Emerging Food Safety Challenges

FAPC Research Symposium OSU, Stillwater, OK

February 18, 2014

www.ulm.edu

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Outline

- Food safety impacts
- Foodborne illness investigation
- Foodborne illness and disease burden estimates of CDC and EPI
- Emergence of food pathogens and challenges
- Selected research works of mine

Food safety definition

Food safety (food hygiene) involves any practice in processing, preparation or handling of food to ensure it is safe.

Food safety is the state of acceptable and tolerable risks of illness, disease, or injury from the consumption of foods

Food safety impacts

(risks of unsafe food consumption)

❖ On human health;

✓ Short run (hygiene depended) risks;

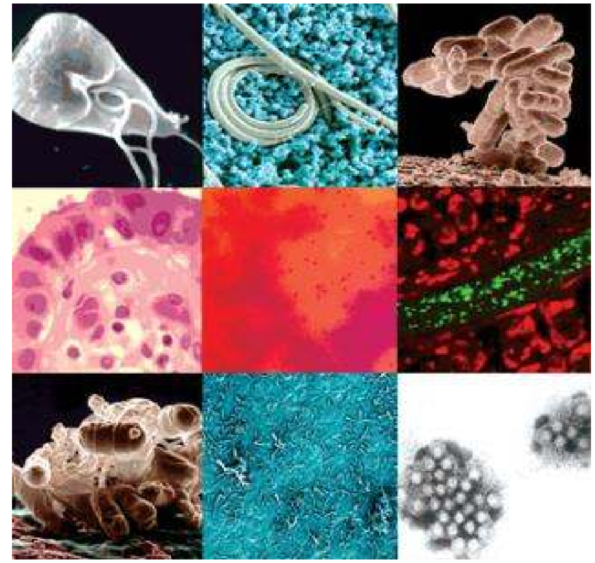
➔ throw-up, food poisoning, etc.

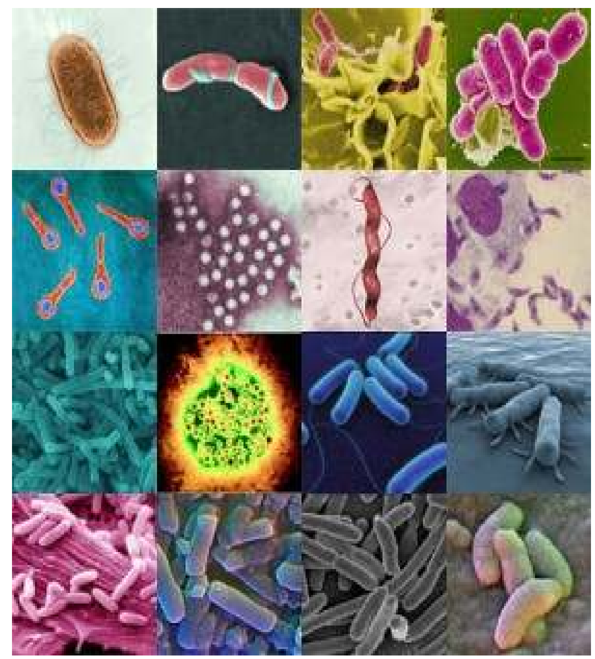
✓ Long run (nutrition content, production methods depended) risks;

➔ obesity, heart attack, diabetes, immune disorders, cancer, liver disease, GI issues etc.

FDA estimates that 2-3% of all foodborne illnesses lead to serious secondary long-term illnesses.

Causes of foodborne illnesses and diseases





Foodborne diseases result from ingestion of a wide variety of foods contaminated with pathogenic microorganisms, microbial toxins, or chemicals

Foodborne illness investigation

What is a food illness outbreak?

When two or more people get the same illness from the same contaminated food or drink, the event is called a foodborne outbreak (2 or more unrelated cases).

Case: an instance of a particular disease

In an outbreak, there should be at least 2 or more unrelated cases reporting illness.

Exception: 1 case of a chemical-related foodborne illness or *Clostridium botulinum* poisoning constitutes an outbreak

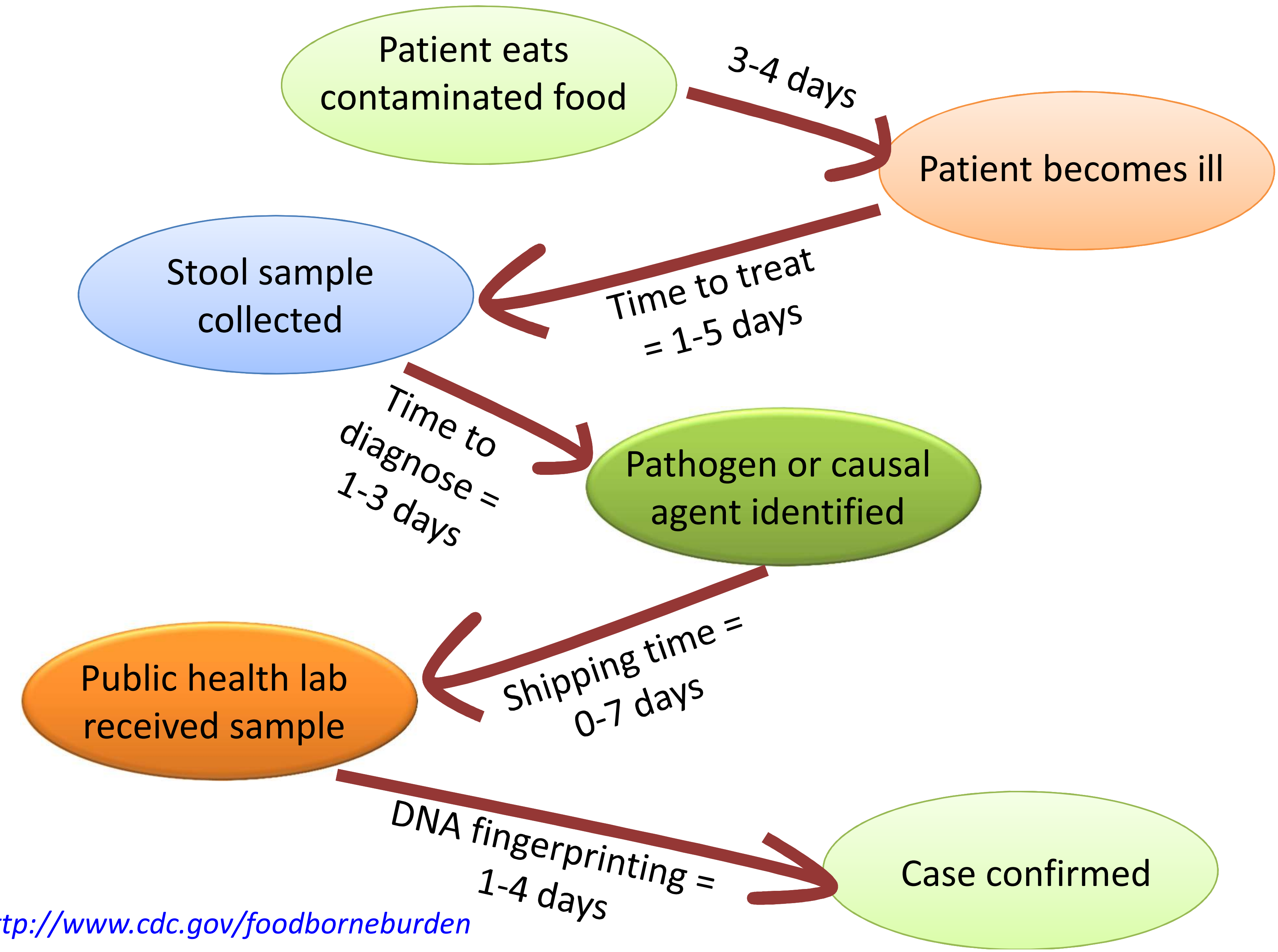
Why investigate?

→Public health officials investigate outbreaks to control them, so more people do not get sick in the outbreak, and to learn how to prevent similar outbreaks from happening in the future.

Foodborne illness investigation

- Foodborne disease is a common reason for people to seek medical care.
- Majority of foodborne illnesses are never reported.
- The outbreak investigation is time consuming process.

Why does it take so long?



http://www.cdc.gov/foodborneburden

Foodborne illness investigation

Department of Health and Human Services

Monitors foodborne illnesses through its Foodborne Disease Outbreak Surveillance System

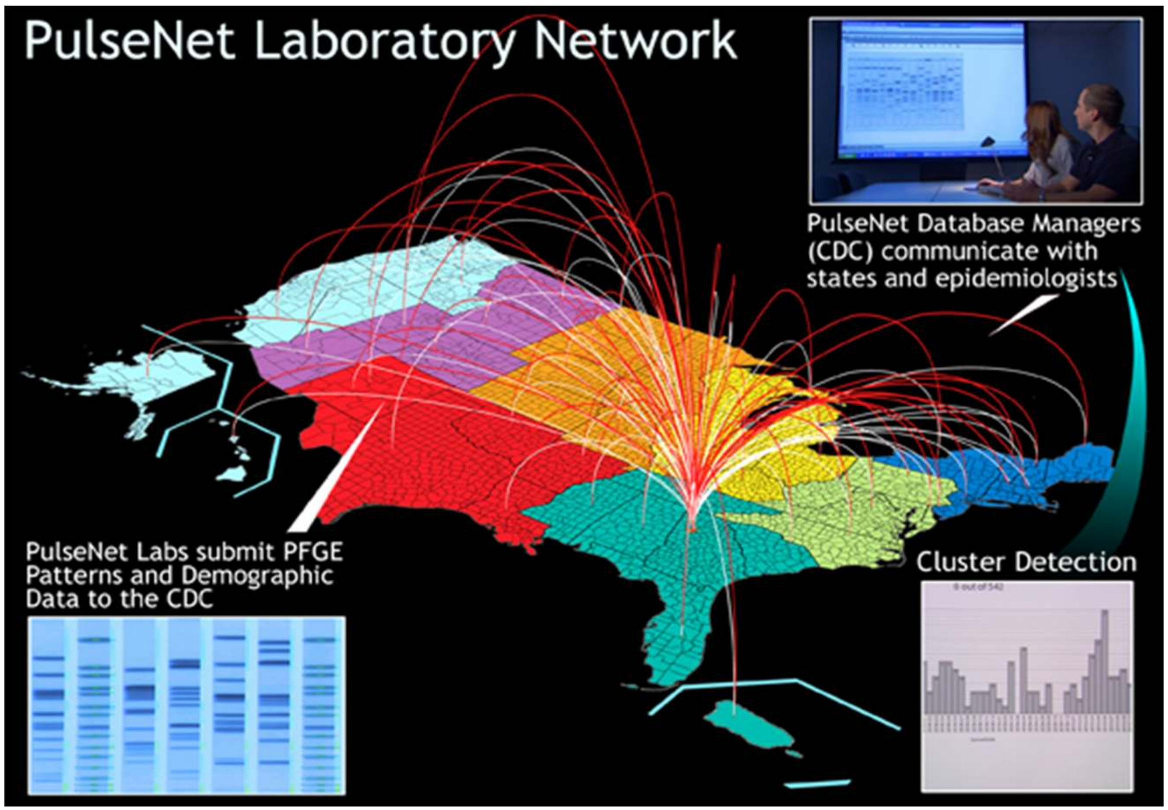
Centers for Disease Control and Prevention. Gather data on foodborne illnesses, investigate foodborne illnesses and outbreaks, and monitor the effectiveness of control efforts in reducing foodborne illnesses. CDC also plays a key role in building state and local health department epidemiology, laboratory, and environmental health capacity to support foodborne disease surveillance and outbreak response.

Foodborne Disease Outbreak Surveillance System

- Local Health Departments
  - Patient complaints
  - Laboratory, HCW, CMR reports
- State Health Departments
  - Foodborne outbreak reports
  - *Salmonella* serotyping
  - PFGE
- Federal Health Agencies (CDC and regulatory)
  - PulseNet and FoodNet

PulsNet (http://www.cdc.gov/pulsenet/)

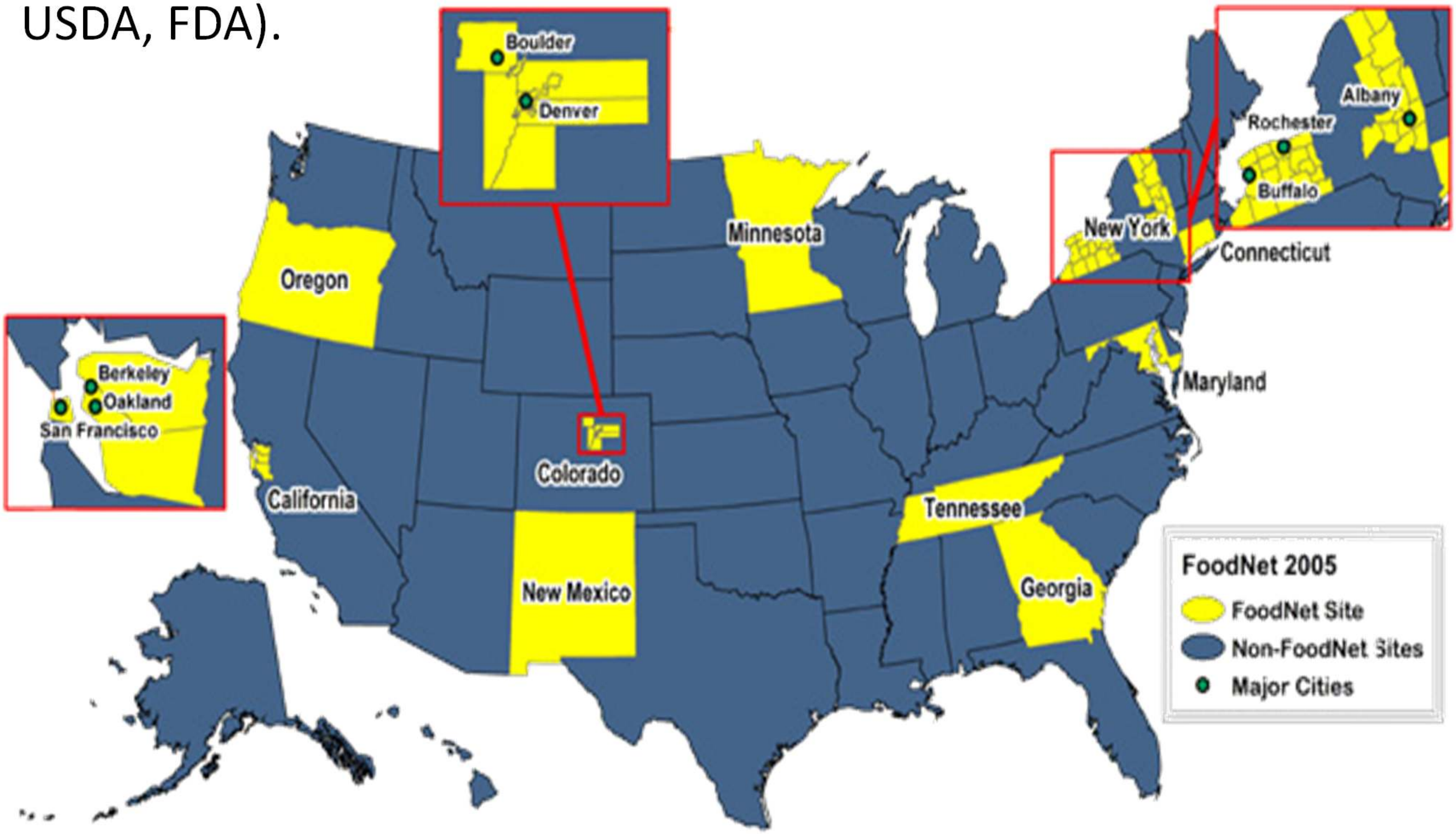
- PulseNet is a national laboratory network made up of 87 laboratories−at least one in each state.
- PulseNet compares the 'DNA fingerprints' of bacteria from patients to find clusters of disease that might represent unrecognized outbreaks.



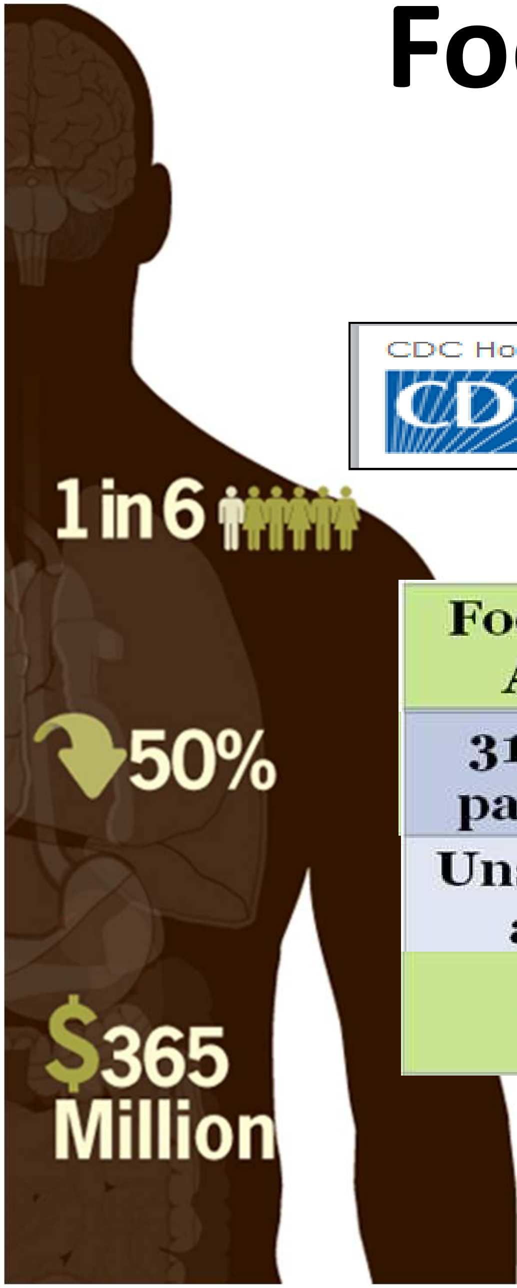
PulseNet detects subtypes of *E. coli O157* and other Shiga toxin-producing *E. coli, Campylobacter jejuni, Clostridium botulinum, Listeria monocytogenes, Salmonella, Shigella, Vibrio cholerae,* and *Vibrio parahaemolyticus.*

FoodNet is the Foodborne Diseases Active Surveillance Network (http://www.cdc.gov/foodnet/)

- Food Net - Foodborne Diseases Active Surveillance Network (CDC, USDA, FDA).



Foodborne Illness in the United States



CDC Home
CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

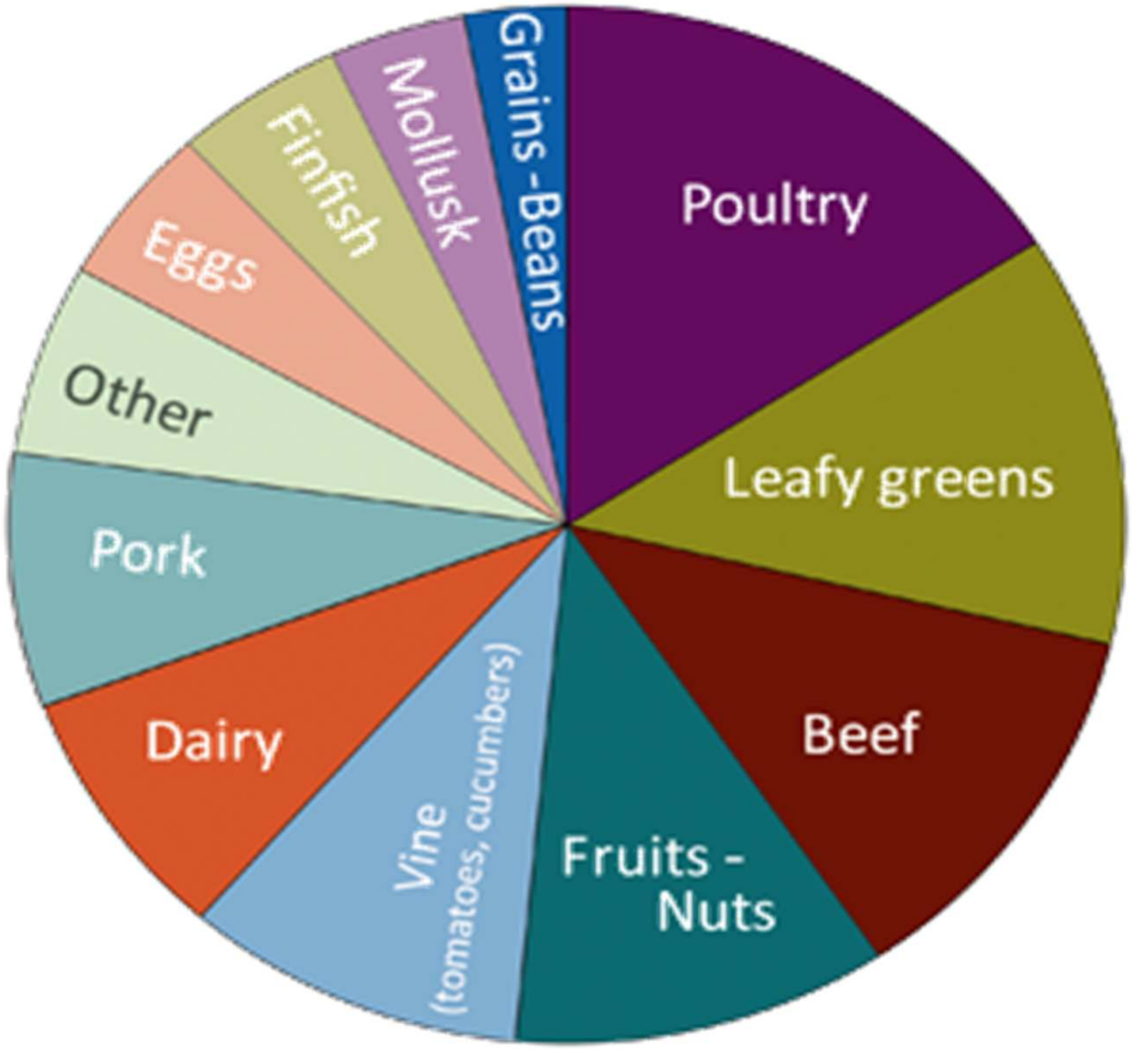
Foodborne Agents	Illnesses	%	Hospitalizations	Deaths
31 known pathogens	9.4 million	20	55,961	1,351
Unspecified agents	38.4 million	80	71,878	1,686
Total	47.8 million	100	127,839	3,037

http://www.cdc.gov/foodborneburden/2011-foodborne-estimates.html

Germs (and some foods) responsible for most foodborne illness

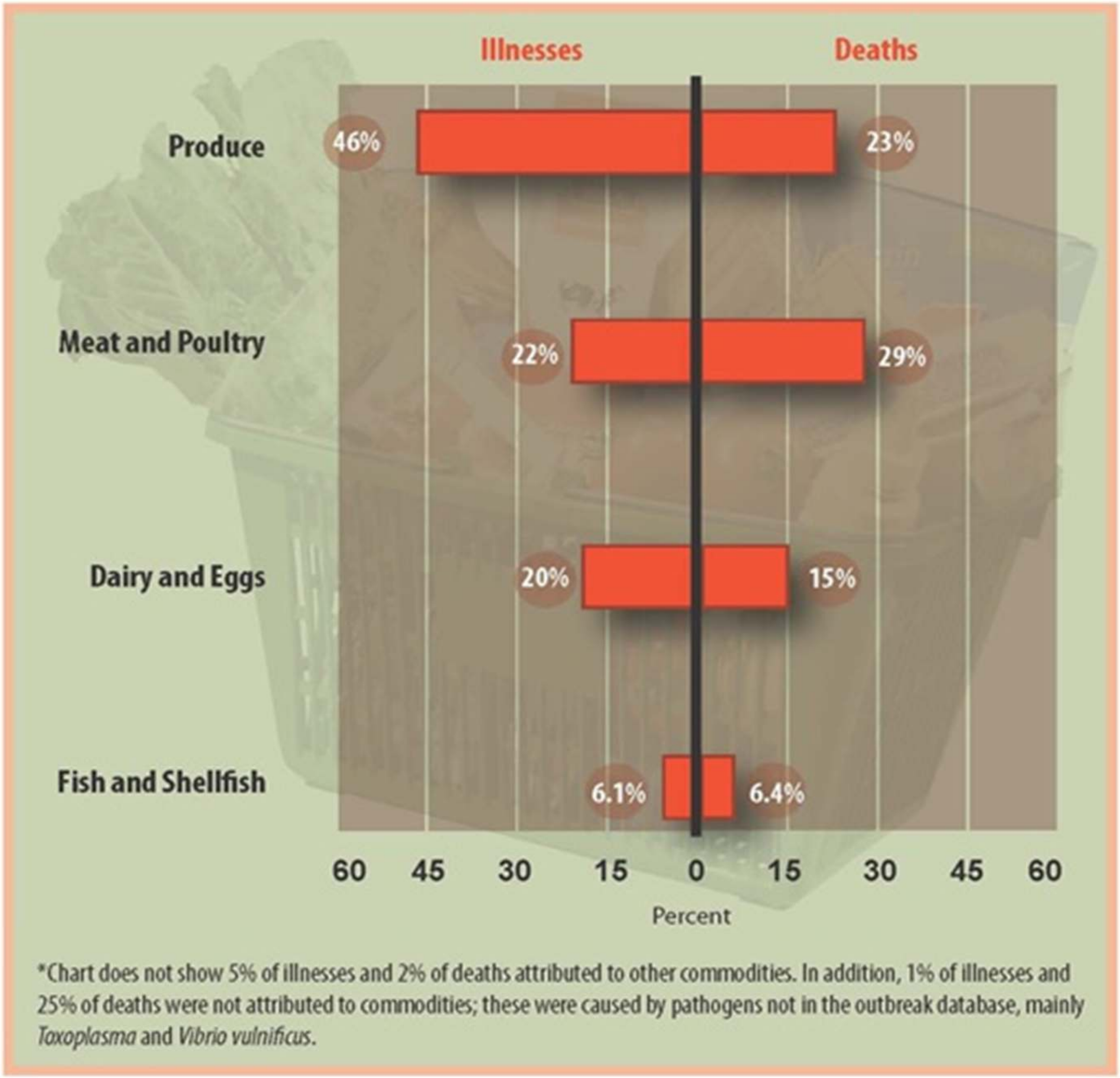
➢ *Campylobacter*	Poultry
➢ *E. coli* O157	Ground beef, Leafy greens, Raw milk
➢ *Listeria*	Deli meats, Unpasteurized soft cheeses, Produce
➢ *Salmonella*	Eggs, Poultry, Meat, Produce
➢ *Vibrio*	Raw oysters
➢ Norovirus	in many foods (e.g., Sandwiches, Salads)
➢ *Toxoplasma*	Meats

Causes of illness in outbreaks of single food commodities: 1998-2010



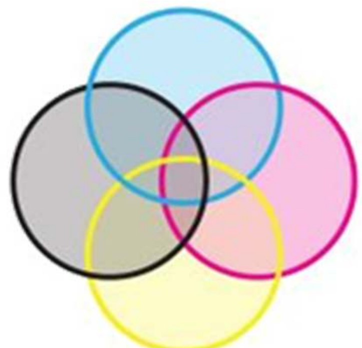
http://www.cdc.gov

Contribution of different food categories to estimated domestically acquired illness and deaths, 1998-2008



Source: Painter JA, Hoekstra RM, Ayers T, Tauxe RV, Braden CR, Angulo FJ, Griffin PM. Attribution of foodborne illnesses, hospitalizations, and deaths to food commodities by using outbreak data, United States, 1998–2008. Emerg Infect Dis [Internet]. 2013 Mar [date cited]. http://dx.doi.org/10.3201/eid1903.111866

FDA FOOD SAFETY MODERNIZATION ACT



Aims to ensure the U.S. food supply is safe by shifting the focus from responding to contamination to preventing it

www.fda.gov/FSMA

NATIONAL ACADEMY OF SCIENCES & GAO U.S. Government Accountability Office

Have called US FDA and USDA-FSIS to become more preventative and risk-based

<u>Need:</u>

Development of new data and risk-prioritization models to identify high-risk foods and facilities and to inform resource allocation decisions.

which pairs of foods and microbes present the greatest burden?

RANKING THE RISKS:

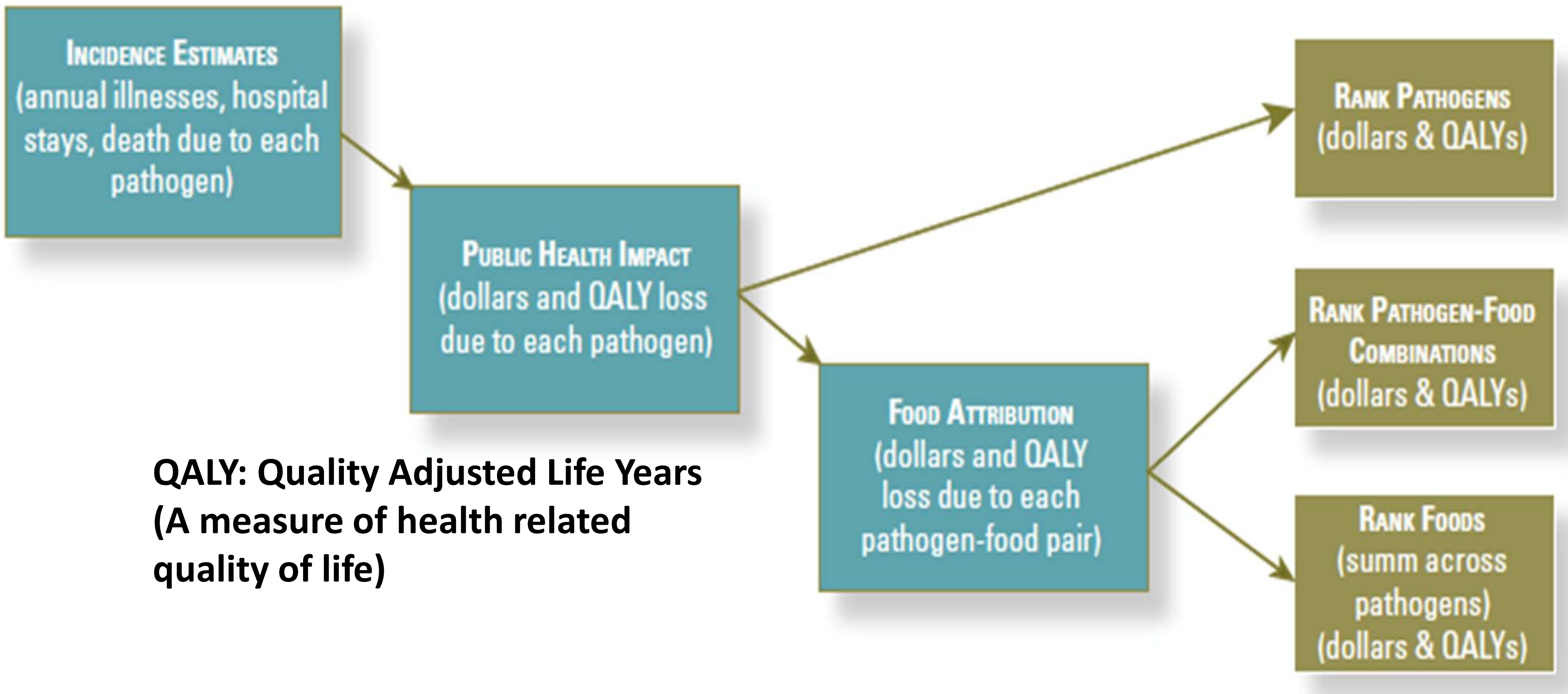
THE 10 PATHOGEN-FOOD COMBINATIONS WITH THE GREATEST BURDEN ON PUBLIC HEALTH

MICHAEL B. BATZ, SANDRA HOFFMANN AND J. GLENN MORRIS, JR.

UF | Emerging Pathogens Institute
UNIVERSITY *of* FLORIDA

Support for this report was provided by a grant from the Robert Wood Johnson Foundation.

Steps in Foodborne Illness Risk Ranking



QALY: Quality Adjusted Life Years (A measure of health related quality of life)

EPI, Univ of Florida

Annual Burden of Disease Caused by Fourteen Foodborne Pathogens, Sorted by Share of Overall Public Health Impact s (rank in parentheses)

Pathogen	Combined Rank*	QALY loss	Cost of Illness ($ mil.)	Illnesses	Hospital-izations	Deaths
Salmonella spp.	1	16,782 (1)	3,309 (1)	1,027,561 (2)	19,336 (1)	378 (1)
Toxoplasma gondii	2	10,964 (3)	2,973 (2)	86,686	4,428 (4)	327 (2)
Listeria monocytogenes	3	9,651 (4)	2,655 (3)	1,591	1,455	255 (3)
Campylobacter spp.	3	13,256 (2)	1,747 (5)	845,024 (4)	8,463 (3)	76 (5)
Norovirus	5	5,023 (5)	2,002 (4)	5,461,731 (1)	14,663 (2)	149 (4)
E. coli 0157:H7	6	1,565	272	63,153	2,138 (5)	20
Clostridium perfringens	6	875	309	965,958 (3)	438	26
Yersinia enterocolitica	8	1,415	252	97,656	533	29
Vibrio vulnificus	8	557	291	96	93	36
Shigella spp.	10	545	121	131,254 (5)	1,456	10
Vibrio other+	11	149	107	52,228	183	12
Cryptosporidium parvum	12	341	47	57,616	210	4.
E. coli STEC non-0157	13	327	26	112,752	271	0.
Cyclospora cayetanensis	14	10	2	11,407	11	0.
Total		63,375	14,120	8,914,713	53,678	1,322

* Combined rank is average of QALY loss rank and COI rank.
+ includes *Vibrio parahaemolyticus* and other non-choleric *Vibrio* species

EPI, Univ of Florida

The top 10 pathogen-food combinations in terms of annual disease burden, by combined rank

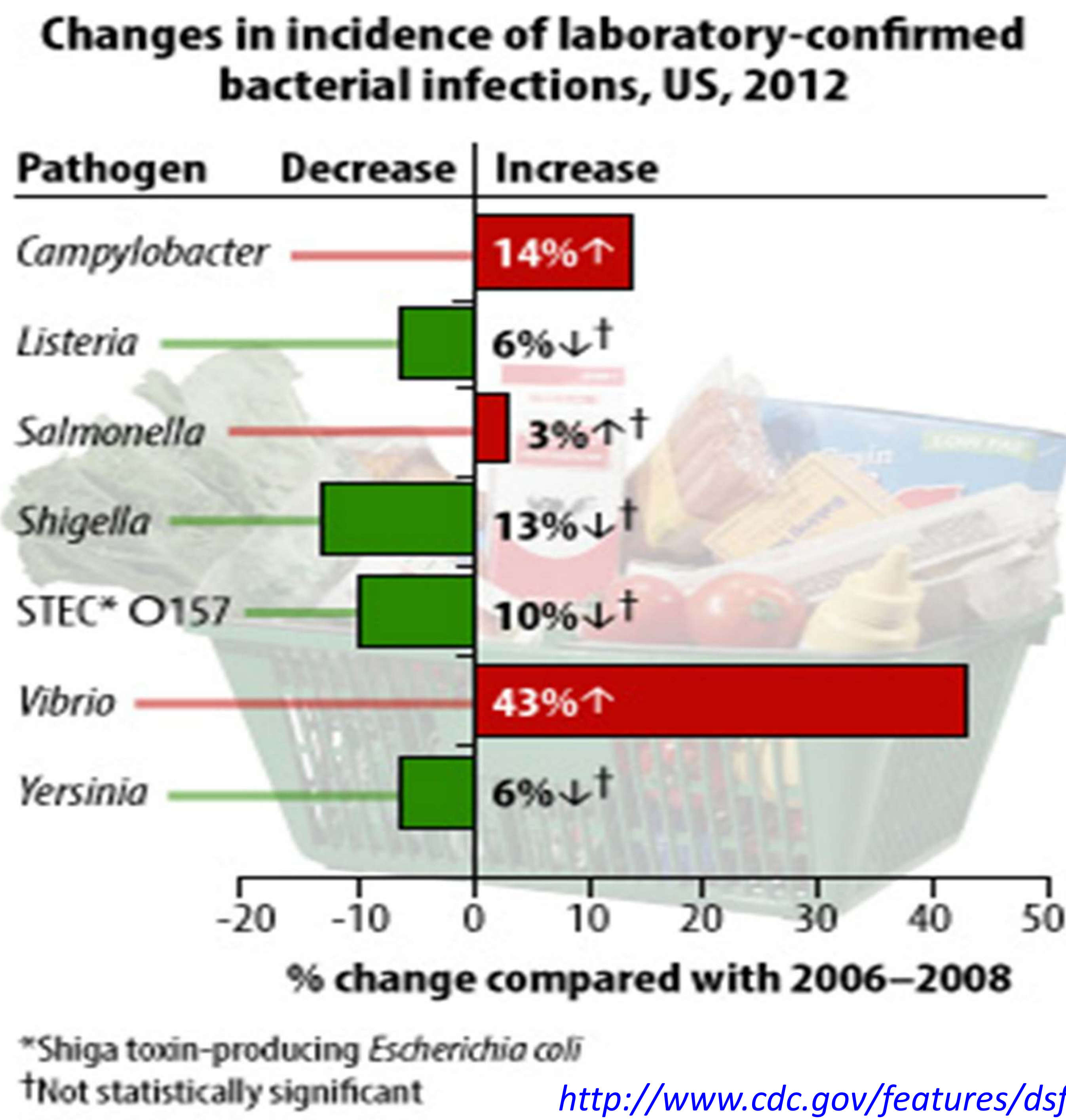
Pathogen-Food Combinations	Combined Rank	QALY loss	Cost of Illness ($ mil.)	Illnesses	Hospital-izations	Deaths
Campylobacter – Poultry	1	9,541	1,257	608,231	6,091	55
Toxoplasma – Pork	2	4,495	1,219	35,537	1,815	134
Listeria – Deli Meats	3	3,948	1,086	651	595	104
Salmonella – Poultry	4	3,610	712	221,045	4,159	81
Listeria – Dairy products	5	2,632	724	434	397	70
Salmonella – Complex foods	6	3,195	630	195,655	3,682	72
Norovirus – Complex foods	6	2,294	914	2,494,222	6,696	68
Salmonella – Produce	8	2,781	548	170,264	3,204	63
Toxoplasma – Beef	8	2,541	689	20,086	1,026	76
Salmonella – Eggs	10	1,878	370	115,003	2,164	42
Total		36,915	8,151	3,861,128	29,830	765

EPI, Univ of Florida

Disease Burden by Food Category, Summed Across Pathogens, by Combined Rank

	Food Category	QALY Loss	Cost of illness ($ mil.)	Illnesses	Hospital-izations	Deaths
1	Poultry	14,744	2,462	1,538,468	11,952	180
2	Complex foods	7,518	2,078	3,001,858	11,674	189
3	Pork	7,830	1,894	449,322	4,334	201
4	Produce	6,171	1,404	1,193,970	7,125	134
5	Beef	5,766	1,338	760,799	4,818	131
6	Deli/Other Meats	5,065	1,338	204,293	1,889	129
7	Dairy products	5,410	1,232	297,410	2,933	114
8	Seafood	2,762	921	642,860	2,937	97
9	Game	2,551	651	46,636	1,106	69
10	Eggs	2,252	428	170,123	2,472	45
11	Baked goods	988	273	462,399	1,833	25
12	Beverages	403	94	146,577	606	8
	Total	61,461	14,114	8,914,713	53,678	1,322

EPI, Univ of Florida



http://www.cdc.gov/features/dsfoodnet2012/

FOOD SAFETY PROGRESS REPORT FOR 2012

Disease Agents	Percentage change in 2012 compared with 2006–2008	2012 rate per 100,000 Population	2020 target rate per 100,000 Population	CDC estimates that...
Campylobacter	14% increase	14.30	8.5	For every *Campylobacter* case reported, there are 30 cases not diagnosed
Escherichia coli O157	No change	1.12	0.6	For every *E. coli* O157 case reported, there are 26 cases not diagnosed
Listeria	No change	0.25	0.2	For every *Listeria* case reported, there are 2 cases not diagnosed
Salmonella	No change	16.42	11.4	For every *Salmonella* case reported, there are 29 cases not diagnosed
Vibrio	43% increase	0.41	0.2	For every *Vibrio parahaemolyticus* case reported, there are 142 cases not diagnosed
Yersinia	No change	0.33	0.3	For every *Yersinia* case reported, there are 123 cases not diagnosed

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

For more information, see http://www.cdc.gov/foodnet/

Preliminary FoodNet 2012 Data

April 2013
CS239349

Needs of food safety management

Quick and accurate identification of hazards, ranks and the hazards by level of importance

and

Identifying microbial control approaches of greatest impact on reducing hazards, including strategies to address ***emerging hazards***

Institute of Food Technologists

Emerging hazard or risk

It is a new risk which is in the process of being understood and quantified

- risks that have no track record which can be used to estimate likely probabilities and expected losses

- risks that are expected to grow greatly in significance

Emerging food safety risk: The new risk emerging to different kinds of foods

Emerging foodborne pathogens

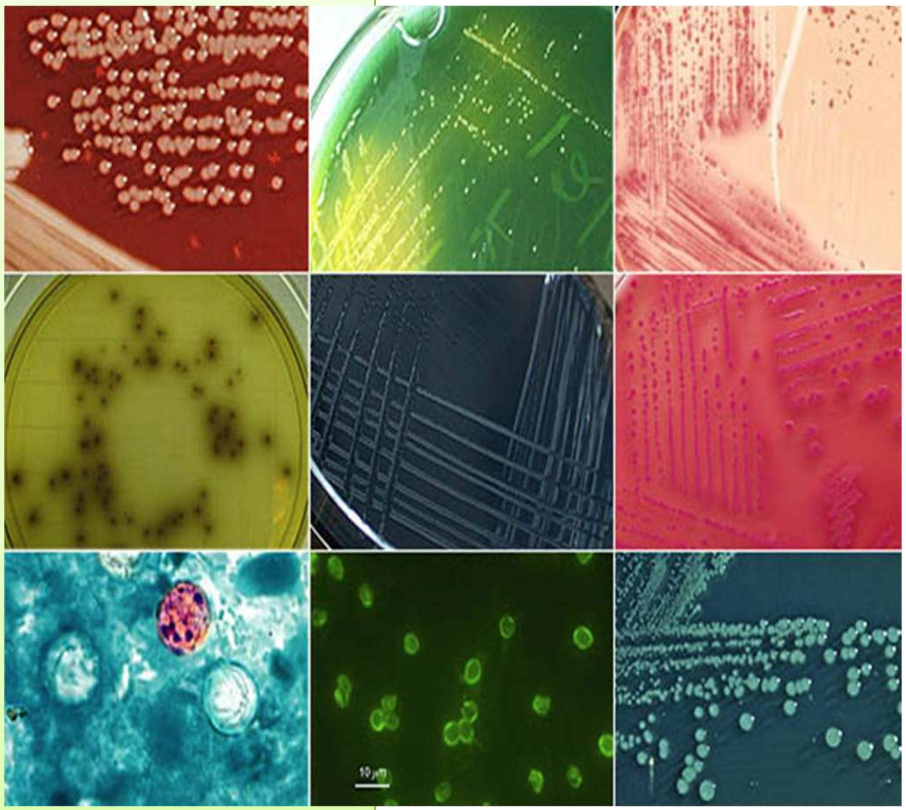
→ Those causing illnesses that have only recently appeared or been recognized in a population

and also

→ those that are well recognized but are rapidly increasing in incidence or geographic range

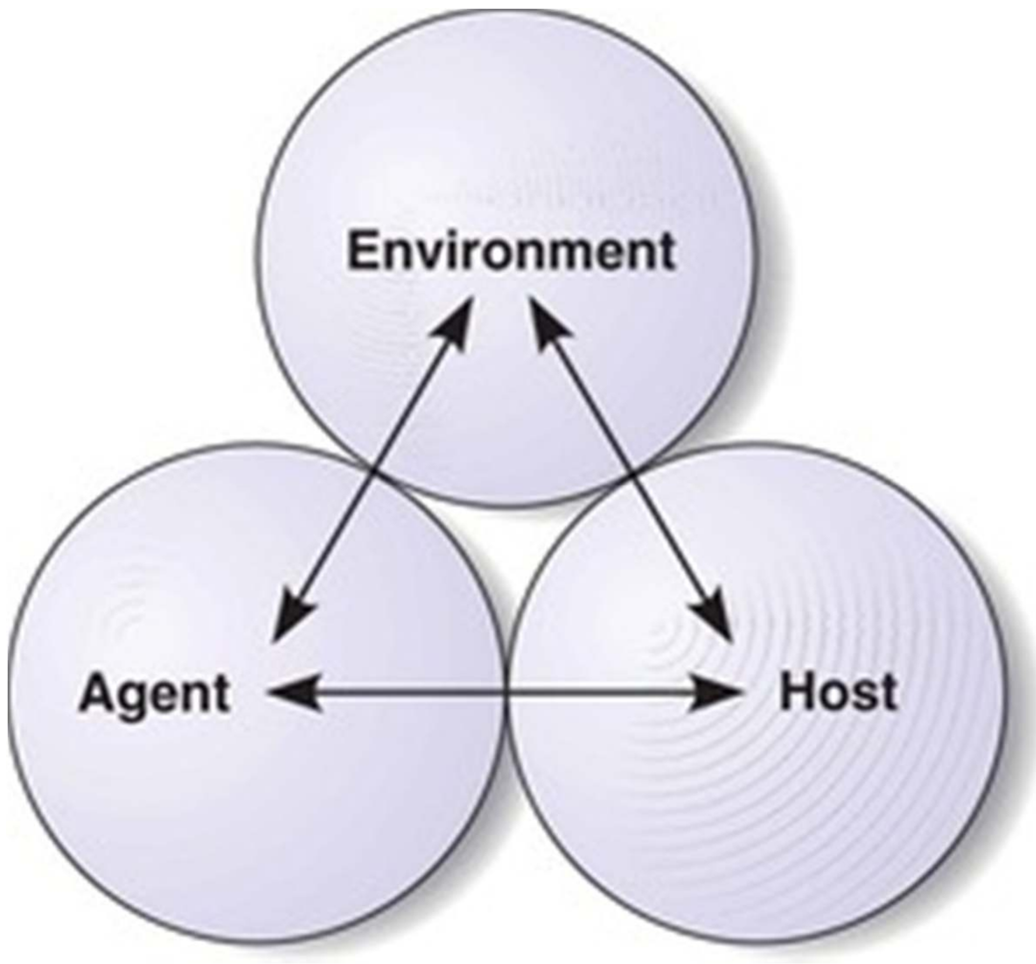
Emerging foodborne bacteria

- *Salmonella* (multidrug resistant strain)
- *Campylobacter jejuni*
- *E. coli* O157:H7 and non O157
- *Listeria monocytogenes*
- *S. aureus* MRSA
- *Vibrio vulnificus*
- *Yersinia enterocolitica*
- *Arcobacter* spp.
- *Mycobacterium paratuberculosis*

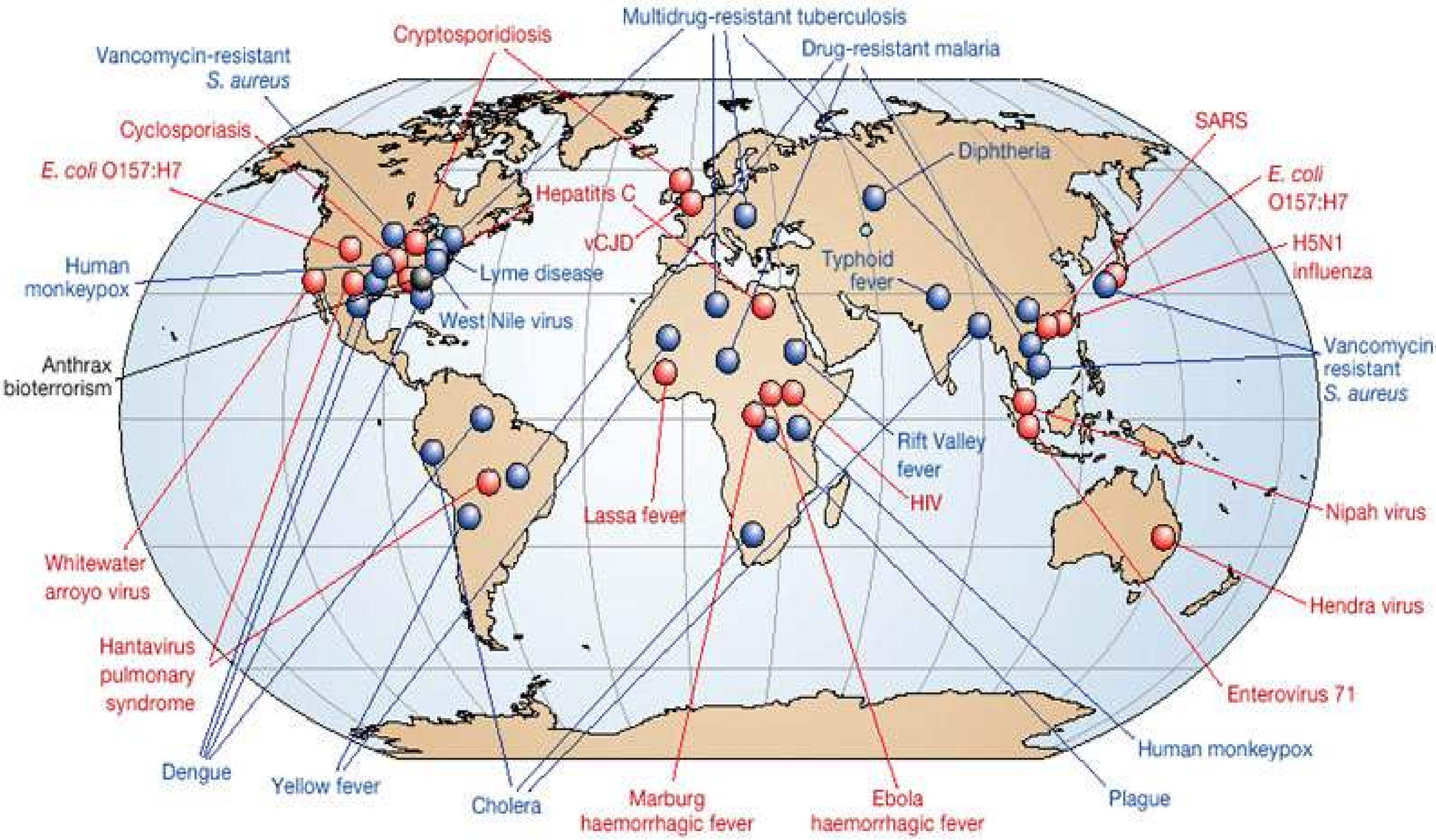


Why do pathogens emerge?

Factors leading to pathogen emergence



Examples of recent emerging diseases



Nature; Vol 430; July 2004

Food pathogens emerge mainly due to

- Newly identified host or pathogenicity
- Known pathogens spreading to new geographical areas or populations
- ‘Old’ disease re-emergence

Key issues on the horizon

- Globalization of the Food Supply
- Alternative Processing Technologies and Novel Foods
- Increases in Organic Foods
- Changes in Food Consumption
- At-Risk Subpopulations
- Pathogen Evolution
- Consumer Understanding
- Integrated Food Safety System

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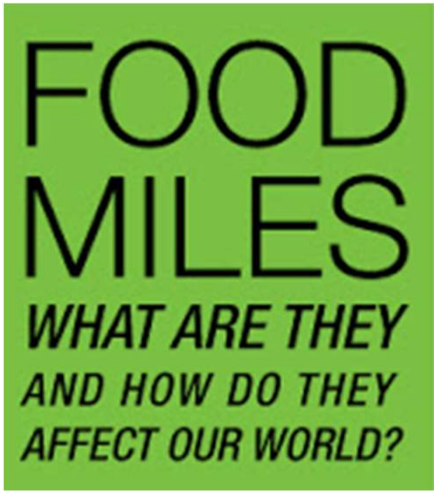
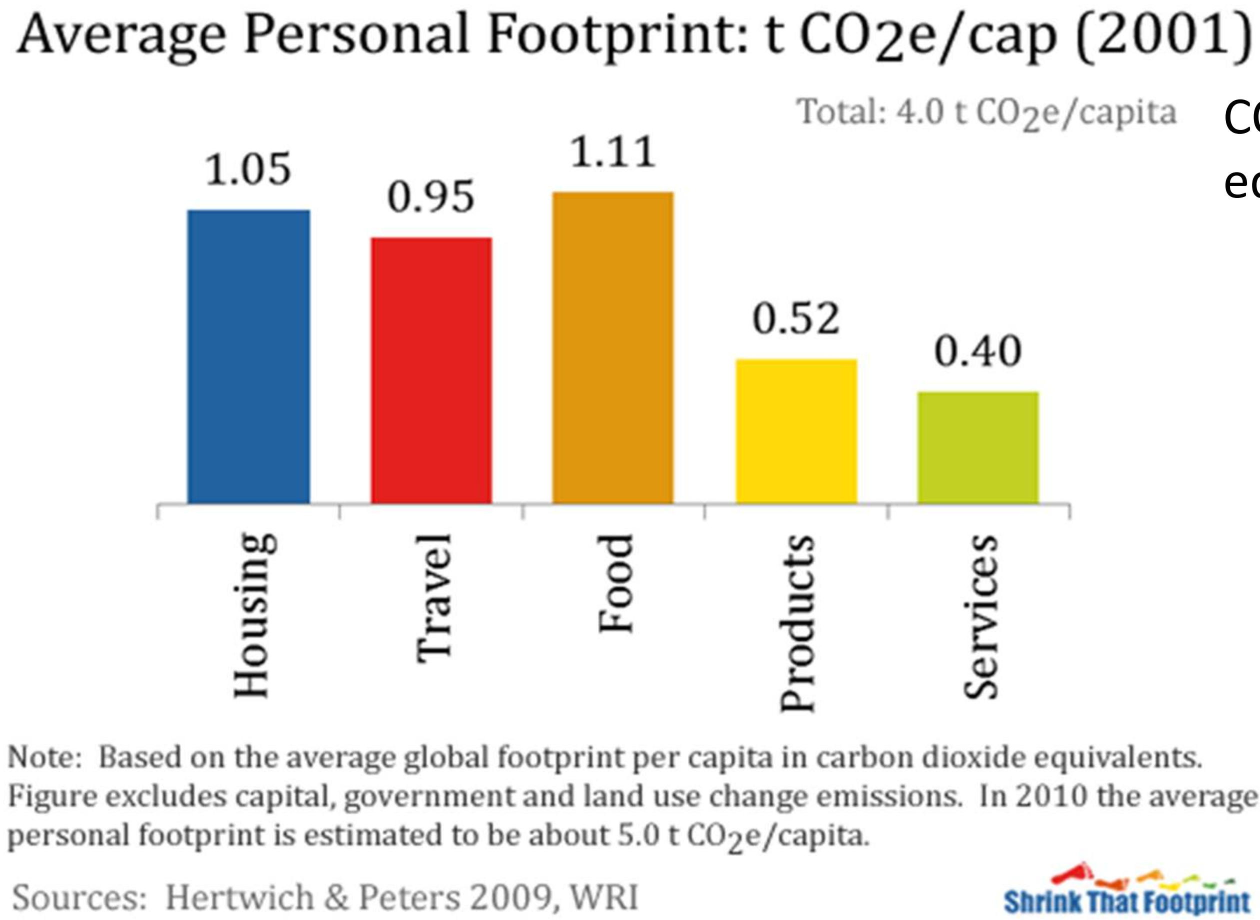
Global travel of food

Global travel and trade

Global travel and trade



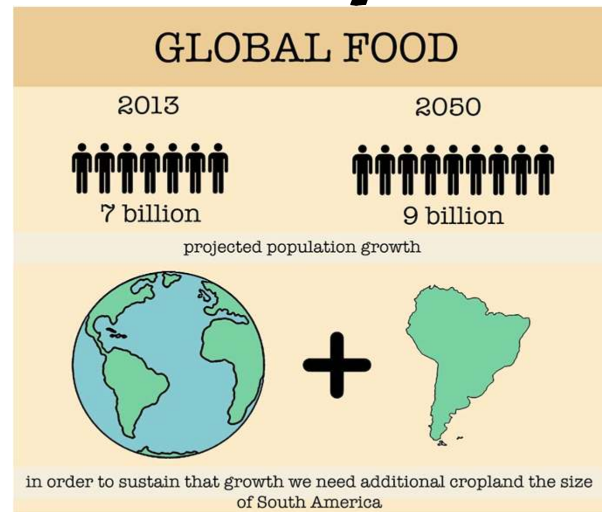
Global travel and trade



CO_2e: Carbon dioxide equivalents

A personal footprint is a measure of how a person's lifestyle contributes to climate change.

Population and food security



By 2050

- ➢ World's population→9-10 billion (34% higher than today)

- ➢ Increased urbanization from 49% today to 70%
  - Food production must increase by 70%
  - Annual cereal production must rise from 2.1 billion tons today to 3 billion
  - Annual meat production must rise to 470 million tons from 200 million tons today.

Key issues on the horizon

- Globalization of the Food Supply
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- Increases in Organic Foods
- Changes in Food Consumption
- At-Risk Subpopulations
- **Pathogen Evolution**
- Consumer Understanding
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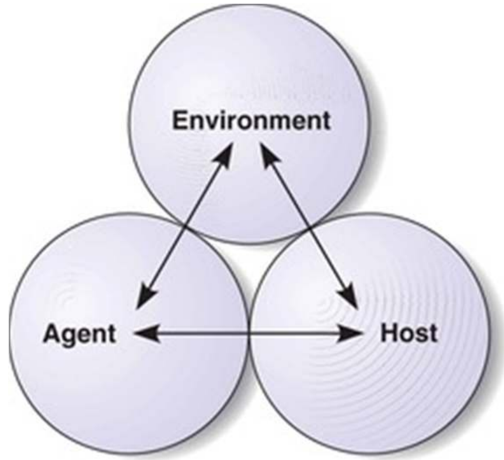
Microbial evolution

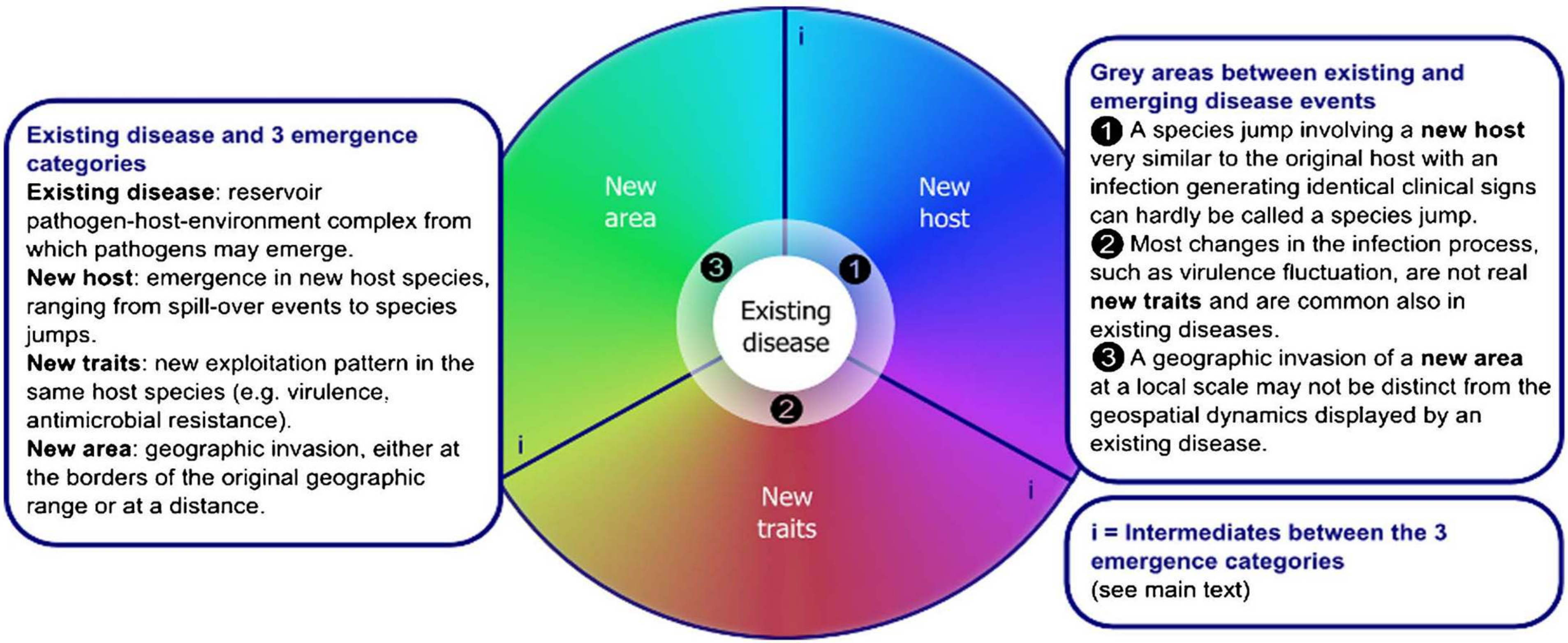


Environmental and ecological changes

- Selection/evolution
- Adaptation to extreme temperatures, pH
- New hosts or vectors

Antimicrobial resistance

An infectious disease emergence framework



Nature Reviews-2013

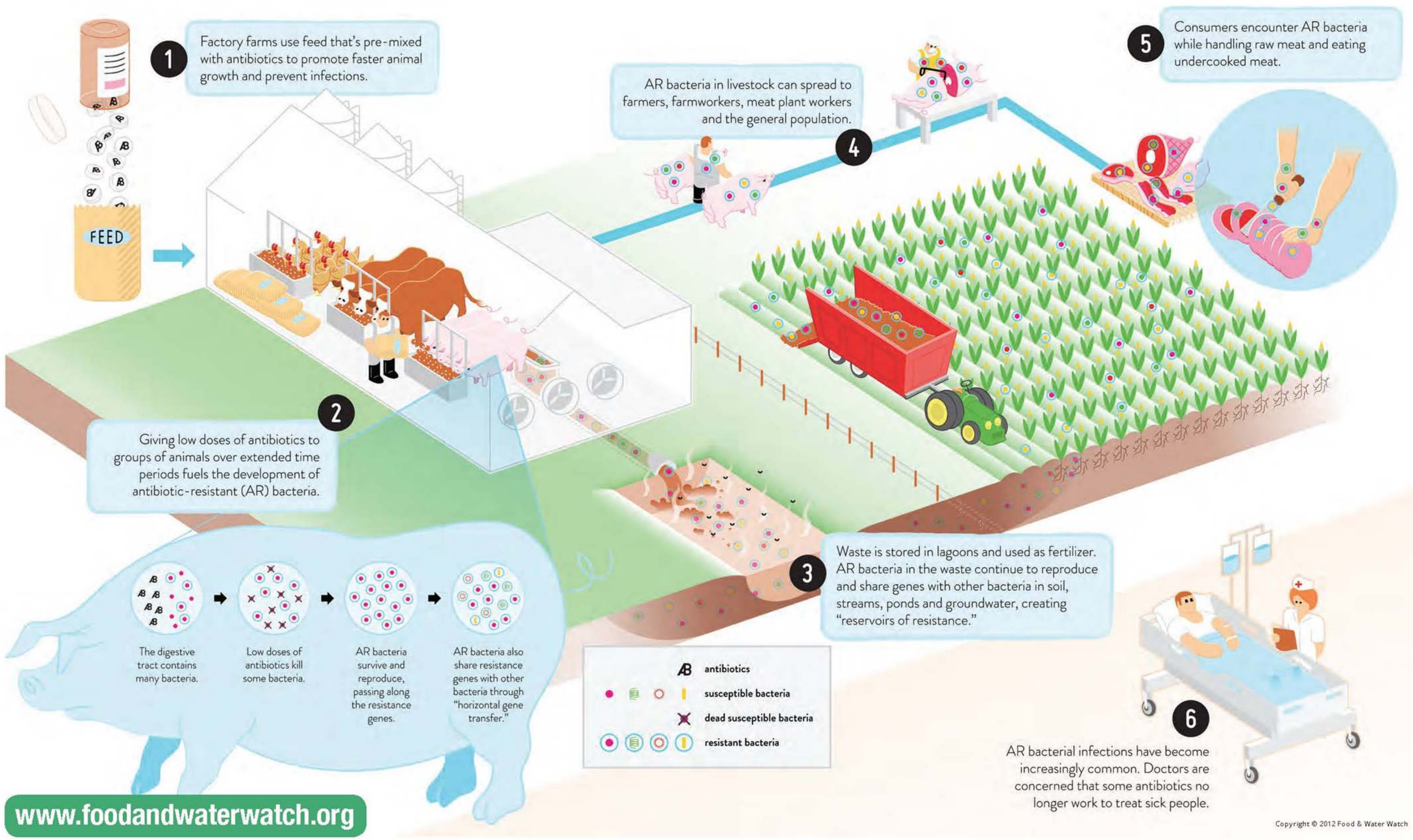
Microbial evolution

Antimicrobial usage

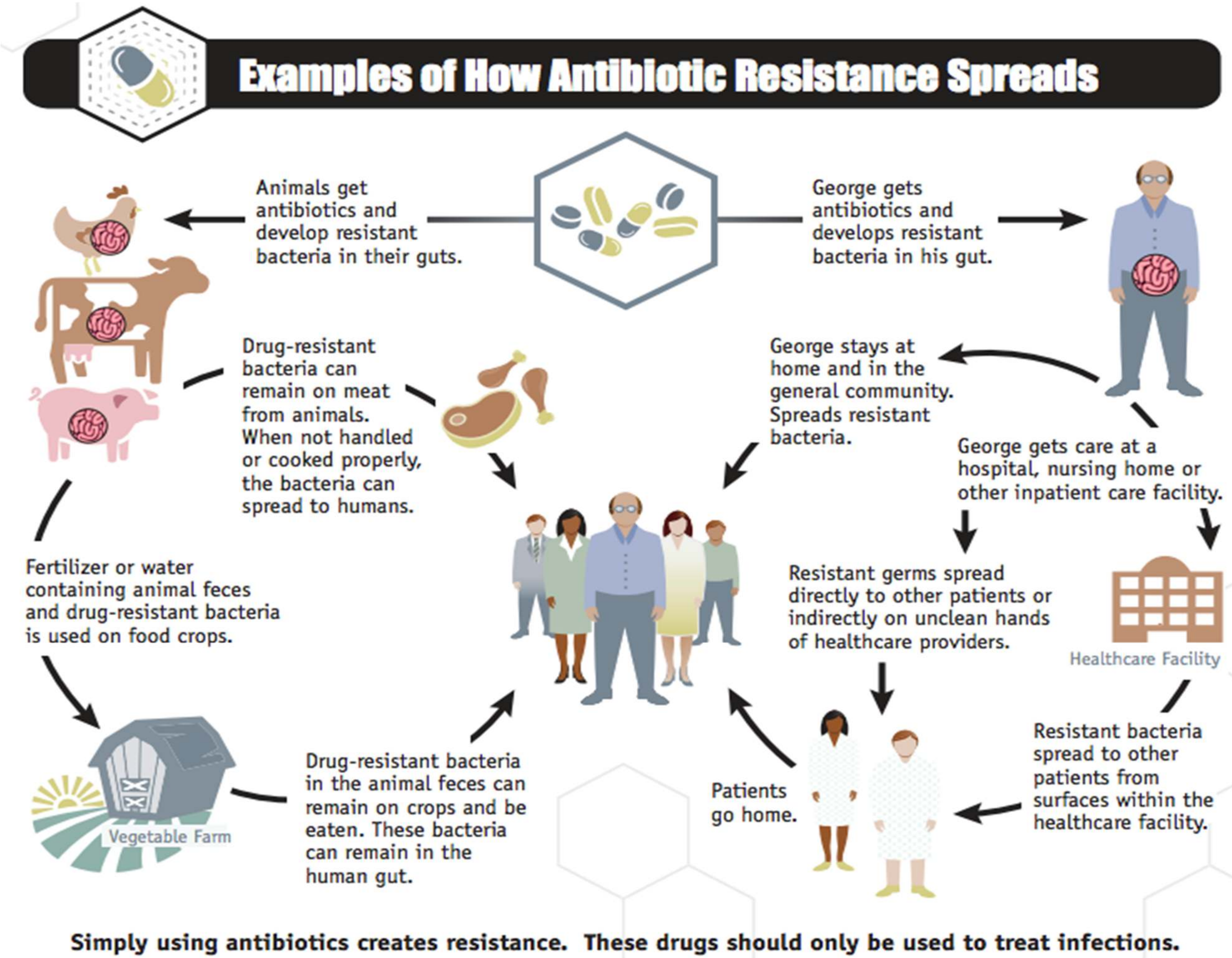
In the United States, antibiotic-resistant infections are responsible for an estimated $20 billion in excess healthcare costs, $35 billion in societal costs, and 8 million additional hospital days. CDC

How Antibiotic Misuse on Factory Farms Can Make You Sick

food&waterwatch



www.foodandwaterwatch.org



http://www.cdc.gov/drugresistance/threat-report-2013/

Microbial evolution

Antimicrobial resistance

- *Vancomycin-resistant enterococci* (VRE)
- *Salmonella Typhimurium* DT 104
- *Campylobacter jejuni* and *C. coli*
- *S. aureus* (30-40% MRSA)
- *Mycobacterium tuberculosis* (15% MDR)

CDCs four core actions to fight antibiotic resistance

1. Preventing Infections, Preventing the Spread of Resistance

2. Tracking Resistance Patterns

3. Improving Use of Today's Antibiotics (Antibiotic Stewardship)

4. Developing New Antibiotics and Diagnostic Tests

http://www.cdc.gov/drugresistance/threat-report-2013/

Summary

Food safety challenges

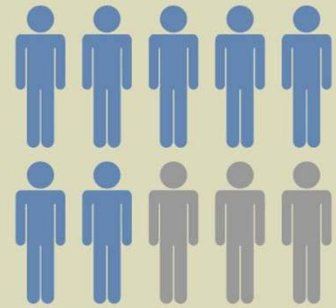
- The emergence and spread of new microbes, new hosts
- The globalization of travel and food supply
- The rise of drug-resistant pathogens

http://www.cdc.gov/foodborneburden

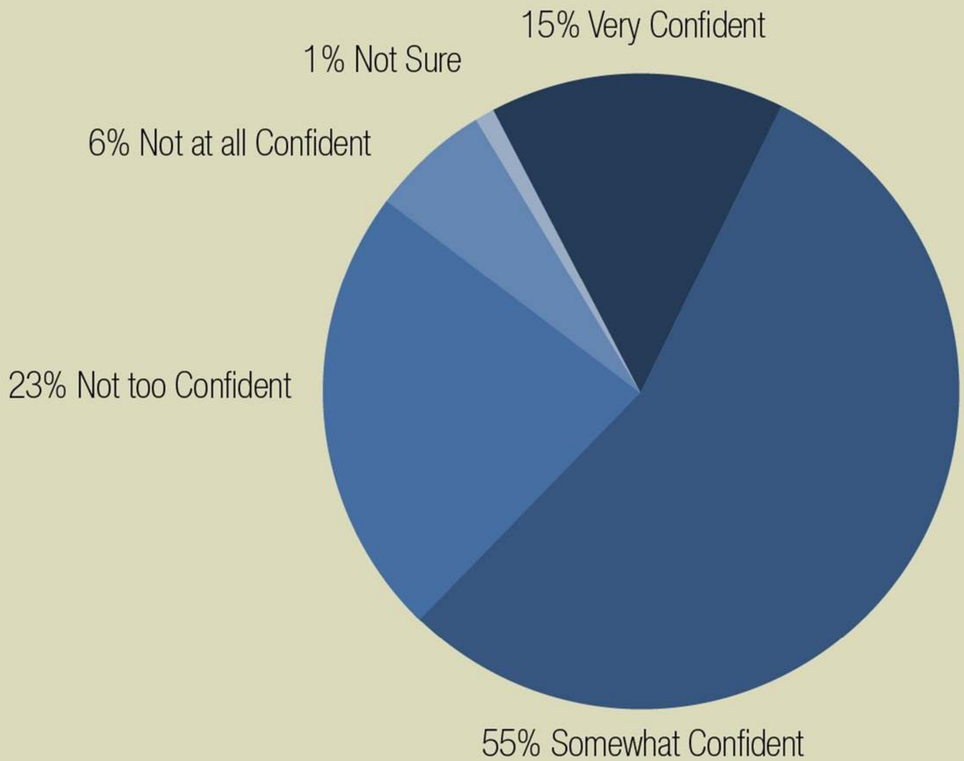
Managing emerging pathogens

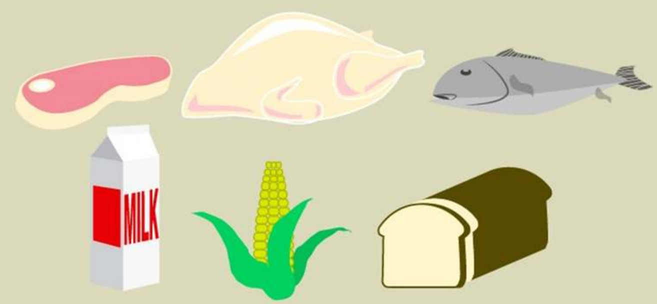
- Recognition
- Investigation
  - Diagnosis and surveillance
  - Applied epidemiological and ecological research
- Education/knowledge transfer
- Information/communication
- International/interdisciplinary interventions

7 OUT OF 10 CONSUMERS ARE CONFIDENT IN THE SAFETY OF THE U.S. FOOD SUPPLY



BREAKDOWN OF ALL RESPONSES:





70% of consumers are **VERY** or **SOMEWHAT** confident in the safety of the U.S. food supply.

SOURCE: 2013 IFIC Foundation *Food & Health Survey* www.foodinsight.org

5 YEARS OF FOOD SAFETY SUCCESS

More Americans are taking basic food safety precautions when cooking, preparing, or consuming food.

Which of the following actions do you perform regularly when cooking, preparing, and consuming food products?*	2009	2013
Wash my hands with soap and water.	87%	97%
Wash cutting board with soap and water or bleach.	77%	89%
Properly store leftovers within 2 hours of serving.	69%	81%
Separate raw meat, poultry, and seafood from ready-to-eat products.	63%	77%
Cook to required temperature (such as 165˚F for poultry).	71%	77%
Use different or freshly-cleaned cutting boards for each product (such as raw meat, or poultry or produce.	50%	67%
Use a food thermometer to check the doneness of meat and poultry items.	25%	36%

SOURCE: 2013 IFIC Foundation *Food & Health Survey* www.foodinsight.org


THERES LIGHT AT THE END OF EVERY TUNNEL,
KEEP MOVING.

My research work

Journal of Food Protection, Vol. 75, No. 6, 2012, Pages 1148–1152
doi:10.4315/0362-028X.JFP-11-543

Research Note

Screening of Commercial and Pecan Shell–Extracted Liquid Smoke Agents as Natural Antimicrobials against Foodborne Pathogens

ELLEN J. VAN LOO,[1,2,3] D. BABU,[1,2]* PHILIP G. CRANDALL,[1,2] AND STEVEN C. RICKE[1,2]

[1]*Department of Food Science and the Center for Food Safety, University of Arkansas, Fayetteville, Arkansas, 72704, USA;* [2]*Sea Star International LLC, 2138 East Revere Place, Fayetteville, Arkansas, 72701, USA; and* [3]*Department of Agricultural Economics, Bioscience Engineering Faculty, Ghent University, Coupure links 653, B-9000 Ghent, Belgium*

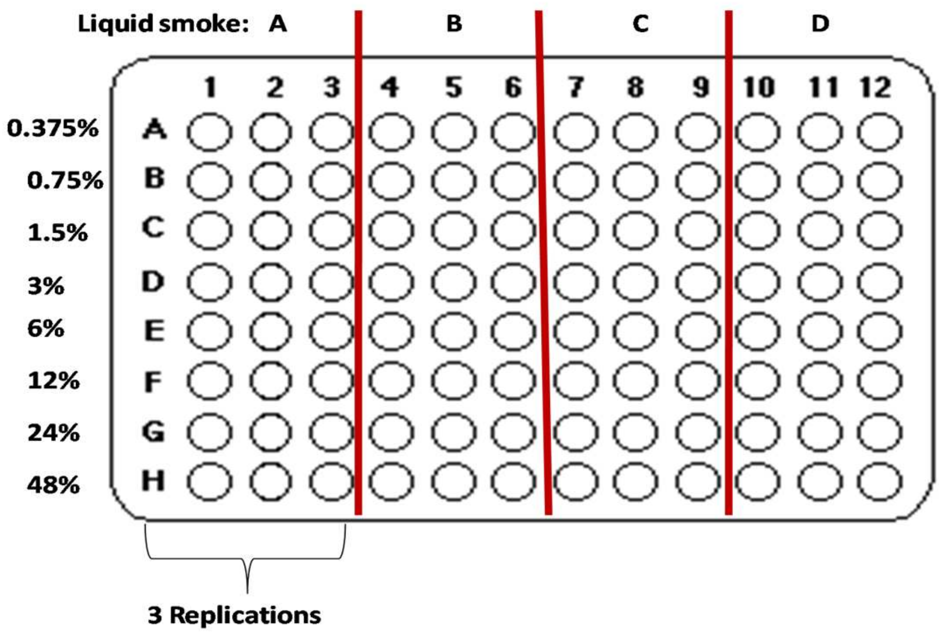
MS 11-543: Received 12 December 2011/Accepted 24 January 2012

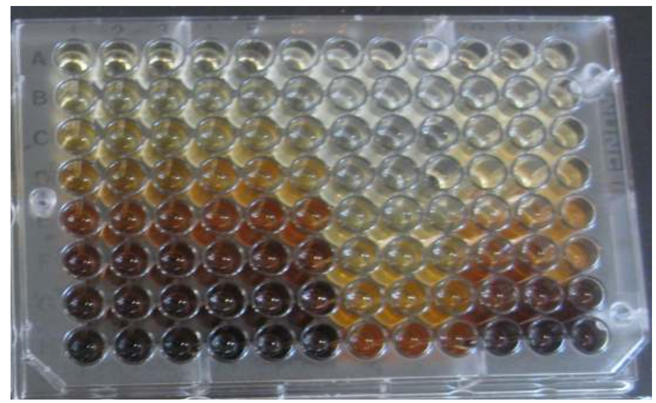
Prepared solvent-extracted antimicrobials in the laboratory (Acetic acid and Methanol) and compared with commercial liquid smokes (of different woods) against food pathogens.

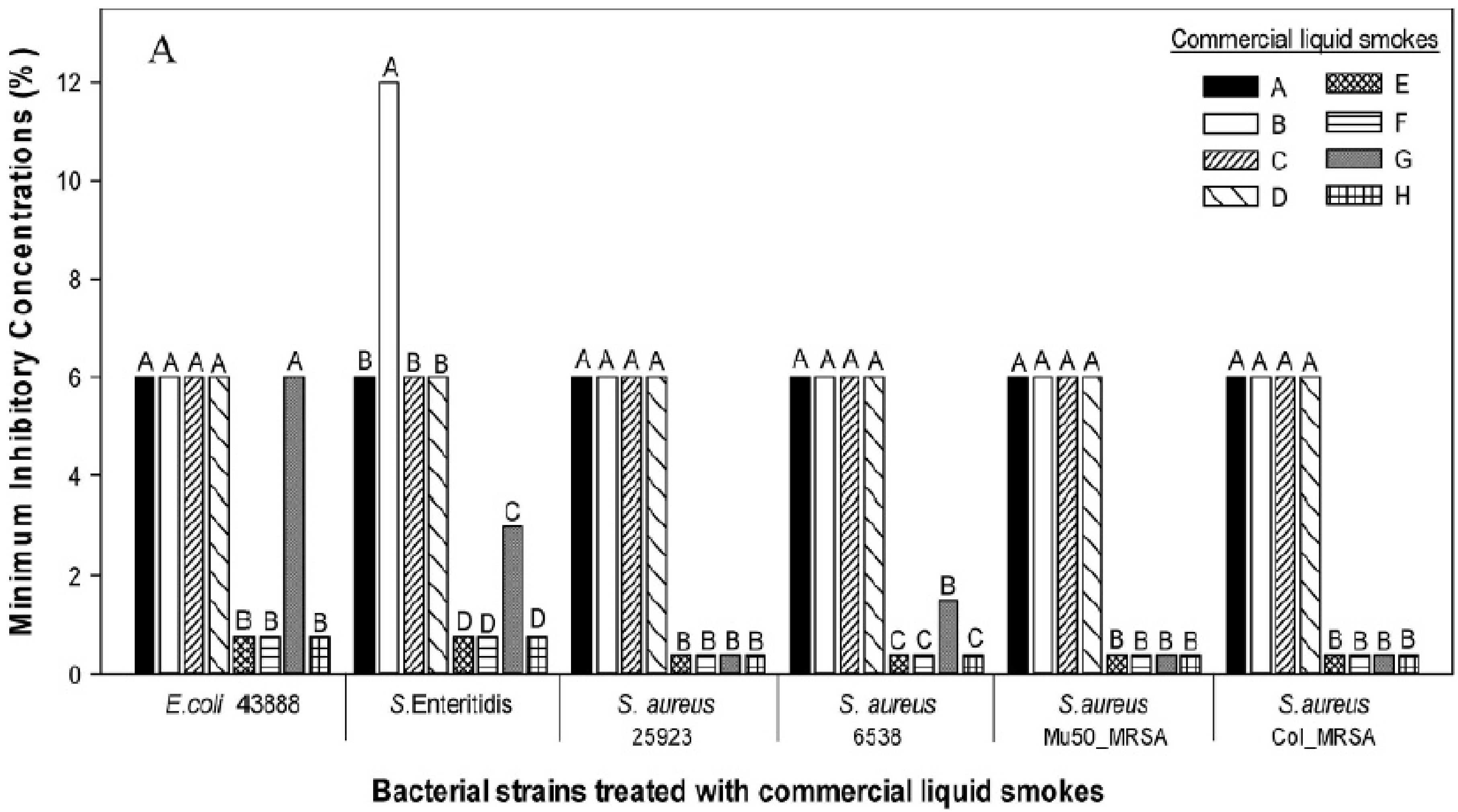
TABLE 1. *Overview of the strains and sources*

Strain	Source
E. coli O157:H7	ATCC 43888
Salmonella Enteritidis	PT 13A, Poultry Science, University of Arkansas, Fayetteville
S. aureus	ATCC 25923
S. aureus	ATCC 6538
S. aureus Mu50, MRSA (methicillin resistant)	Obtained from Dr. Brian Wilkinson's laboratory, Illinois State University, Normal
S. aureus Col, MRSA (methicillin resistant, homogeneous)	Obtained from Dr. Brian Wilkinson's laboratory, Illinois State University, Normal
Listeria monocytogenes 174, serotype 1/2a	Strain 10403S, wild type, obtained from Dr. Weidemann, Cornell University, Ithaca, NY
Listeria monocytogenes 163 Scott A, serotype 4b	Strain NADC (National Animal Disease Center) 2045, obtained from Dr. Aubrey Mendonca, Department of Food Science and Human Nutrition, Iowa State University, Ames
Salmonella Typhimurium 29	Obtained from Dr. Michael Slavik, University of Arkansas, Fayetteville; source, CDC
Salmonella Typhimurium LT2	ATCC 19585

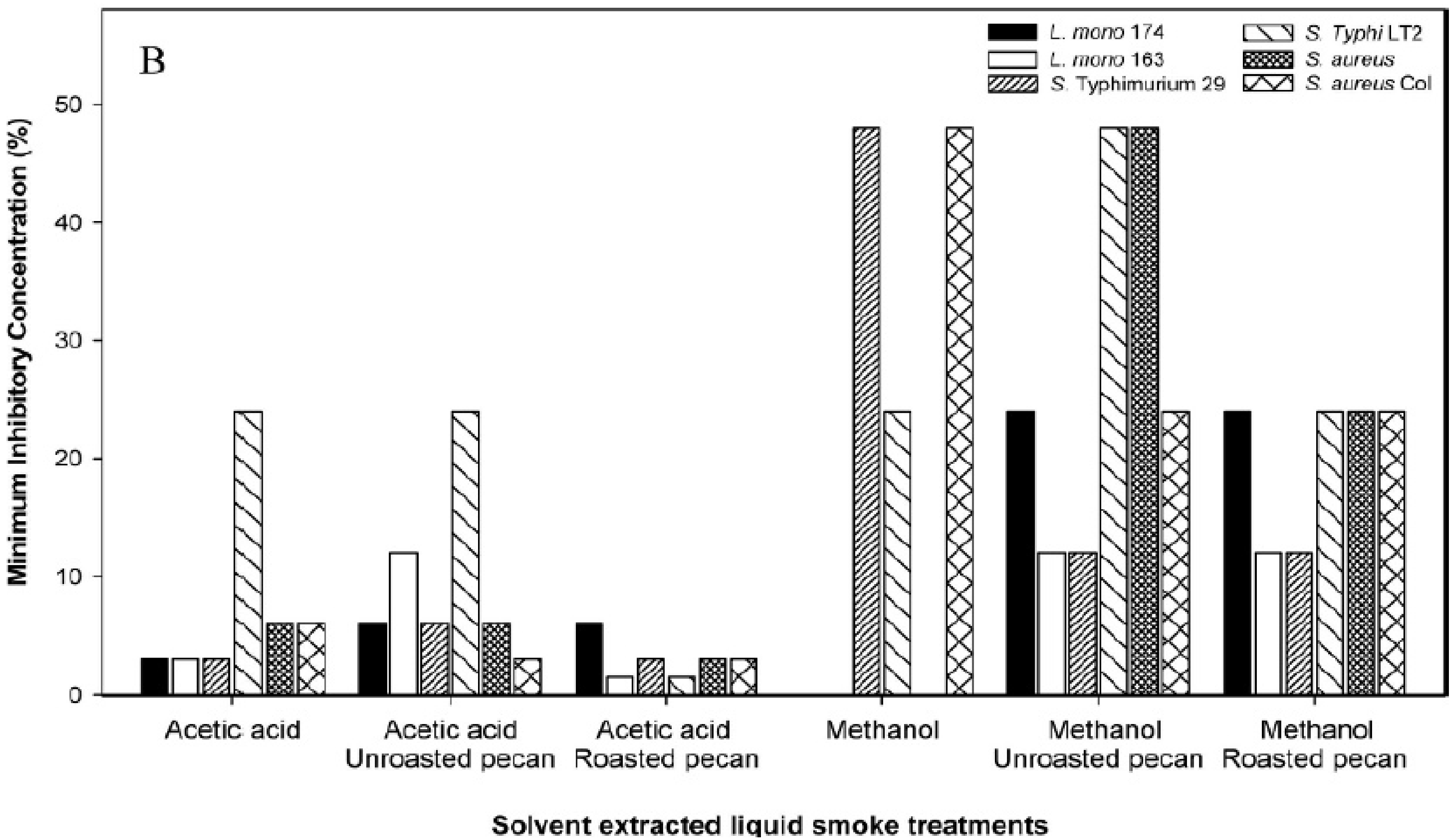
Minimum inhibitory concentrations (% MIC)







%MICs of commercial liquid smoke samples (A) and solvent-extracted antimicrobials prepared in the laboratory (B) against major food pathogens. Mean MIC comparisons were done separately for each bacterial strain. Bars labeled with different letters indicate a significant difference (P , 0.05) between treatments for a particular bacterium.



%MICs of commercial liquid smoke samples (A) and solvent-extracted antimicrobials prepared in the laboratory (B) against major food pathogens. Mean MIC comparisons were done separately for each bacterial strain. Bars labeled with different letters indicate a significant difference (P , 0.05) between treatments for a particular bacterium.

Solvent extracted antimicrobials prepared using pecan shells indicated significant differences between their inhibitory concentrations depending on the type of solvents used for extraction.

Liquid smoke samples tested in this study could serve as effective natural antimicrobials and their inhibitory effects depended more on the use of solvents for extraction rather than the wood sources.

Journal of Food Science
Volume 78, Issue 12, pages M1899–M1903, December 2013

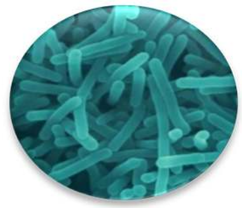
Efficacy of Antimicrobials Extracted from Organic Pecan Shell for Inhibiting the Growth of *Listeria* spp.

Dinesh Babu, Philip G. Crandall, Casey L. Johnson, Corliss A. O’Bryan, and Steven C. Ricke

- We tested the efficacy of natural antimicrobials extracted from organic pecan shells.

- We estimated the minimum inhibitory concentrations of the antimicrobials against pure cultures and tested on inhibition of *Listeria* strains and inoculated on a chicken skin model and native bacteria on chicken skin.

Inhibition of *L. monocytogenes* on chicken skin



Cocktail mix
(*L. monocytogenes*)

Poultry skin model

incubation on ice

30 min

Antimicrobial extract

15min

Stomaching in BPW

Dilution plating in MOX

Table 1–*Listeria* serotypes subjected to the antimicrobial treatments.

Listeria strain	Serotype
L. innocua (*Li* 169)	M1
L. monocytogenes (*Lm* 187)	4b
L. monocytogenes (*Lm* 188)	4b
L. monocytogenes (*Lm* 189)	1/2a
L. monocytogenes (*Lm* 190)	1/2a
L. monocytogenes (*Lm* 191)	1/2a
L. ivanovii (*Li* 192)	–

Table 2–Minimal inhibitory concentrations of pecan shell extracts on *Listeria* species individually and as a cocktail. Different capital letters in a row indicate significant difference ($P < 0.05$) between species; different lower case letters within a column indicate significant difference ($P < 0.05$) for treatment within species.

	Li 169	*Lm* 186	*Lm* 187	*Lm* 188	*Lm* 190	*Lm* 191	*L. ivanovii*	Cocktail
Pecan shell extract (unroasted)	1.5Ba	1.5Ba	1.5Ba	1.5Ba	1.5Bb	3Aa	1.5Ba	1.5Ba
Roasted pecan shell powder extract	0.75Bb	0.75Bb	0.375Cb	0.375Cb	6Aa	0.188Db	0.375Cb	0.375Cb

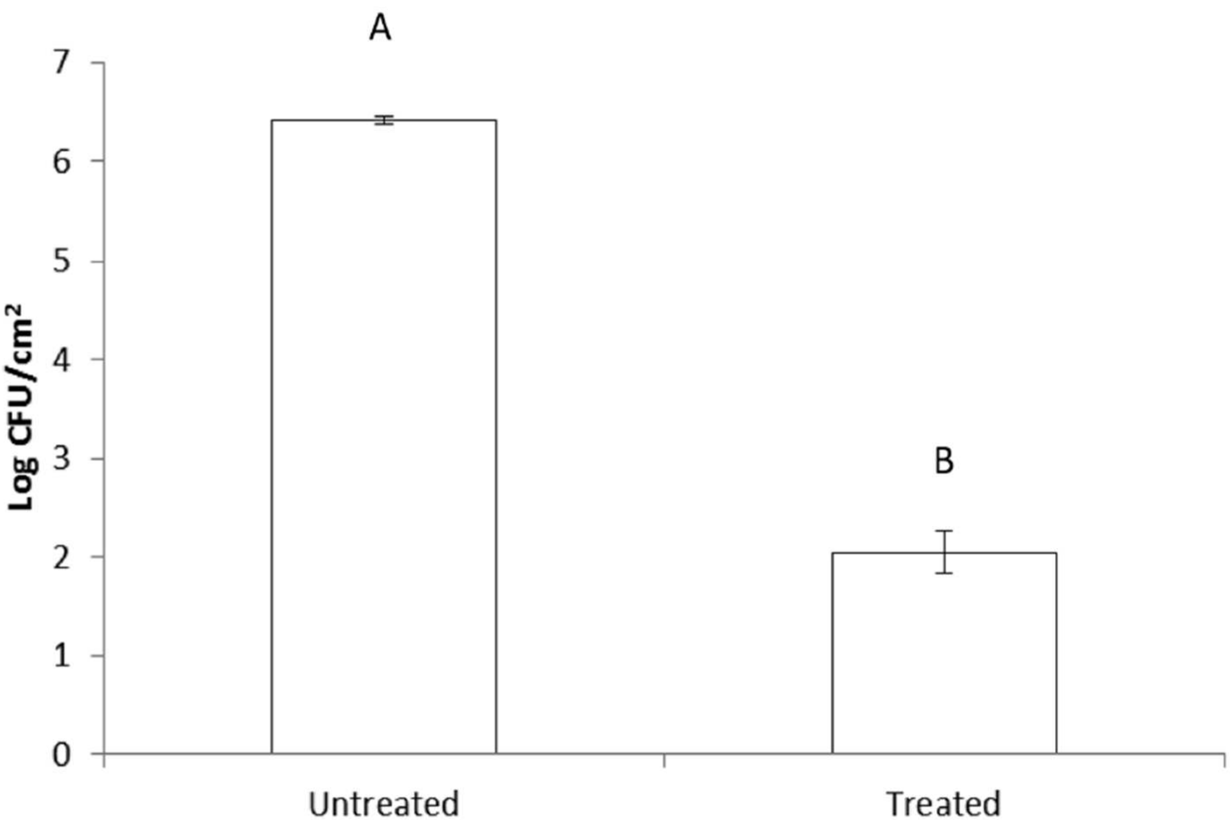


Figure 1–Effect of unroasted pecan shell extract on indigenous microflora of uninoculated chicken skin. Error bars represent standard error of the mean. Three replication mean comparisons were done using SAS 9.2 statistical software and different letters on each bar indicate significant difference ($P < 0.05$) between treated and untreated.

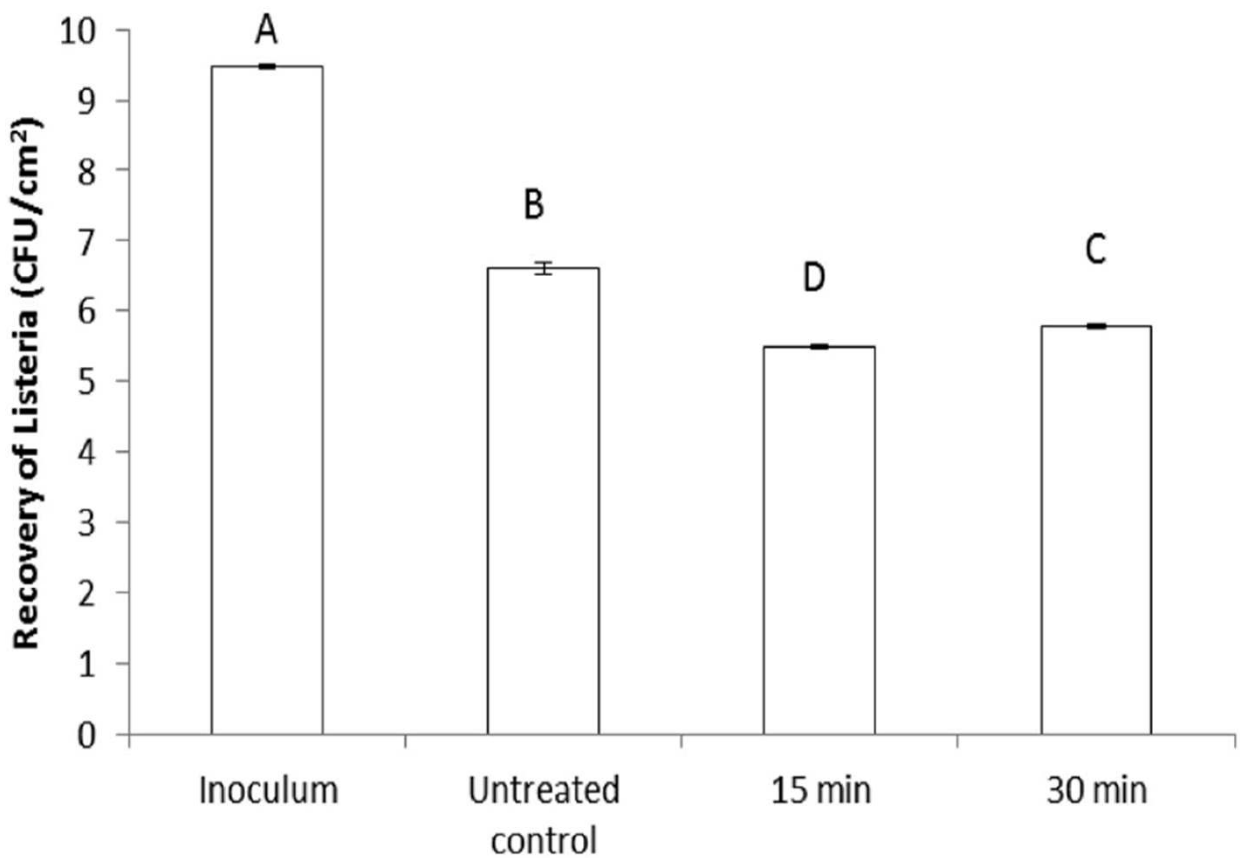


Figure 2–Effect of 0.75% unroasted pecan shell extract on the growth of *Listeria* cocktail mix inoculated on chicken skin. Skin models were treated for 15 or 30 min. Error bars represent standard deviation from the mean. Three replication mean comparisons were done using SAS 9.2 statistical software and different letters on each bar indicate significant difference ($P < 0.05$) with other treatments.

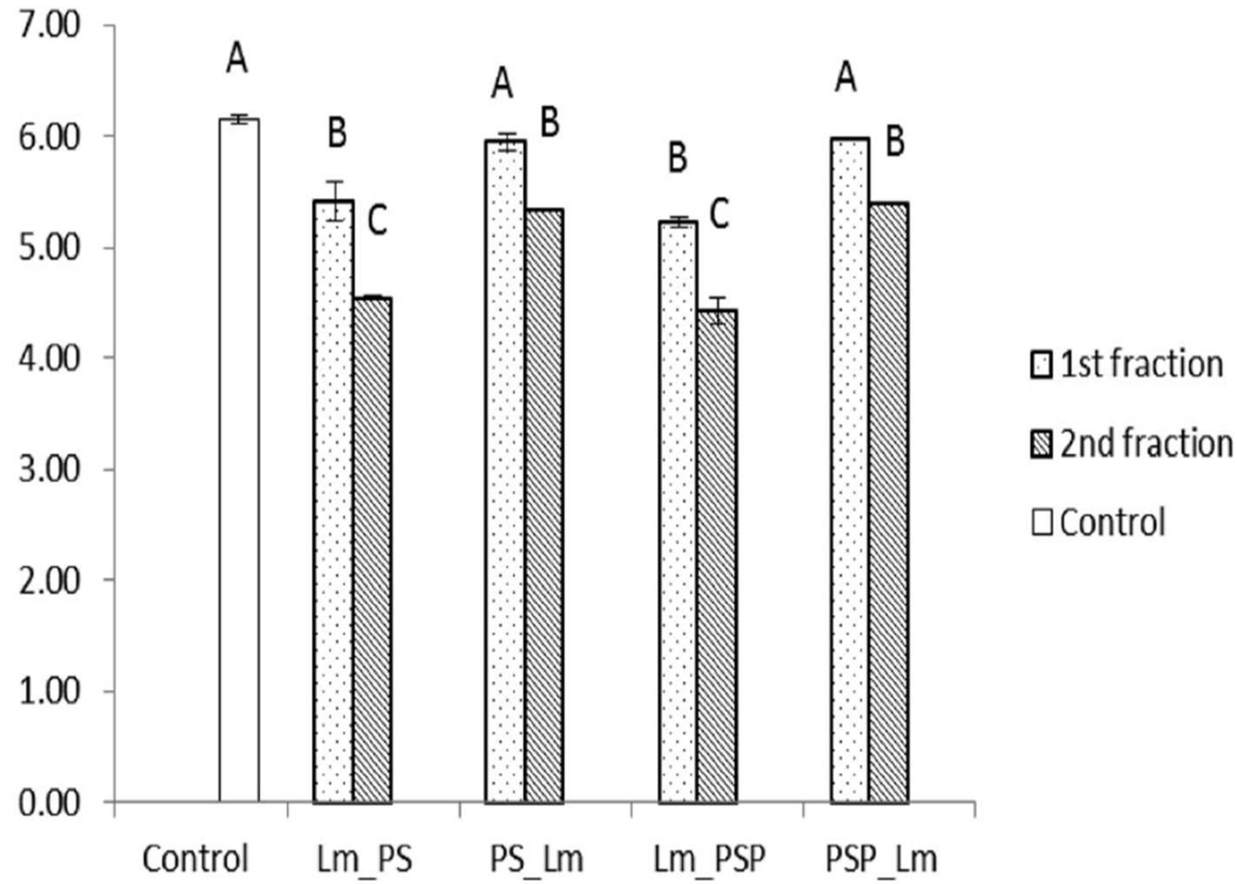
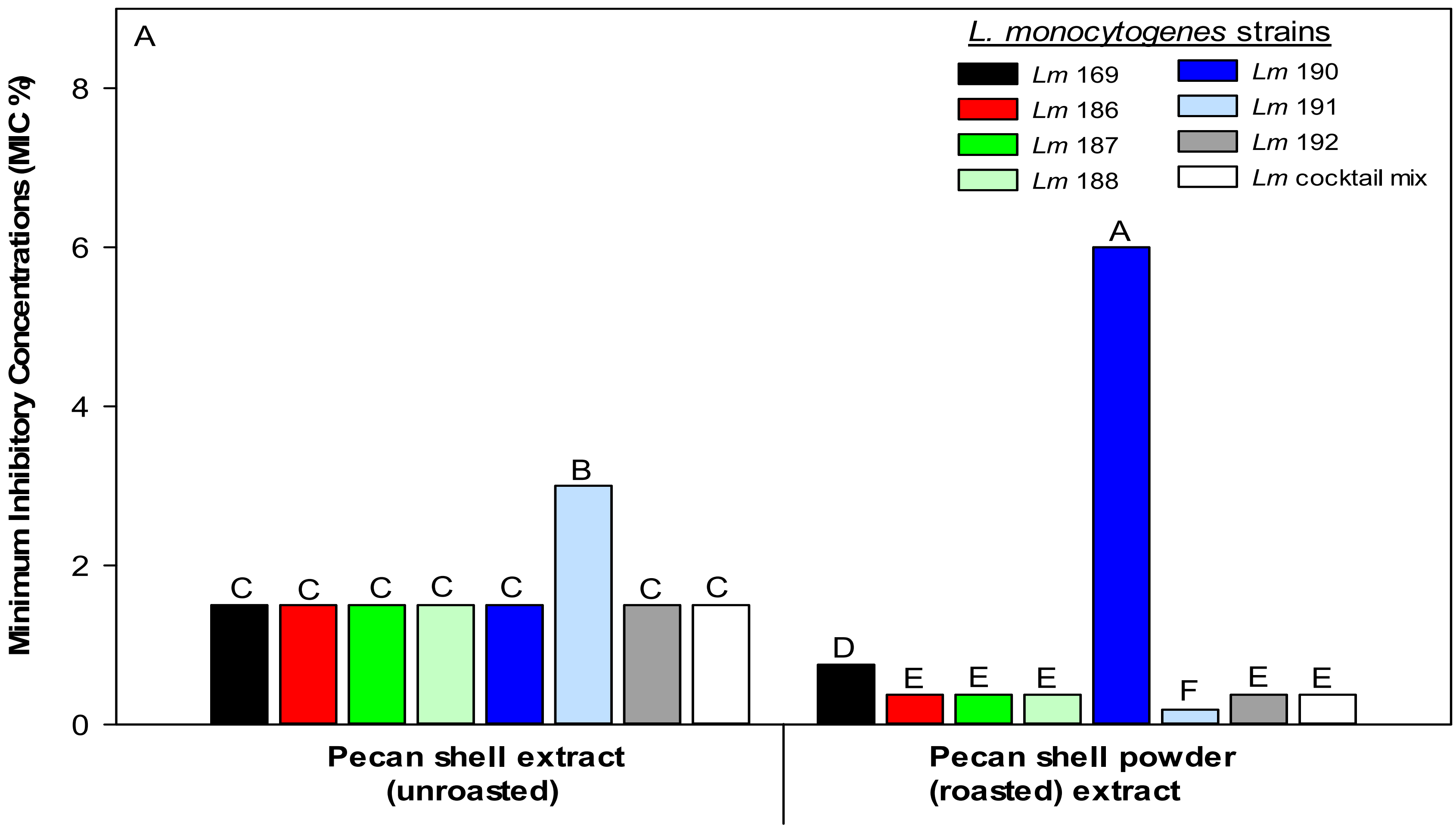
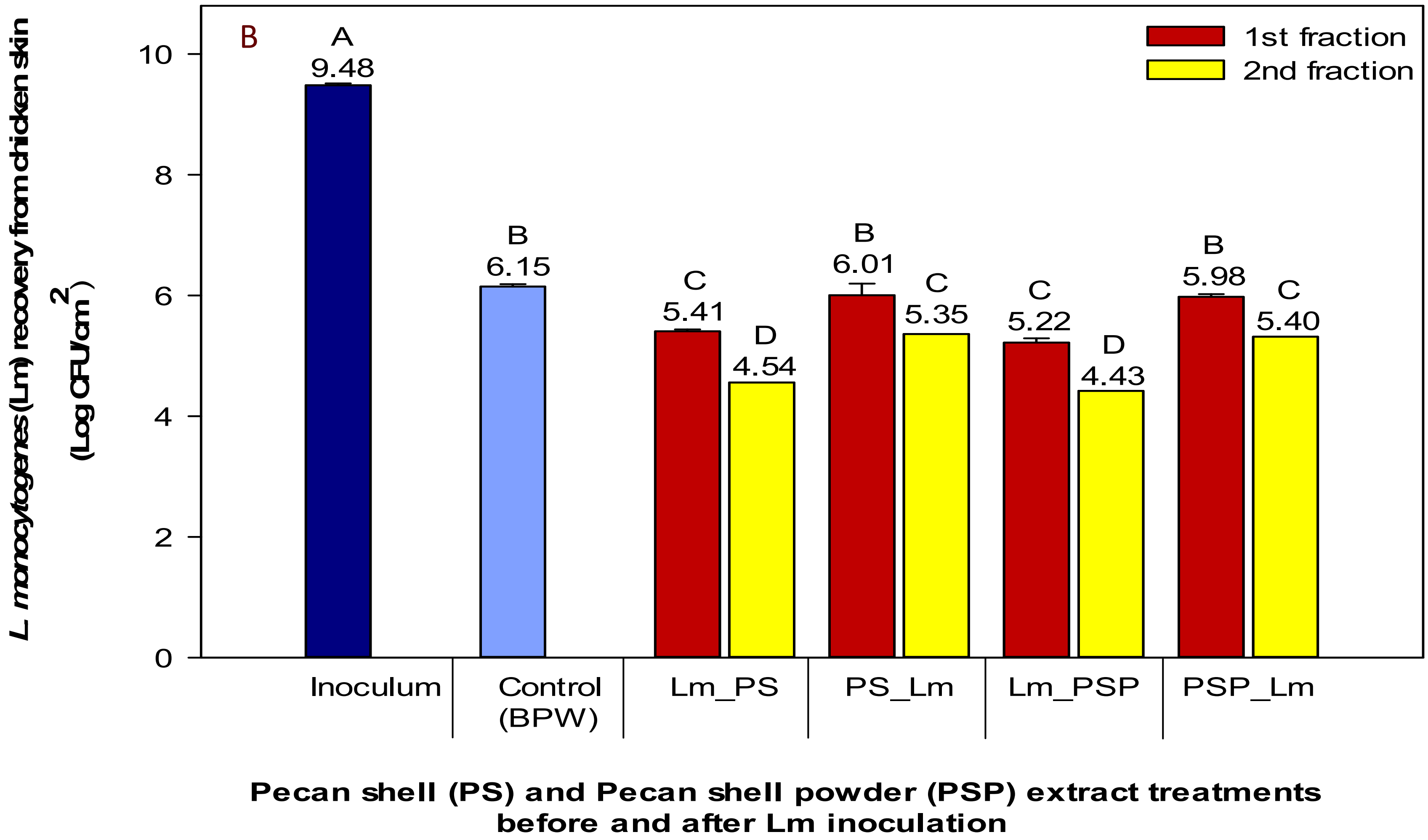


Figure 3–Effect of unroasted pecan shell (PS) and roasted pecan shell powder (PSP) extracts at 1.5% for 30 min showing inhibition of *Listeria* cocktail mix inoculated on chicken skin. For Lm_PS and Lm_PSP, *Listeria* were added first; for PS_Lm and PSP_Lm the skin samples were treated first before addition of *Listeria*. Three replication mean comparisons were done using SAS 9.2 statistical software and different letters on each bar indicate significant statistical difference ($P < 0.05$) with other treatments.

Minimum inhibitory concentrations (% MIC)



Efficacy of natural antimicrobials



- Extraction method that affects the concentration of inherent inhibitory compounds may affect the efficacy of the antimicrobial preparations.

- Organic poultry products will benefit from use of these antimicrobials prepared from organic pecan shells.

Antimicrobial Combinations that Help Protect Against Salmonella spp.&L. monocytogenes in Organic&Natural Poultry Products

$450K
Phase 2 SBIR

Period of Performance: 01/01/2012 - 12/31/2012

Share

Recipient Firm
SEA STAR INTERNATIONAL, LLC
2138 REVERE PL
Fayetteville, AR 72701

Principal Investigator
Dinesh Babu

Firm POC
Philip G. Crandall

Abstract

This is a critical crossroads for the poultry industry with a majority of consumers demanding minimal or chemical free foods and the ever present threat of foodborne illness from Salmonella and Listeria associated with raw and ready-to-eat (RTE) poultry products. As a potential solution, we have demonstrated the effectiveness of novel, all natural antimicrobials. This proposed Phase II research will optimize combinations of antimicrobials that will provide additional hurdles of protection from Listeria and Salmonella to minimize the risk of foodborne illness for poultry. This research will minimize the growth of spoilage organisms to provide a much needed increase in shelf-life for these high-value products, while maintaining the quality of the organic foods. Specific details are contained in the Commercialization Plan. This proposal will add-value to agricultural wastes currently being burned as cheap fuel sources by upgrading thes waste product to food grade antimicrobials. We will do this in a sustainable manner that minimizes or eliminates most of the liquid wastes typically associated with biological extraction methods.

Similar Awards

Phase 2 SBIR
Phage preparation for managing Salmonella in foods
Intralytix, Inc.
awarded $450K on 01/01/2012

Phase 1 SBIR
Development of phage preparation for managing Salmonella in foods
Intralytix, Inc.
awarded $100K on 01/01/2011

Phase 2 SBIR
Practical Detection of Food Borne Pathogens Utilizing Biochemically Stable Bacteriophage

http://sbirsource.com/sbir/awards/

Journal of
Applied Microbiology

Journal of Applied Microbiology ISSN 1364-5072

ORIGINAL ARTICLE

Cleaning and decontamination efficacy of wiping cloths and silver dihydrogen citrate on food contact surfaces

S.M. Masuku[1], D. Babu[1], E.M. Martin[1,2], O.K. Koo[1], C.A. O'Bryan[1], P.G. Crandall[1] and S.C. Ricke[1]

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doi:10.1111/j.1365-2672.2012.05318.x

2012/0403: received 2 March 2012, revised 30 March 2012 and accepted 13 April 2012

Cross contamination

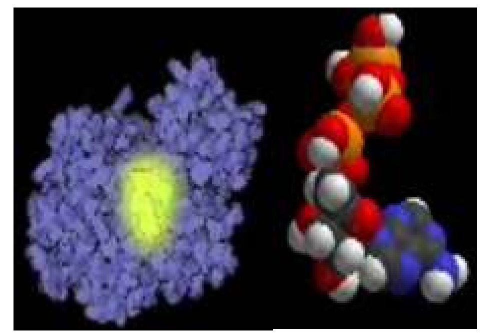
~80% of the reported foodborne outbreaks→ Food service facilities

Collins et al., 1997

How efficient is the cleaning practice??

Aim: To test the efficacy of four wipe cloth types (cotton bar towel, nonwoven, microfibre and blended cellulose ⁄ cotton) with either quaternary ammonia cleaning solution or silver dihydrogen citrate (SDC) in cleaning food contact surfaces.

Rapid hygiene monitoring system

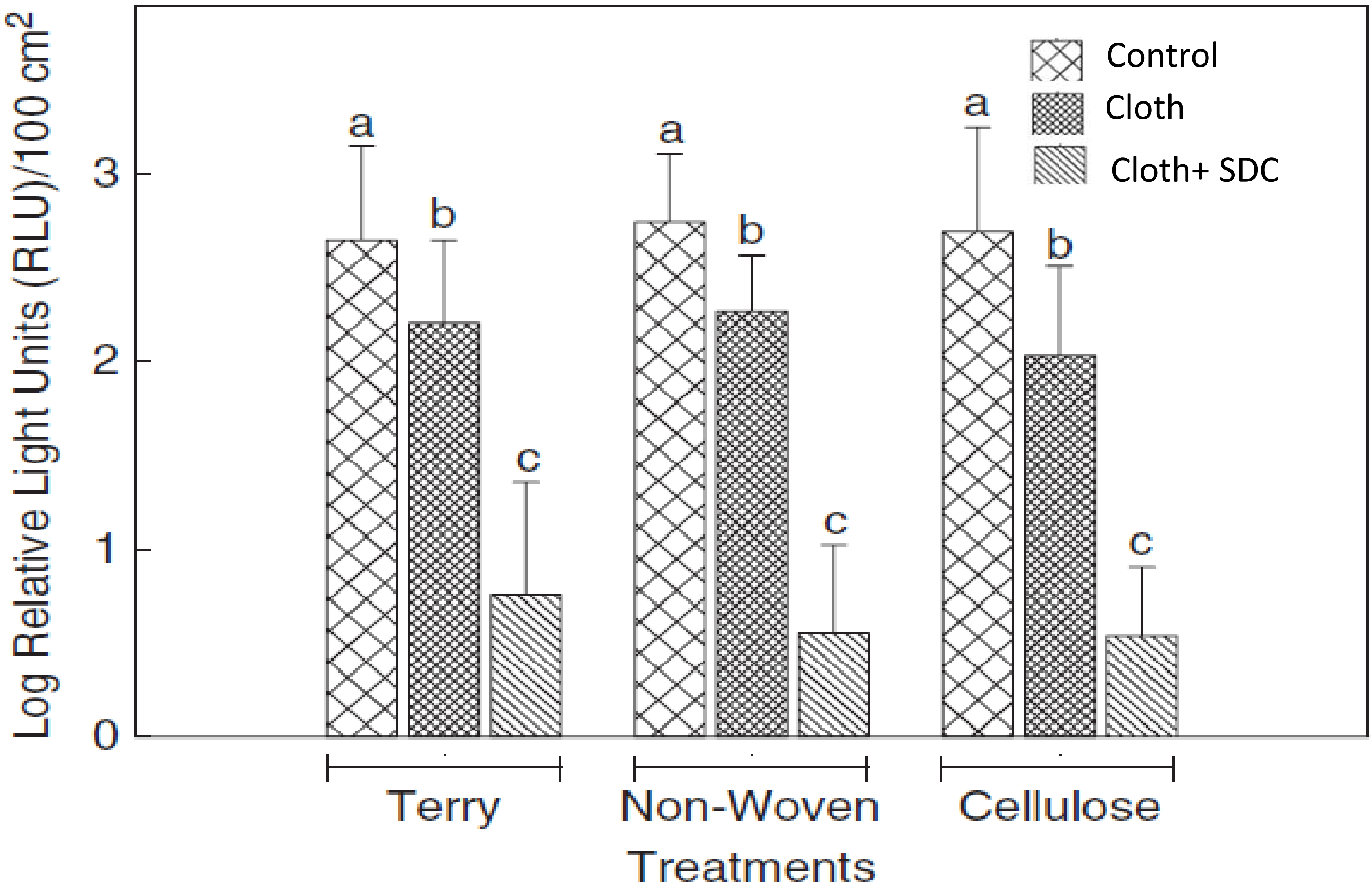


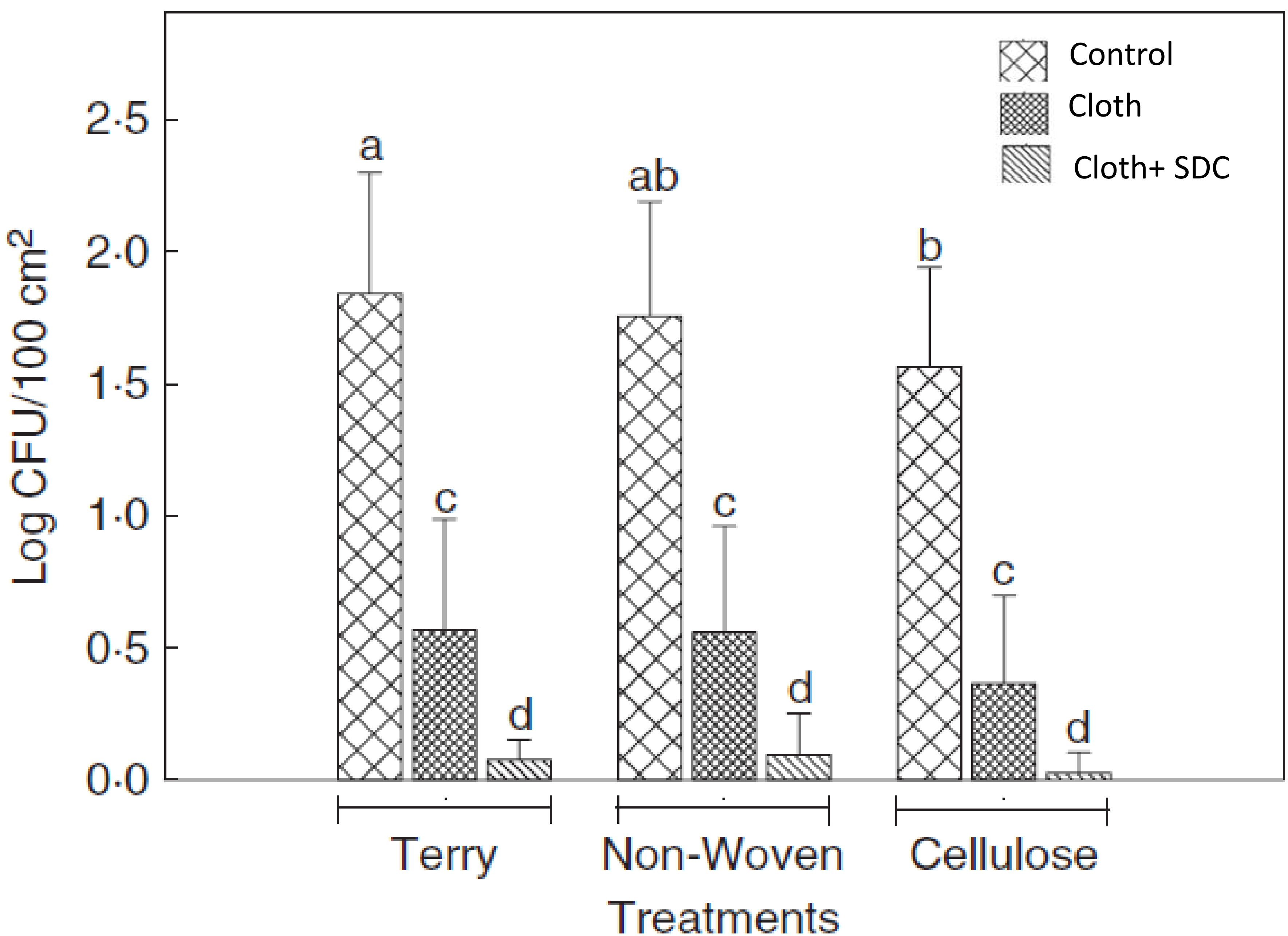
RLU >30 = dirty, RLU between 11 and 29 = caution and RLU < 10 = clean

Table 1 Least significant differences values showing differences in mean log RLU 100 cm^{-2} for each cloth type in the first study*

Cloth types	N†	ATP-B test Mean log RLU 100 cm^{-2}
Nonwoven	59‡	$2{\cdot}89 \pm 0{\cdot}30^{A}$
Microfibre	90	$2{\cdot}30 \pm 0{\cdot}30^{B}$
Cotton terry	88‡	$2{\cdot}26 \pm 0{\cdot}25^{CB}$
Cellulose/cotton	90	$2{\cdot}20 \pm 0{\cdot}28^{C}$

*Means with the same letter notation are not significantly different.
†Number of samples collected per treatment.
‡N differs for some cloth types because negative values were removed (Negative values because of variability in contamination of sampling area were not included).


Log Relative Light Units (RLU)/100 cm²
0
1
2
3
Control
Cloth
Cloth+ SDC
a
b
c
Terry
Non-Woven
Cellulose
Treatments


Control
Cloth
Cloth+ SDC
Log CFU/100 cm2
2·5
2·0
1·5
1·0
0·5
0·0
a
c
d
ab
c
d
b
c
d
Terry
Non-Woven
Cellulose
Treatments

Cleaning effect of wiping cloths on food contact surfaces can be
enhanced by dipping them in SDC disinfectant.

ATP-B measurements can be used for real-time hygiene monitoring in public sector, and testing microbial contamination provides more reliable measure of cleanliness.

This study could help to estimate and establish contamination thresholds for surfaces at public sector facilities and to base the effectiveness of cleaning methods.

Meat Science 95 (2013) 137–144

Contents lists available at SciVerse ScienceDirect

Meat Science

journal homepage: www.elsevier.com/locate/meatsci

Review

Whole-chain traceability, is it possible to trace your hamburger to a particular steer, a U. S. perspective

Philip G. Crandall [a,*], Corliss A. O'Bryan [a], Dinesh Babu [a,1], Nathan Jarvis [a], Mike L. Davis [a], Michael Buser [b], Brian Adam [c], John Marcy [a,d], Steven C. Ricke [a]

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[b] Biosystems and Agricultural Engineering, Oklahoma State University, Stillwater, OK 74078, United States
[c] Agricultural Economics, Oklahoma State University, Stillwater, OK 74078, United States
[d] Department of Poultry Science, University of Arkansas, Fayetteville, AR 72701, United States

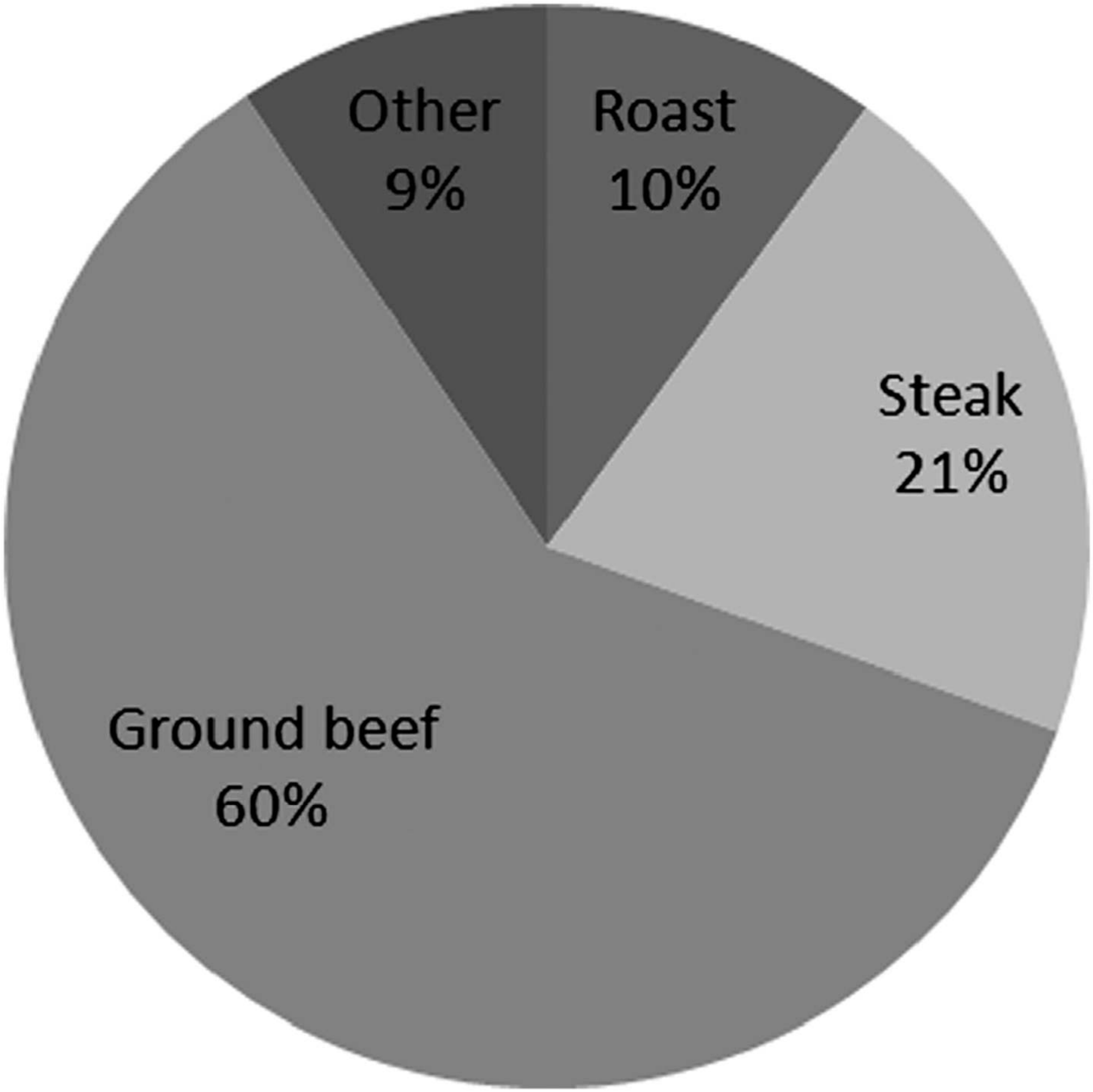

Fig. 1. Beef consumption by cut.
adapted from National Cattleman's Beef Association (2012)

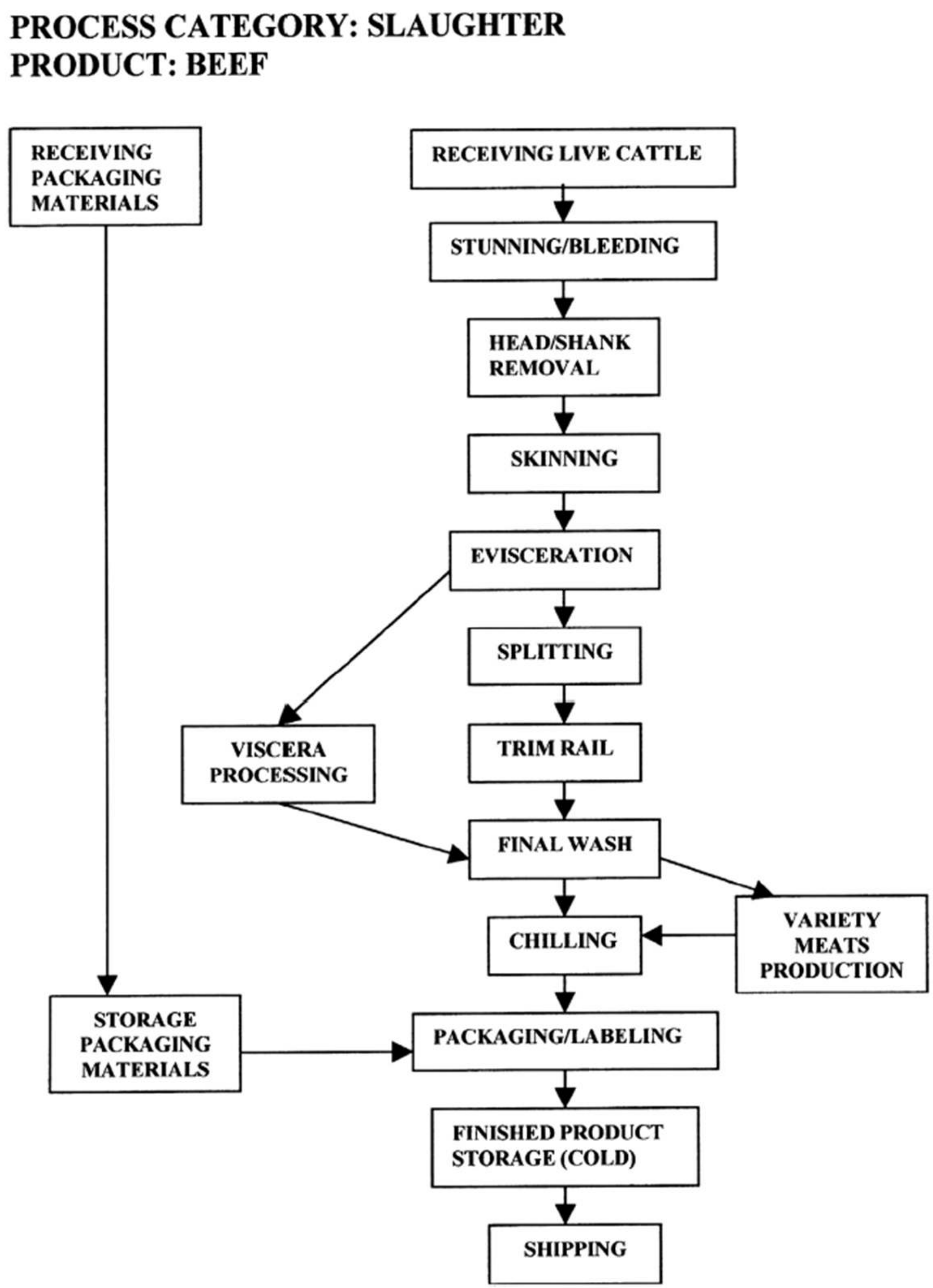

Fig. 2. Simplified diagram of a beef slaughter operation.

J Food Sci. 2012 Jun;77(6):S253-7

Dried Plum Products as a Substitute for Phosphate in Chicken Marinade

Nathan Jarvis, Ashley R. Clement, Corliss A. O'Bryan, Dinesh Babu, Philip G. Crandall, Casey M. Owens, Jean-Francois Meullenet, and Steven C. Ricke

ULM research plans

- ❖Influence of dietary choline and colonization with human gut microflora and probiotic cultures on Flavin-Containing Monooxygenase (FMO) genes in gnotobiotic mice.

- ❖Can Food Polyphenols Prevent or Limit Expansion of Toxic Liver Injury?.

Thank you all