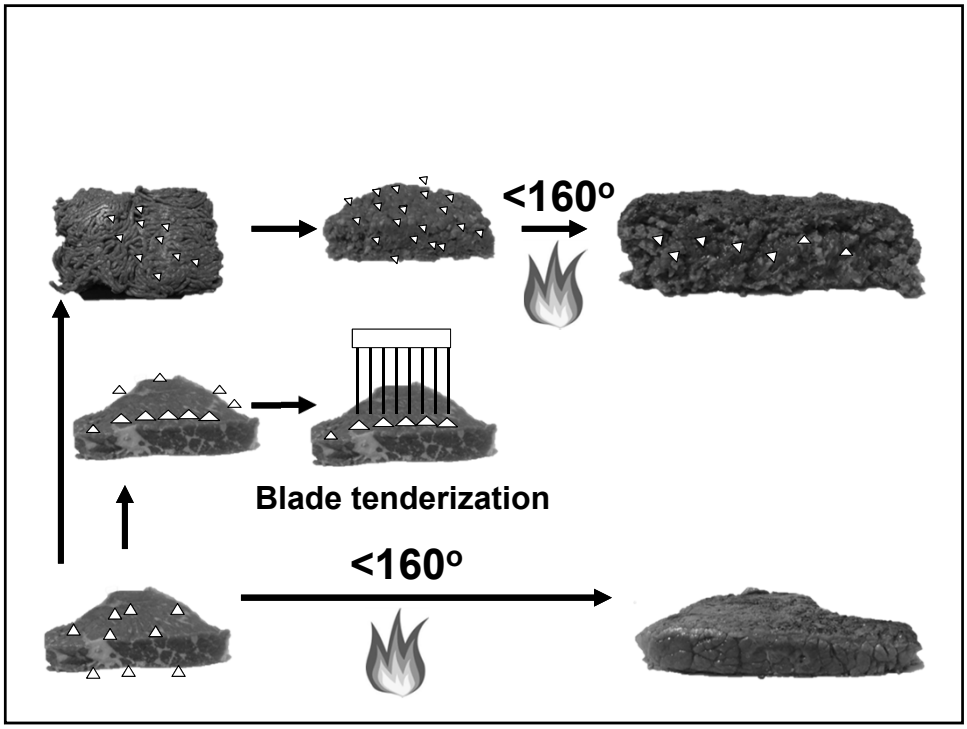
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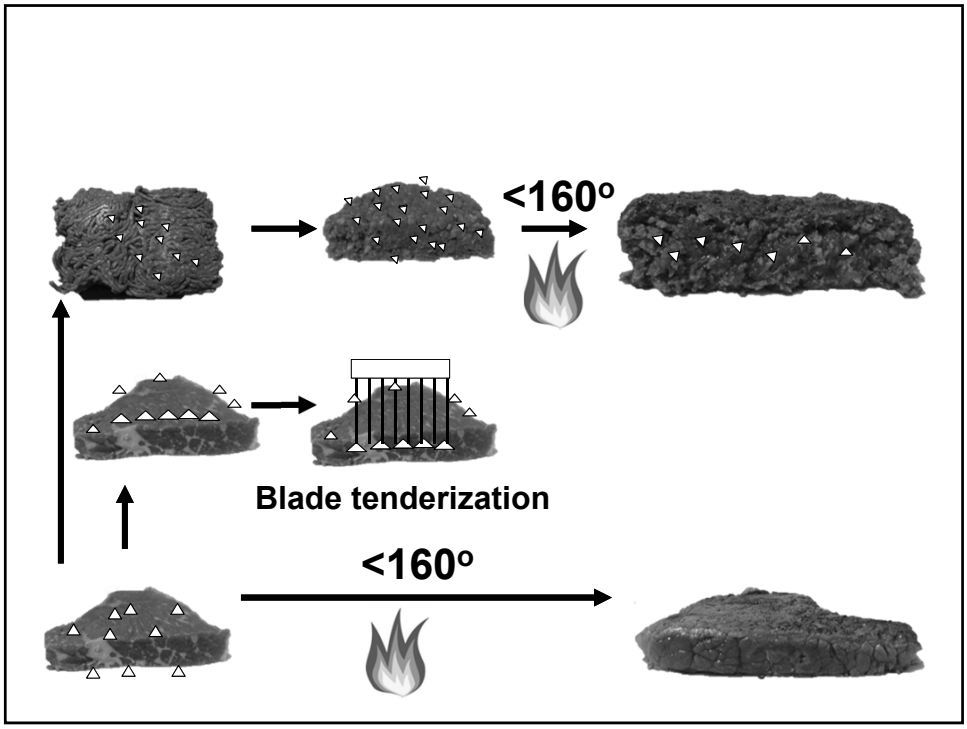
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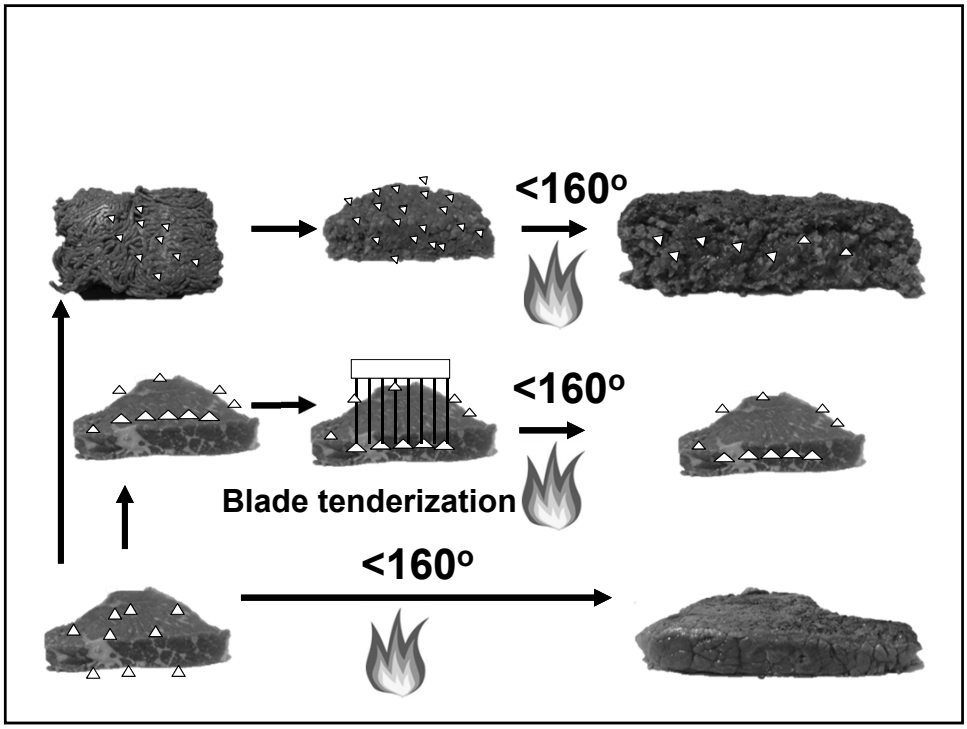
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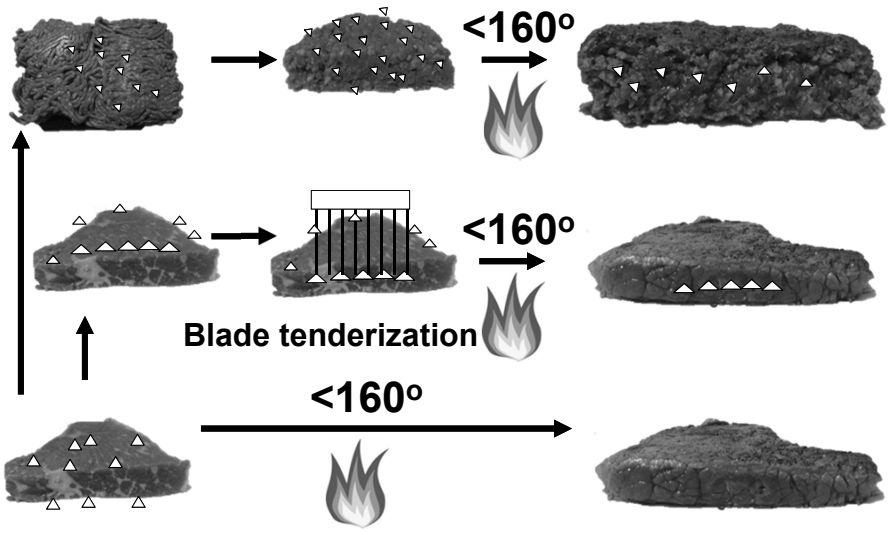
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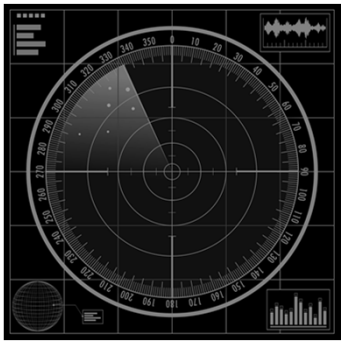

Antibiotic Resistance

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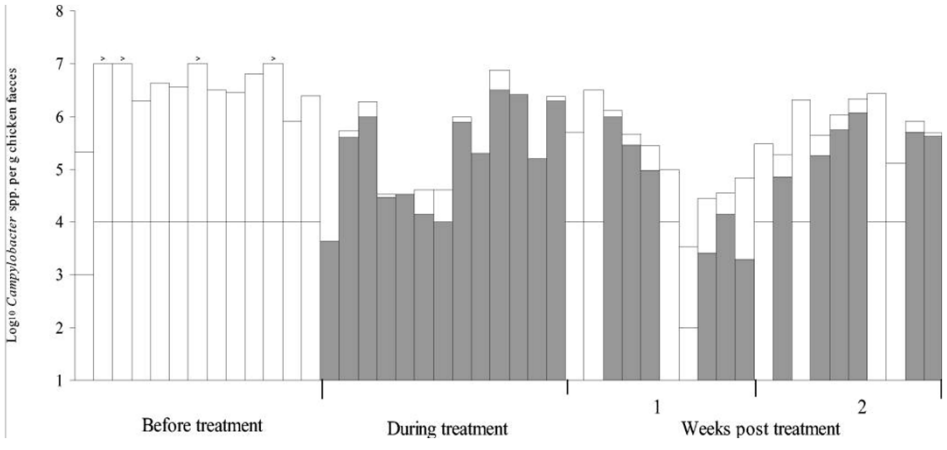
Antimicrobial Resistance

- **Food is a vehicle for transmission of AMR bacteria to humans**
- **Antimicrobial use in animals selects for AMR in commensal flora and in pathogens**
- **AMR does not always result in a "fitness cost" to bacteria.**

Quinolone-resistance selection in poultry



Antimicrob Agents Chemother. 2005 Feb; 49(2): 690–698.

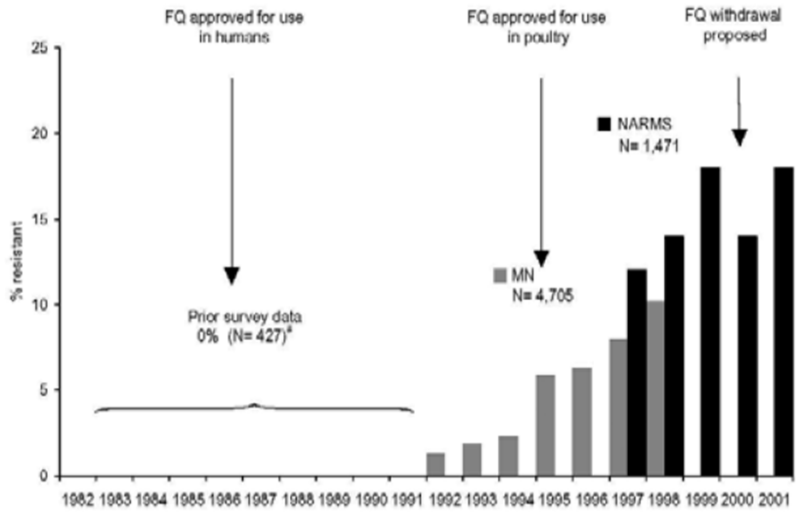
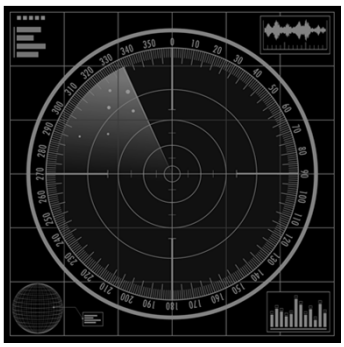


Figure 2. Quinolone- and fluoroquinolone-resistant *Campylobacter jejuni* in the United States, 1982–2001. FQ, fluoroquinolone; MN,

http://www.cdc.gov/narms/publications/2004/A_gupta_ABRX_campyEID2004.pdf

Changes in regulations

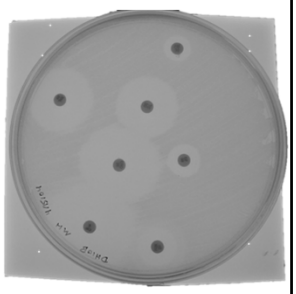
- **Certain "off-label" drug uses in veterinary medicine restricted**
- **Voluntary removal of all in-feed growth promotion antibiotics**
- **Stricter oversight of antibiotic use on farms**



Foodborne (poultry) UTI's?

Foodborne Urinary Tract Infections?

- Temporal Clusters of UTIs
- Community-acquired
  - Similar resistance type
  - Similar serotype
  - Similar virulence profile
  - Similar PFGE-type



NEJM 345,1 (2001)

ST131

- Predominate lineage of ExPEC
- Commonly resistant to extended-spectrum β-lactamases (ESBL)
- Present in food animals
- Present in foods (poultry)
- Present in companion animals

Clin Microbiol Rev 27: 543-574 (2014)

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Clin Microbiol Rev 27: 543-574 (2014)

Why ?

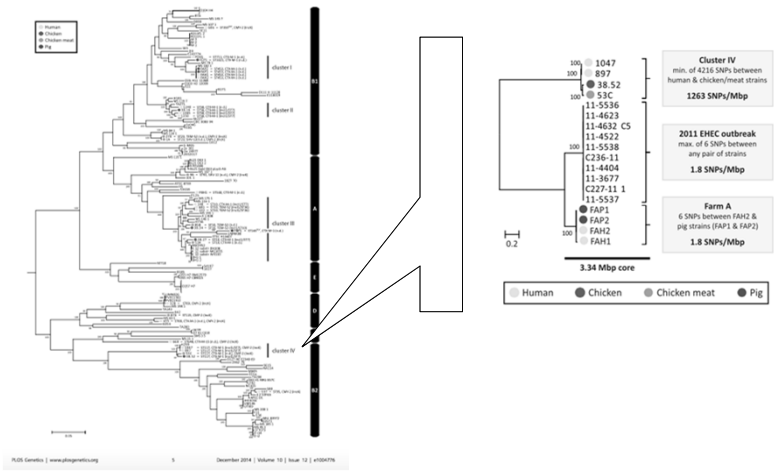
(1) unidirectional transmission from one species to another,

(2) bidirectional transmission between the species,

(3) transmission to each species from a common external source, or

(4) completely independent pathogen transmission pathways

MLST WGS



Summary

Knowns

- Fruits and vegetables sources of FBD
- Steaks and roast as sources of O157
- Foodborne AMR

Unknowns

- Sources of non- O157 STECs
- Role of foods in UTIs