UNIVERSITY OF GEORGIA

Peanut-Related Food Safety Issues

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Hot Topics on Peanuts

Albany, GA

GEORGIA PEANUT TOUR

Center for Food Safety
College of Agricultural & Environmental Sciences
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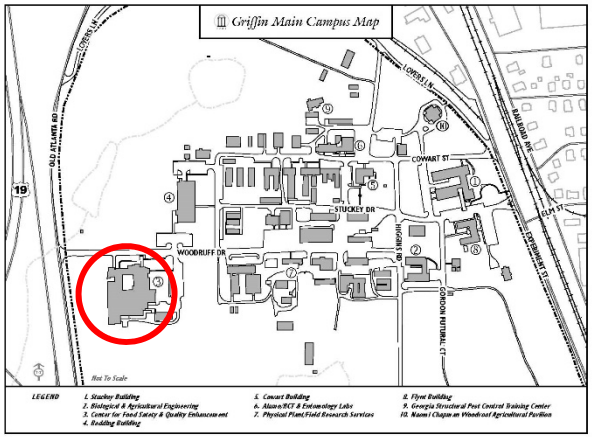
Griffin Campus

Center for Food Safety at UGA's Griffin Campus



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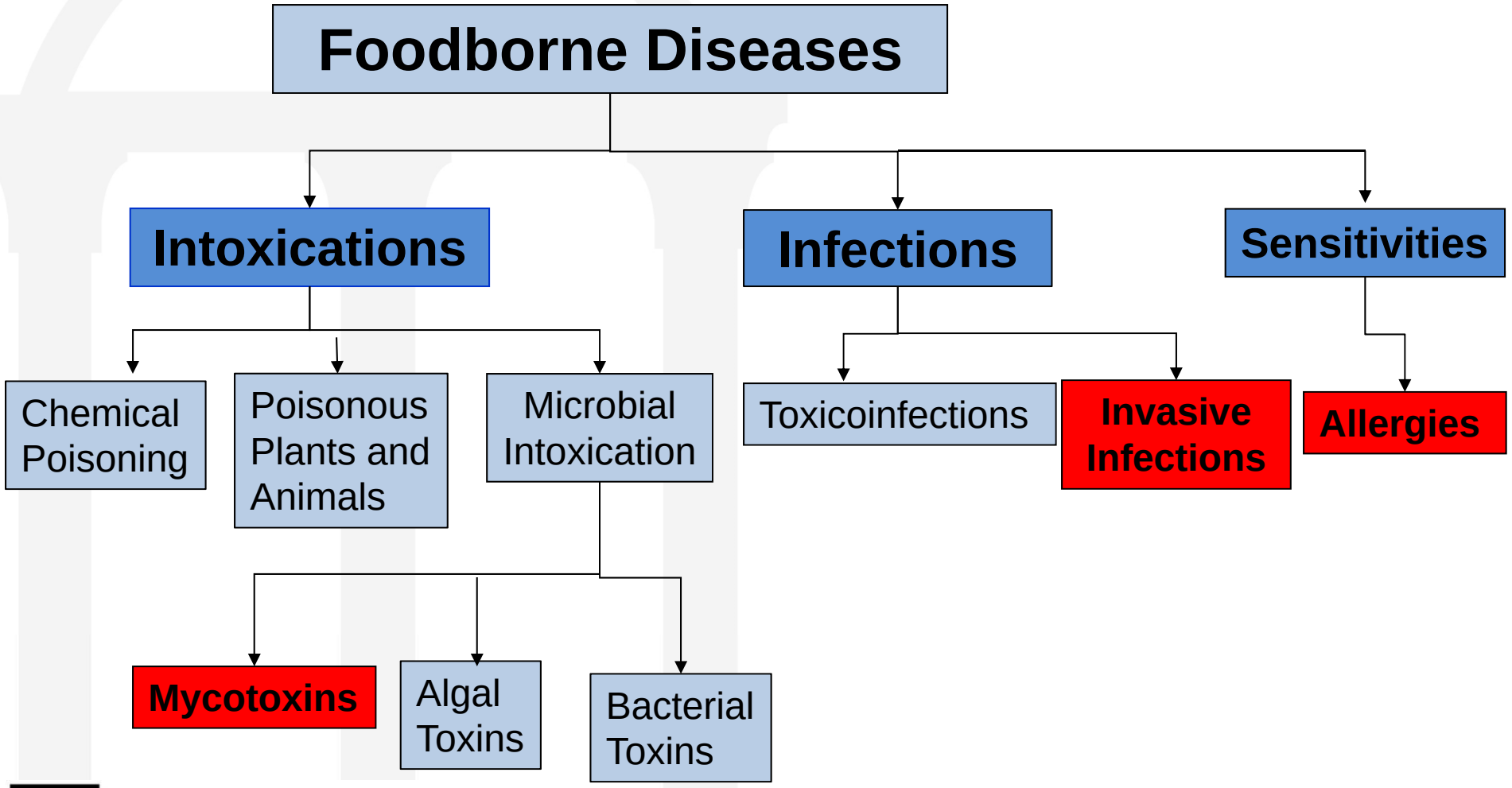
Risks in Foods



Peanut's Food Safety Risks

1. **Allergies**
2. **Mycotoxins**
3. ***Salmonella***

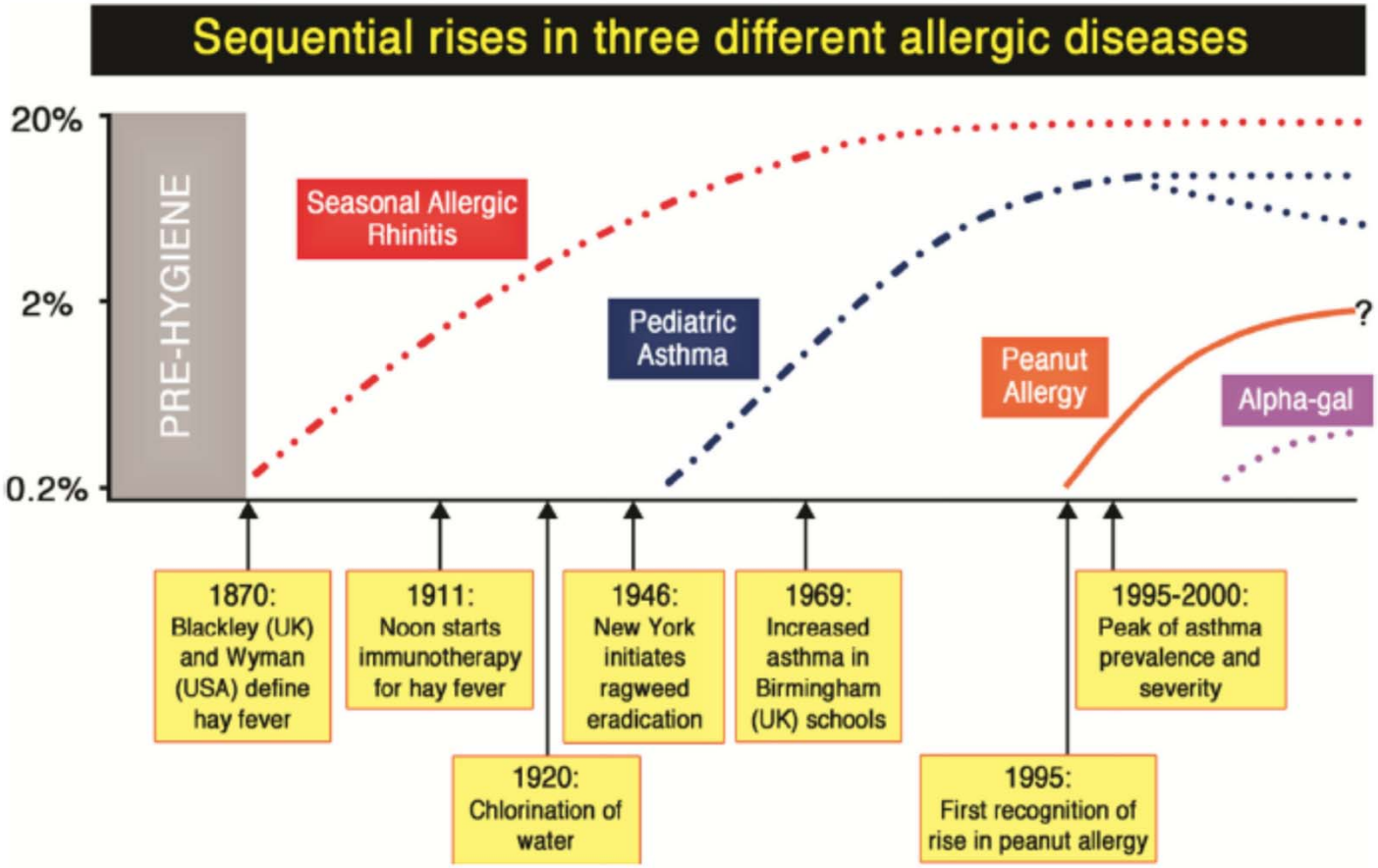
Peanuts as Allergens

- One of the top 8 food allergens
- Food allergens top reason for food recalls
  - 2016 – **44 recalls due to undeclared peanuts out of 470**
- 3.3 million people suffer peanut or tree nut allergies
- 0.6 to 1.5% of children suffer peanut allergy

Peanuts as Allergens

- Allergy incidence is lower in Asia
- Symptoms: mild to severe (including life-threatening anaphylactic shock)
- Affect skin, GI tract, respiratory tract
- Occur within minutes or few hours after ingestion

Peanut Allergy Origins



Copied from Platts-Mills et al. 2015

Peanuts as Allergens

- Early oral exposure to peanuts reduces peanut allergy
- 18 allergenic peanut proteins
- Resistant to digestion, heat denaturation and any type of hydrolysis
- Main types: cupin, conglutin, conarachin, Ara h 1, Ara h 2, Ara h 3

Prevention of Undeclared Peanuts

- Based on the 2004 FALCPA
  - GMP's
  - Ingredient labelling
  - Informed consent statements on packaging
- FSMA
  - GMP revisions
  - Formally recognized as hazard – HARPC
  - Introduced the concept of cross-contact

Peanut's Food Safety Risks

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Mycotoxins in Peanuts

- Aflatoxins (produced by *Aspergillus flavus*)
- Became evident in 1960s
  - Turkey X disease (100,000 poults died from peanut meal)
- Major risk in many developing countries
- US tolerance level < 15 ppb

Salmonella

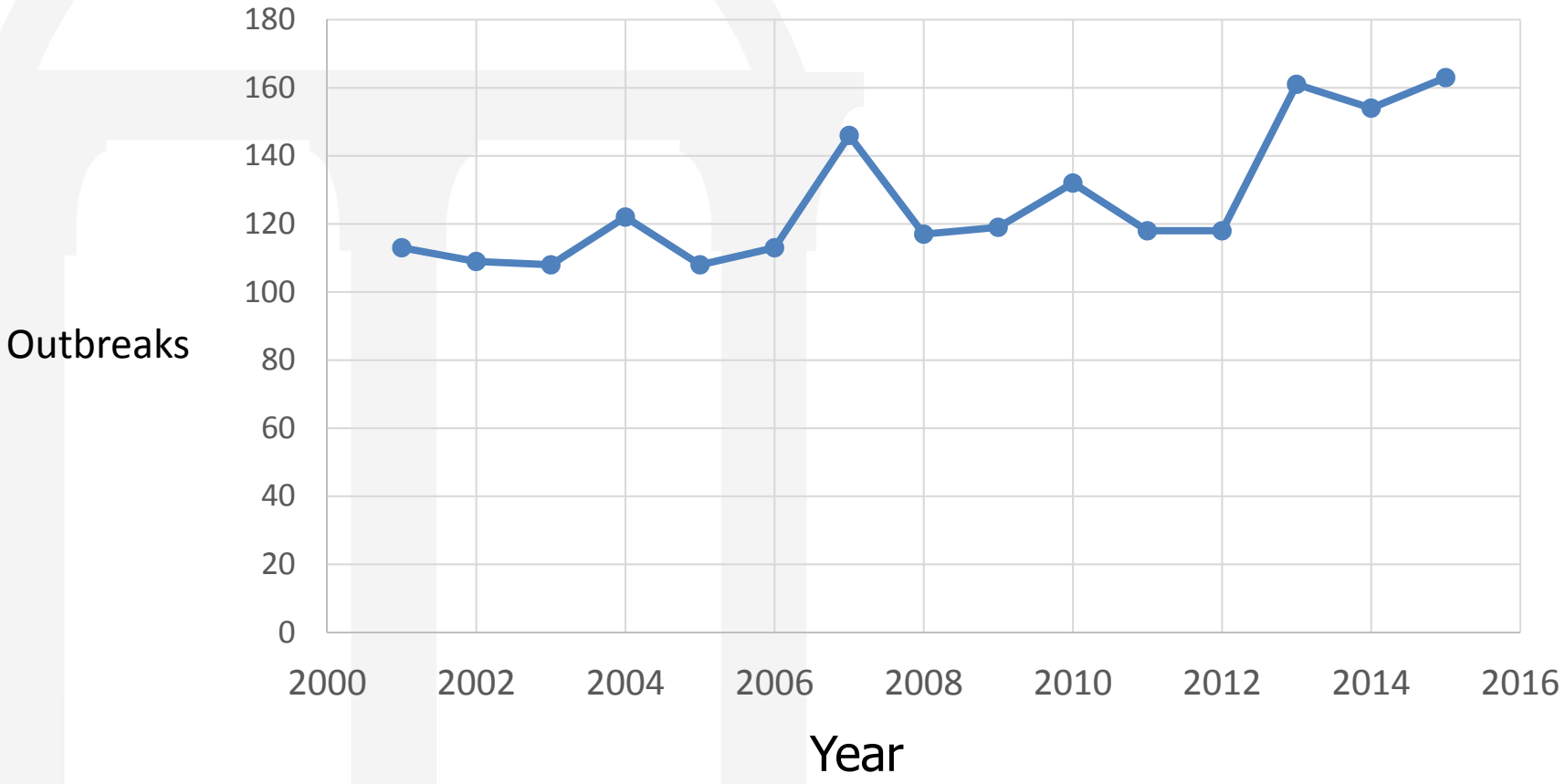
- *Salmonella* are Gram-negative facultative anaerobic bacteria
- Cause serious gastroenteritis diseases
  - Typhoid fever and non-typhoid infections
- Zoonotic pathogenic bacteria
- Associated with poultry and eggs

Estimates of Burden of Bacterial Foodborne Pathogens in the U. S. A.

Bacteria	Cases	Hospitalizations	Deaths
***Salmonella* (non-typhoidal)**	**1,028,000**	**19,336**	**378**
Clostridium perfringens	966,000	438	26
Campylobacter (jejuni, coli)	845,000	8,463	76
Staphylococcus aureus	241,000	1,064	6
Shigella	131,000	1,456	10
STEC non-O157	113,000	271	0
Yersinia enterocolitica	98,000	533	29
Bacillus cereus	63,400	20	0
E. coli O157:H7 (STEC O157)	63,100	2,138	20
Vibrio parahemolyticus	34,700	100	12
Streptococcus	11,200	1	0
Listeria monocytogenes	1,590	1,455	255
TOTAL	**3.6 million**	**35,796**	**861**

(Scallan et al, 2011)

Incidence of *Salmonella* Foodborne Outbreaks



https://wwwn.cdc.gov/foodborneoutbreaks/

Salmonella Outbreaks Associated with Peanuts

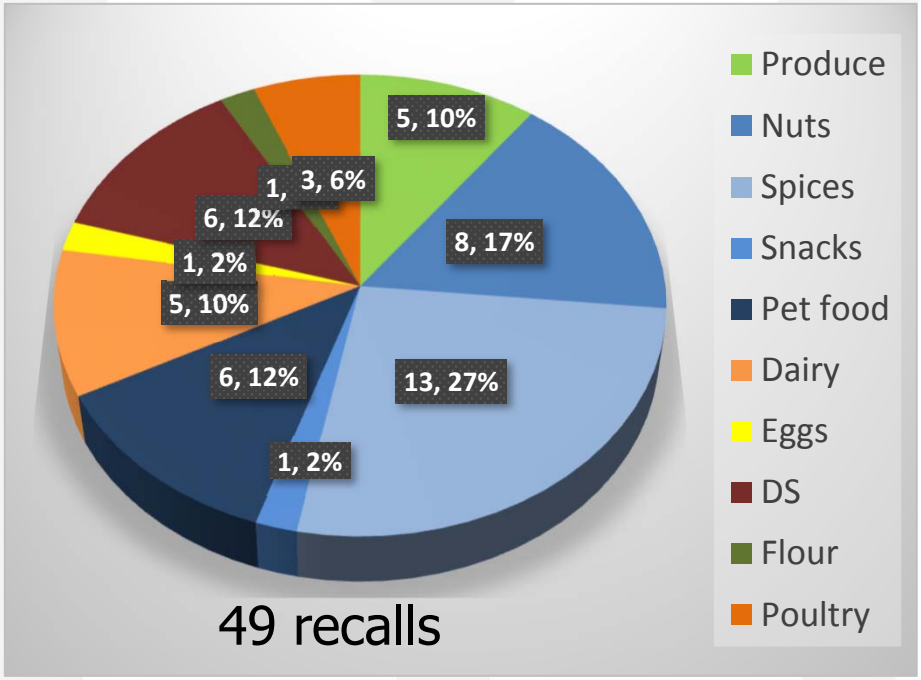
Year	Serovar implicated	Source	Number of cases	Country	Route of contamination
1994/1995	Agona PT 15	Peanut-flavored savory snack	71	Israel, UK, USA	Unidentified
1996	Mbandaka	Peanut butter	15	Australia	Roasted peanuts
2001	Stanley and Newport	In-shell peanuts	109	Australia, Canada, UK	Imported peanuts
2006	Thompson	Boiled peanuts	100	USA	Peanuts
2006/2007	**Tennessee**	**Peanut butter**	**715**	**USA**	**Unidentified**
2008/2009	**Typhimurium**	**Peanut butter**	**714**	**USA, Canada**	**Numerous sources identified**
2010	Typhimurium PT170	Peanut/cashew mix	19	Australia	Unidentified
2012	**Bredeney**	**Peanut butter**	**42**	**USA**	**Cross-contamination between raw and finished product**

Notable *Salmonella* outbreaks due to low water activity (a_w) foods

Food	Year	Serovar	Cases
Raw almonds	2004	Enteritidis	29
Peanut butter	2007	Tennessee	425
Dry pet food	2007	Schwarzengrund	62
Puffed rice/wheat cereals	2008	Agona	28
Peanut products/butter	2009	Typhimurium	714
Black and red pepper	2009	Montevideo	272
Turkish pine nuts	2011	Enteritidis	43
Peanut products/butter	2012	Bredeney	42
Chia sprout powder	2014	Newport, Hartford, Oranienburg	31

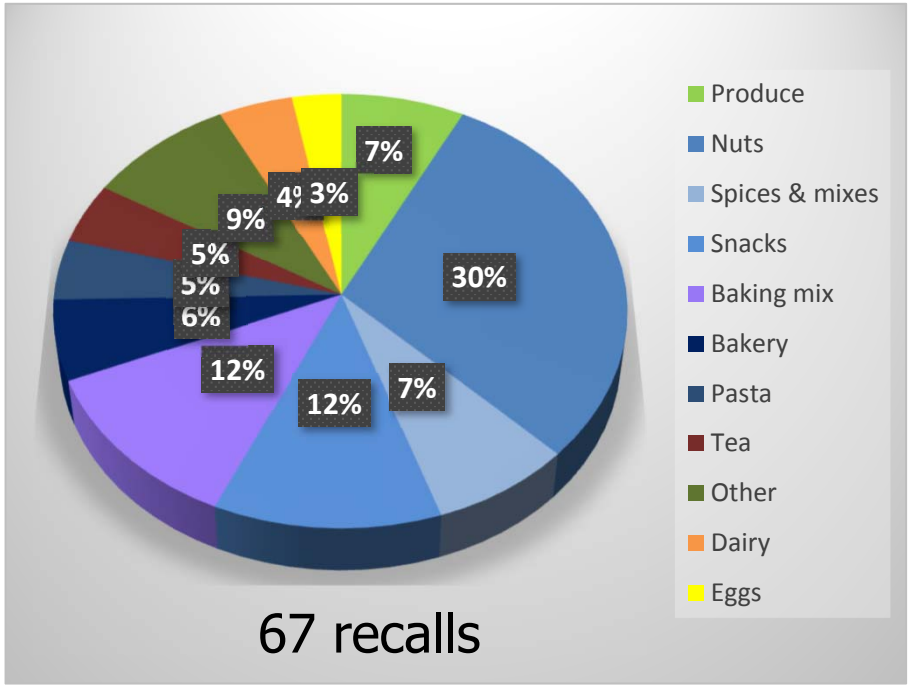
Food recalls due to *Salmonella* detection

2014



49 recalls

2016



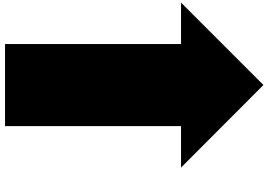
67 recalls

Salmonella in Dry Foods: Origins of this Problem

- *Salmonella* is a pervasive organism in nature
- Increased used of dry ingredients
- *Salmonella*'s ability to remain viable at low moisture levels
- *Salmonella*'s unique tolerance to heat at low water activity
- Improved surveillance and detection systems

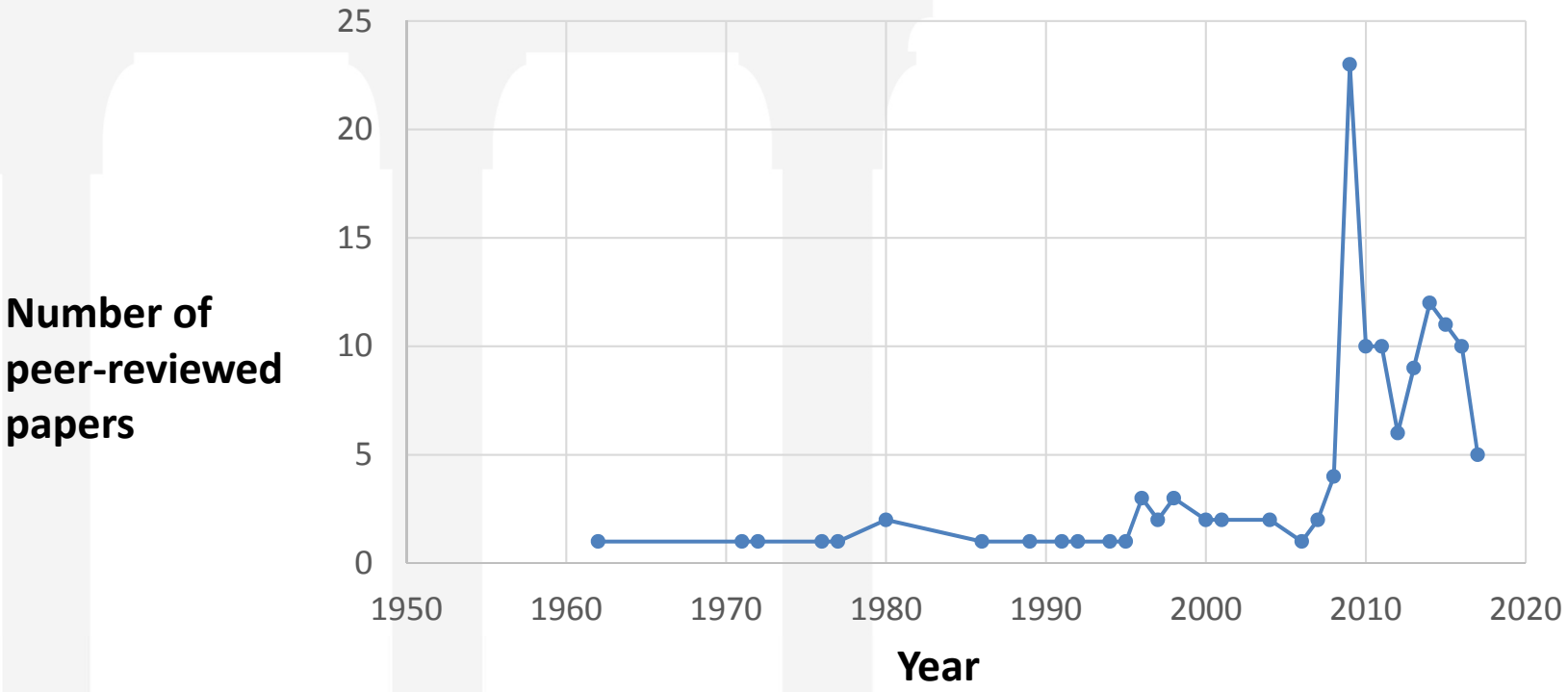
Salmonella in Peanuts: Research Needs

- Sources of contamination
- Prevalence in low a_w foods
- Long term-survival
- Thermal resistance
- Use of surrogates
- Methods of inactivation



Control and Prevention

Salmonella and Peanuts Research Publications



(Pubmed, 2017)

Prevalence of *Salmonella* in Peanuts

- 2.33% of samples (22/944) tested positive (2008-2010)
  - 10 different serovars
  - Included 3 regions (SW, SE, Va/NC)
  - Only 3 samples had > 0.03 MPN/g

  (Calhoun et al., 2013, J. Food Prot. 76:575)
- 0.67% in 10,162 samples (2009-2011)
  - Included 2 states: Texas (Western) and Georgia (Eastern)
  - Prevalence in 2009 was 1.35%
  - Only 12 out of 68 samples were quantifiable (0.7-1.1 MPN)

  (Miksch et al., 2013, J. Food Prot. 76:1668)

Survival of *Salmonella* in Peanuts

- In peanut butter (PB), from 5.7 Log CFU/g – 1.0 Log CFU/g survived after 5.5 months at 21˚C with multiple serovars (Burnett et al., 2000, J. Appl. Microbiol. 89:472)
- Three *S.* Tennessee strains only survived 2 weeks at 22˚C in PB (Miksch et al., 2013, J. Food Prot. 76:1668)
- On peanut kernels, 4 serovars survived 12 months at 22˚C (Brar et al., 2015, J. Food Prot. 78:323)

Control of *Salmonella* in Peanuts

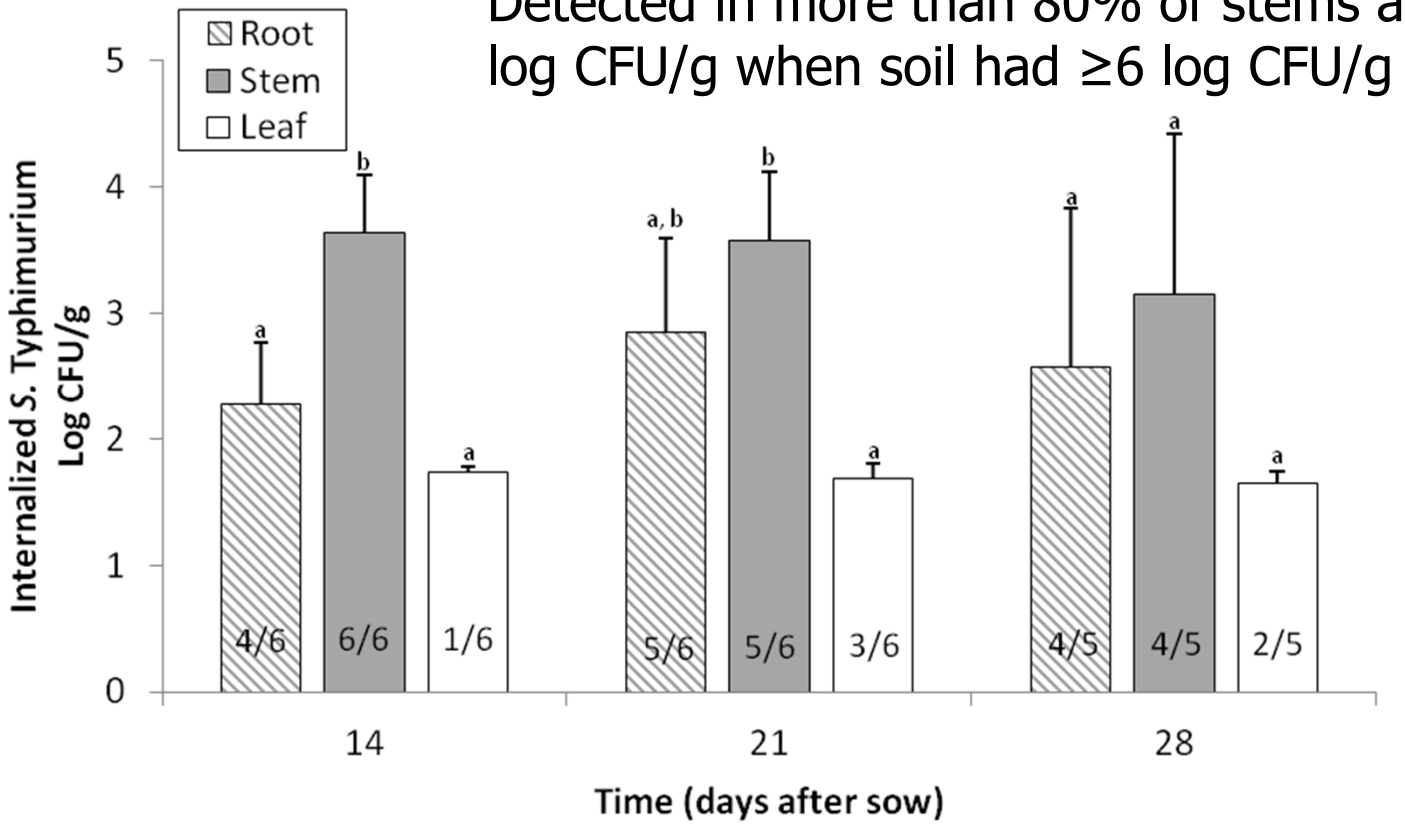
- Heating is limited because of increased thermal tolerance, D-values at 90˚C of 9 to 13 min in PB (Ma et al., 2009, J. Food Prot. 72:1596)
- Roasting of kernels in combination with microwaving reduced 4 Log CFU/g *E. faecium* (Smith et al., 2014, J. Food Sci. 29:1584)
- High pressure processing (HPP) only reduced 1.7 Log CFU/g (D'Sousa et al., 2014, J. Food Prot. 77:1664)
- Gamma-irradiation has been tested with promising results (Ban and Kang, 2014, Intl. J. Food Microbiol. 171:48)

Specific Research Projects

- Kinetics of thermal inactivation in TOC
- Internalization of *Salmonella* into peanut plants
- Identification of GRAS-status bacteria surrogates
- *Salmonella* genes involved in desiccation tolerance

Internalization of *Salmonella* into Peanut Plants

Detected in more than 80% of stems at ≥3 log CFU/g when soil had ≥6 log CFU/g



Summary

- Three main risks are associated with peanuts: allergens, aflatoxins and *Salmonella*
- Allergy prevention is a major focus of FSMA
- *Salmonella* in low a_w foods is a recently recognized risk
- *Salmonella* prevalence in peanuts is relatively low, but posses a risk

Summary

- *Salmonella* pervasiveness and survival fitness allow it to remain viable in peanuts
- Increased heat tolerance is an additional challenge
- Needs for validation of roasting processing and development of alternative technologies


Daniele Pellati

Questions?
Thanks!!!

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