

Food Safety in Poultry Production

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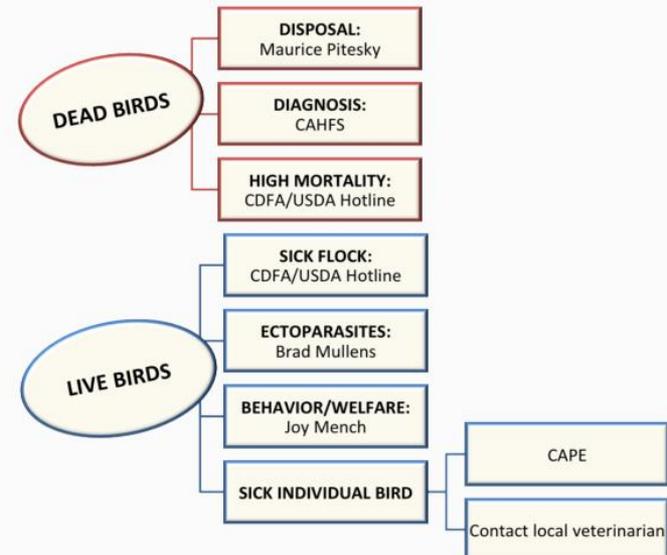
New UCCE Poultry Website

The screenshot shows the UCCE Poultry website interface. At the top, there is a navigation bar with 'SHARE', 'EMAIL', 'PRINT', and 'SITE MAP' options, along with a search bar. The main header features the UCCE logo and the text 'University of California Cooperative Extension Poultry'. A large image of a white chicken with a red comb is visible in the background. Below the header, there are navigation tabs for 'About Us', 'Newsletters', and 'Who to Contact'. A sidebar on the left contains a 'Home' button and a list of categories: 'Production Type', 'Avian Diseases', 'Disease Prevention', 'Food Safety', and 'Additional Resources'. The main content area has a 'Welcome, poultry enthusiasts' message and a list of topics: 'Backyard Poultry', 'Micro-Commercial (Small-Scale) Production', 'Commercial Production', 'Common Avian Diseases', and 'and more!'. At the bottom of the main content area, there is a row of small images showing various poultry-related items like eggs, a brooder, and chickens. A large white box is overlaid on the top right of the screenshot, containing the URL 'http://ucanr.edu/sites/poultry/'.

<http://ucanr.edu/sites/poultry/>

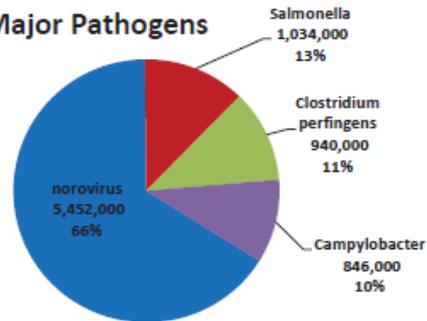
In Case of Poultry Issues:

(See below flowchart for contact information.)



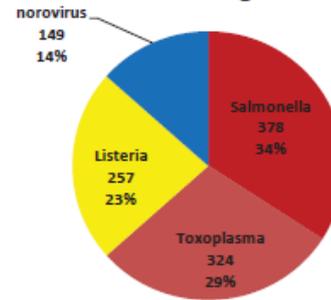
Foodborne Illness, 2011 Estimates, USA

Foodborne Illnesses,
Major Pathogens



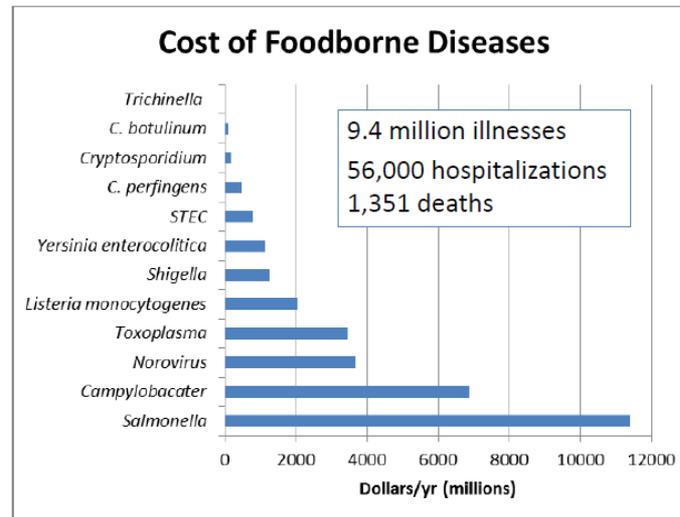
9.4 million

Foodborne Deaths, Major
Pathogens



1,351 total

Scllan et al, 2011



BIG PICTURE: *Salmonella* and *Campylobacter*

They are considered ubiquitous in poultry environments therefore assume they are:

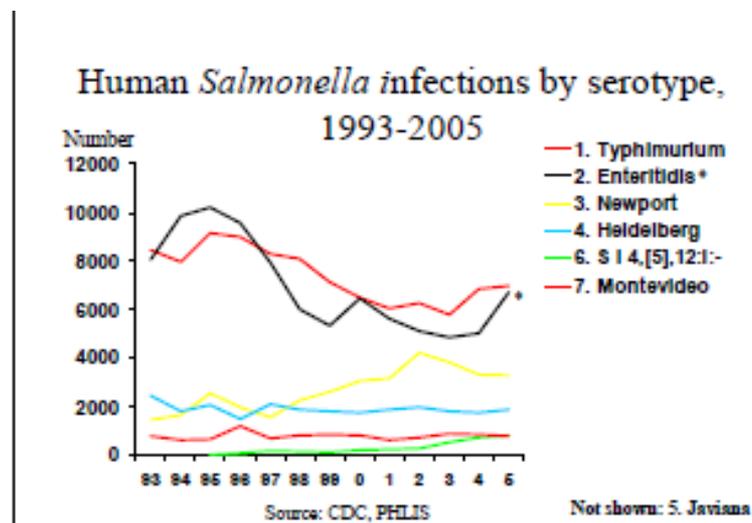
- on live and dead poultry
 - On the surface of eggs and sometimes inside eggs
- In the poultry environment (coop, dirt pad, equipment etc)

How to prevent foodborne illness from poultry:

- Practice good husbandry
- Wash your hands
- Keep dedicated clothes outside with the coop
- Cook all poultry to 165°F

Salmonella

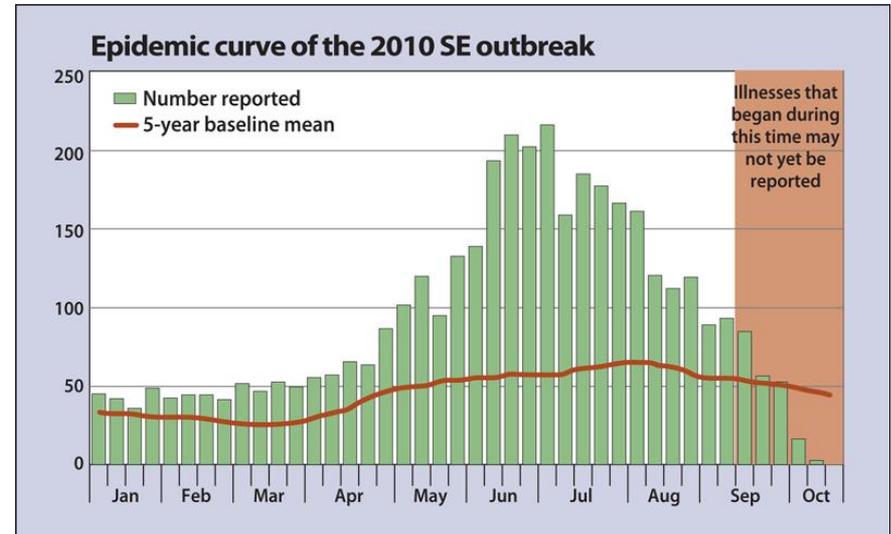
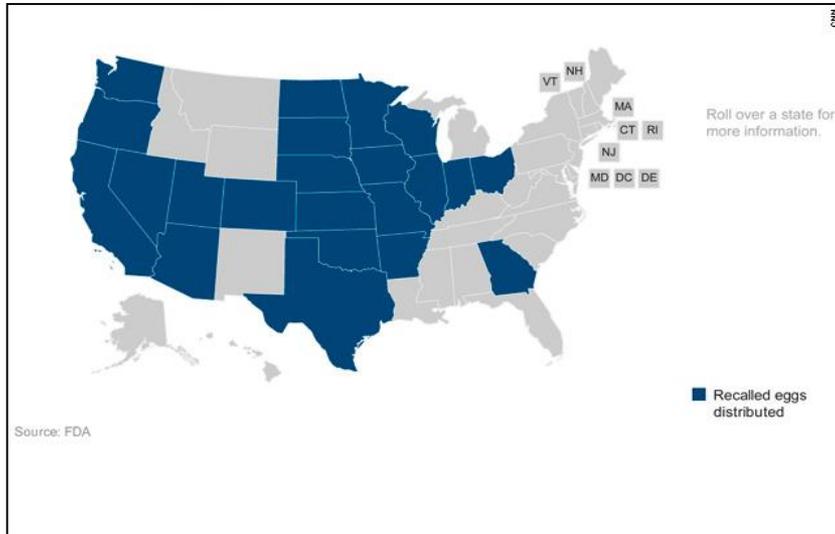
- 1 in 6 people in the US get sick each year from contaminated food
- Most common bacterial cause of foodborne disease in the U.S. is Salmonella
- Many different sources (e.g. meat, poultry, eggs, produce, animal contact).
- Live in the intestinal tract, asymptomatic carriers
 - Animals often appear healthy and clean
- Shed in animal feces, which can then contaminate the environment
 - Shed intermittently



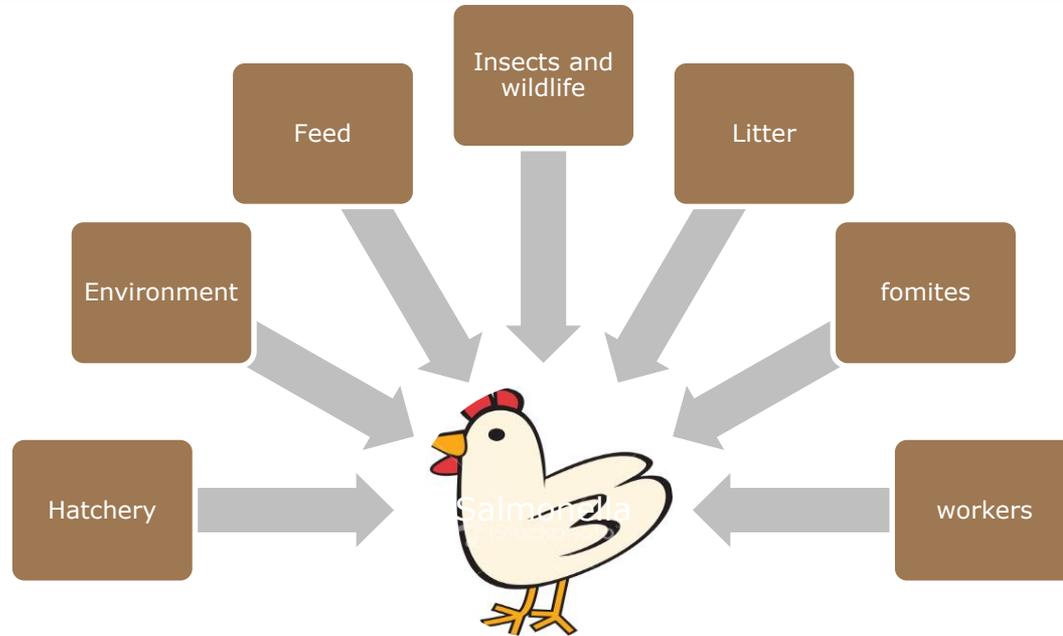
Risk of SE

- SE commonly associated with food borne illness
 - Accounts for 17% of food borne illnesses
- Eggs are the primary source of SE contamination
 - About one in 20,000 eggs is estimated to be contaminated with SE.
 - With approx 65 billion eggs produced/yr and 30% sent to pasteurization an estimated 2.2 million individual eggs are SE positive

SE outbreak of 2009

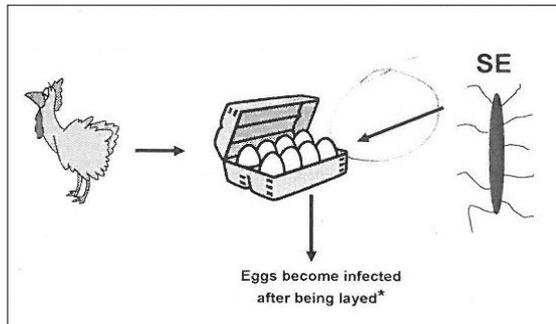


How does the SE get into the bird?

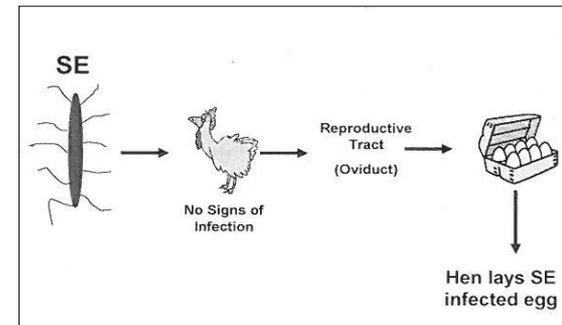


How does the SE get into the egg?

Horizontal Transmission

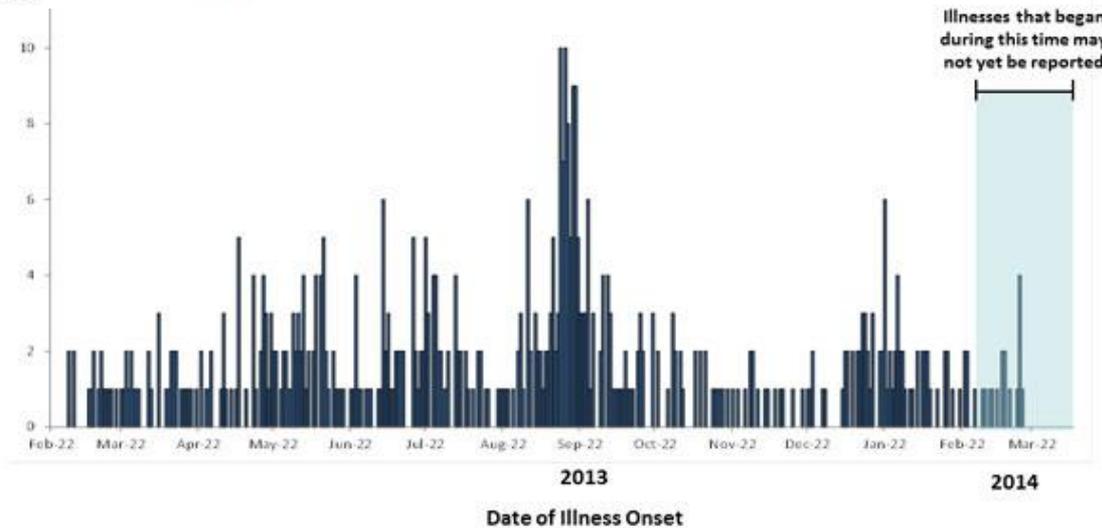
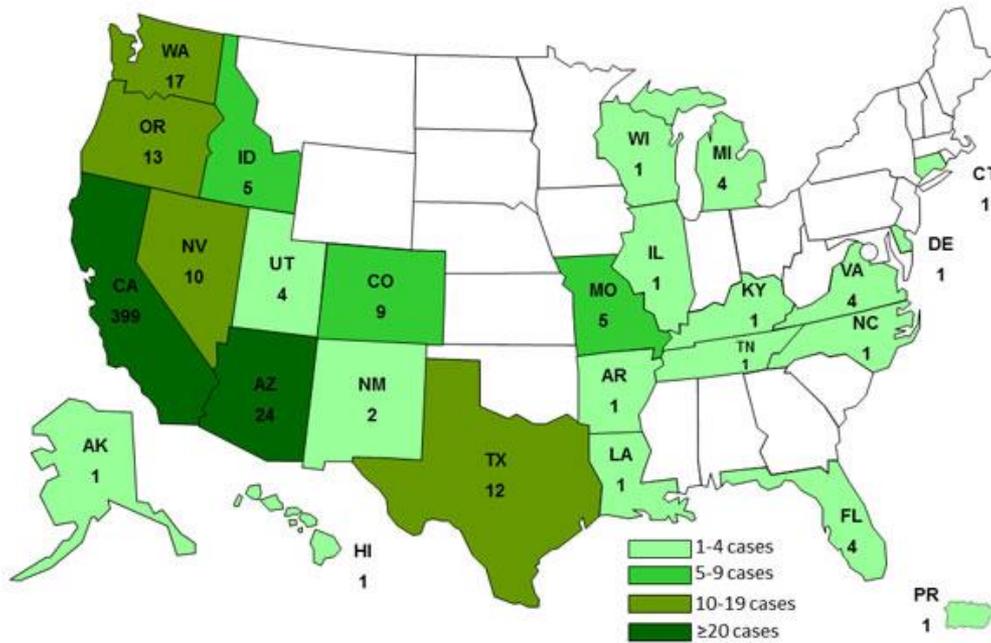


Vertical Transmission



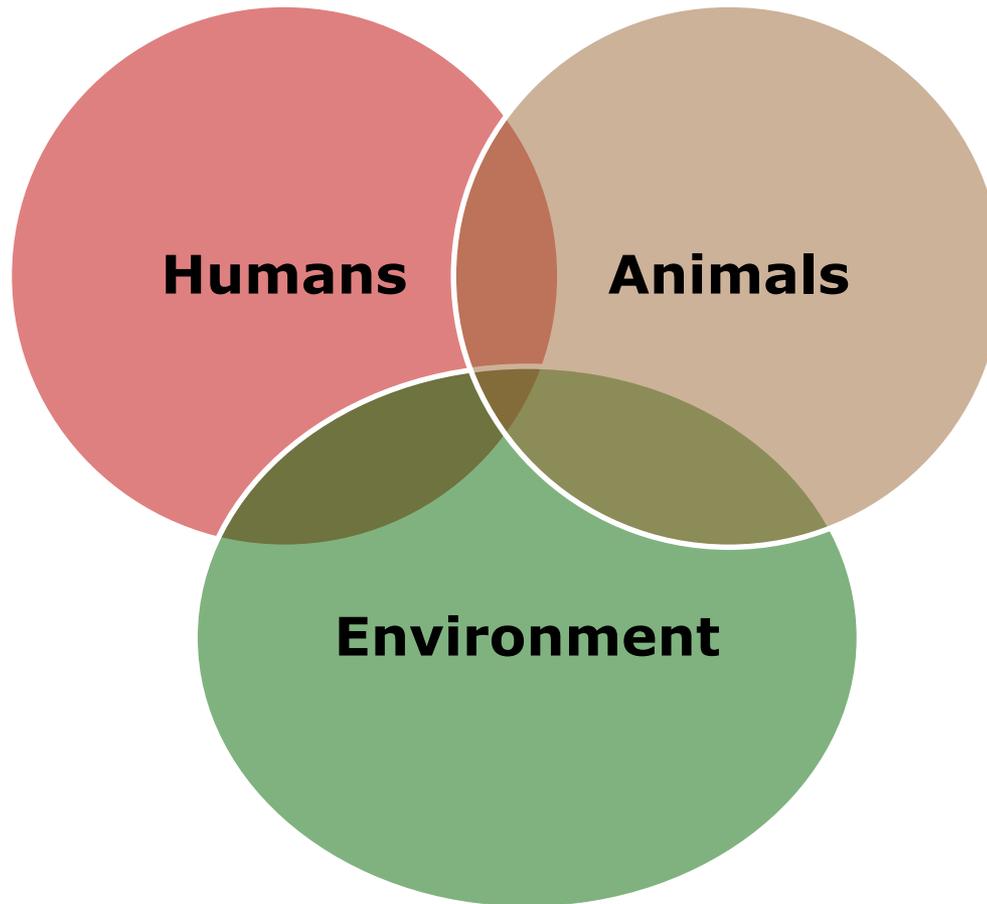
Symptom free SE positive birds exist

Salmonella Heidelberg Outbreak



Disease Transmission

Assume that the chickens and the environment are positive for *Salmonella* and *Campylobacter*



Think of Avian Salmonella two ways:

1. Cause of clinical disease in poultry (non-paratyphoidal)

- Host- specific or host-adapted (i.e. cause systemic disease in poultry)
 - S. pullorum
 - Primarily transmitted horizontally
 - S. gallinarum

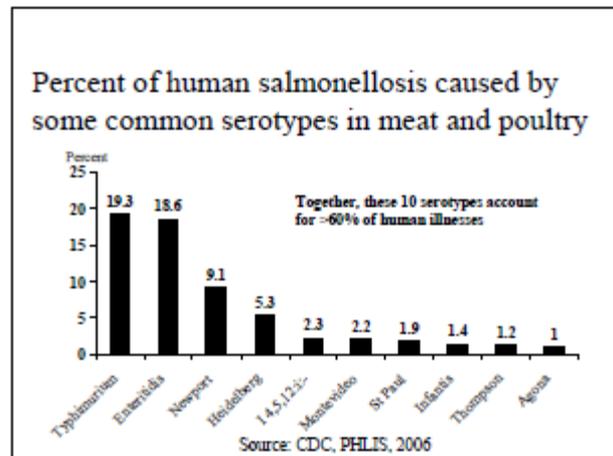
2. Source of food-borne disease in humans (paratyphoidal)

1. Non host-adapted (i.e. carried sub-clinically by poultry). Also called paratyphoid Salmonella
2. Cause little disease in birds except chicks
3. The paratyphoid have been split into 5 groups or subgenera
4. S. enterica contains more than 2,700 serotypes
 - a. Ex. S. *enterica* subspecies *enterica* serovar Enteritidis or more commonly referred to as S. Enteritidis

Salmonella Groupings

Below are the commonly found Salmonella Serotypes by group found in poultry environments and involved with common food poisoning incidents (*).

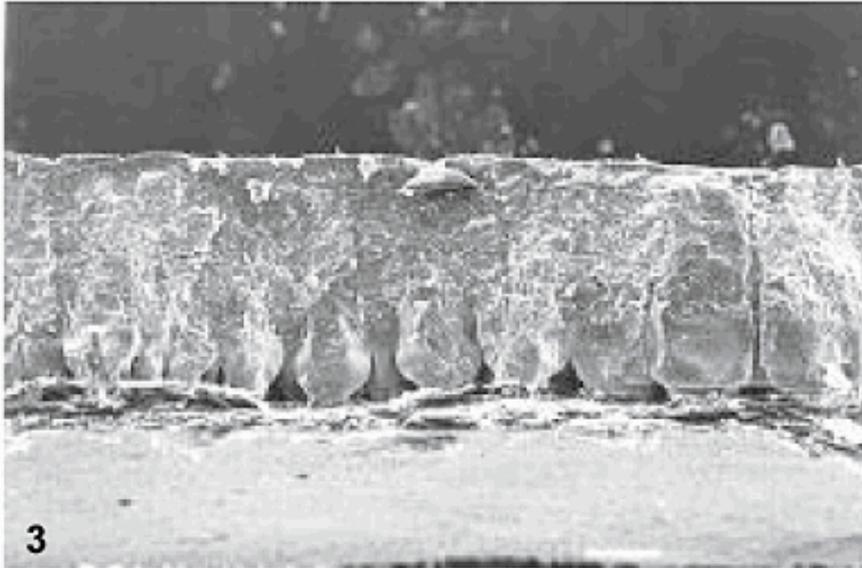
Group B	Group C1	Group C2	Group D	Group E
<u><i>S. typhimurium</i></u> * <u><i>S. heidelberg</i></u> *	<u><i>S. thompson</i></u> * <u><i>S. montevideo</i></u>	<u><i>S. newport</i></u> * <u><i>S. hadar</i></u> *	<u><i>S. enteritidis</i></u> <u><i>S. pullorum/gallinarium</i></u> (F typhoid)**	<u><i>S. anatum</i></u> <u><i>S. broughten</i></u>
<u><i>S. agona</i></u> <u><i>S. schwarzengrund</i></u> <u><i>S. saint paul</i></u> <u><i>S. Indiana</i></u> <u><i>S. brendency</i></u>	<u><i>S. mbandaka</i></u> <u><i>S. braenderup</i></u>	<u><i>S. kentucky</i></u> *	<u><i>S. berta</i></u> <u><i>S. jamaca</i></u>	
		<u>Group E 4</u>	<u>Group K</u>	
		<u><i>S. seftenburg</i></u>	<u><i>S. cerro</i></u>	



A safe egg starts in the coop

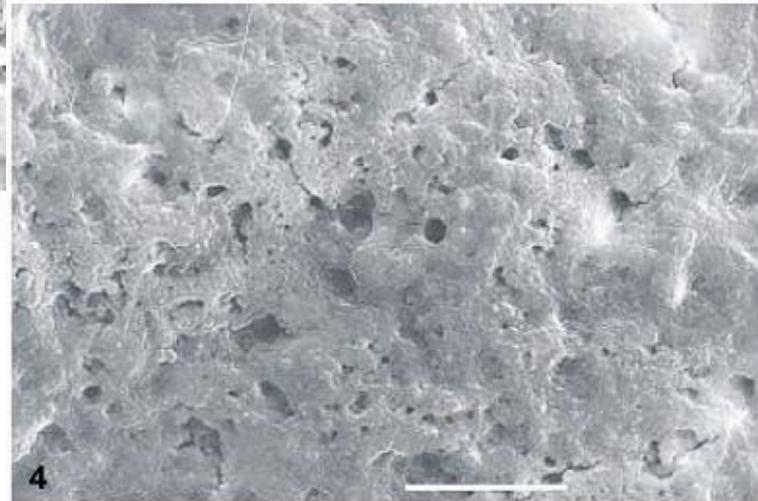


The Porous Shell



3

Figure 3 - Lateral view of the eggshell (bar: 100 μ m).



4

Figure 4 - Outer shell pores (bar: 5 μ m).

Nest Box Details

Location:

Higher than the ground

Lower than roosts

Tapered top



Nest Box Details

1 foot square

Away from high traffic areas

1 box:5 hen maximum ratio

2 inches clean, dry bedding



Backyard Egg Collection

Eggs should be sorted immediately after collection

Discard: Fecal contamination, white/yolk contamination, cracks, weak shells



Backyard Egg Collection

Dry brush any feathers, shavings, dry dirt, etc

Eggs with mild dirt, to be cleaned later, stored separately from visually clean eggs

Refrigerate all eggs directly after collection

Disadvantage of sandpaper: wipe of bloom (Bloom = waxy cuticle naturally found on all eggs which has anti-microbial properties for up to 72 hours)



Backyard Egg Cleaning

Wet washing = facilitating bacterial movement across the shell

Specific protocols required to prevent bacterial introduction

Do not immerse eggs in water



Backyard Egg Cleaning

Cleaning is not required for small producers but cleanliness is

“free from foreign material and from stains or discolorations that are readily visible”

Cleaning and sanitizing is mandated for any egg sales

For personal consumption no cleaning may be most appropriate guidance

IF proper husbandry

If proper handling

If no evidence of soiling

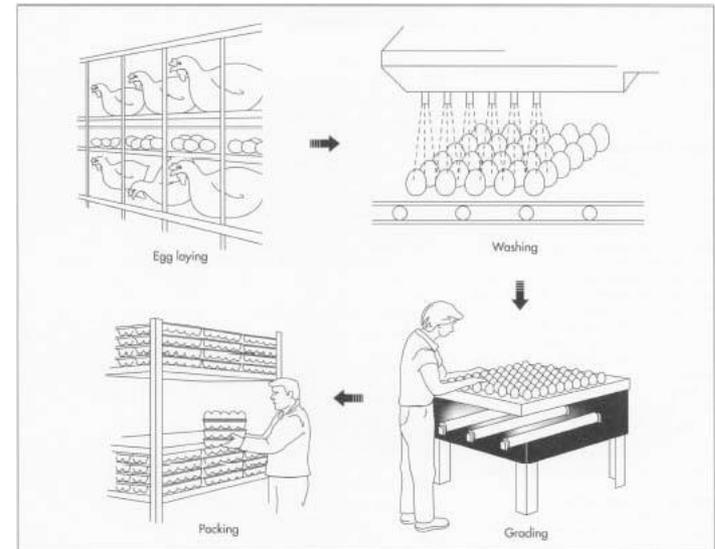


IF you must clean eggs beyond dry

If you sell table eggs you need to clean them

Typical sequence of egg cleaning

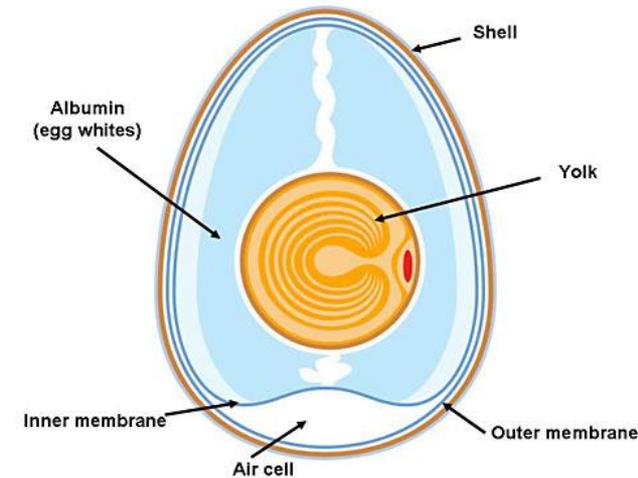
1. Washing
2. Sanitizing
3. Rinsing
4. Drying



Egg Cleaning - Washing

1. Washing
2. Sanitizing
3. Rinsing
4. Drying

- Wash water temp must be at least 90°F and 20°F degrees warmer than the egg (after laying the temp of the egg is $\sim 100^\circ\text{F}$).
- Too big a difference can cause cracks
- In a BY flock, take a "batch" of eggs out of the fridge and warm to room temperature and then wash following the temperature requirement provided above
- However, Salmonella can grow at 100-108°F



Goal of washing:
Removing of fecal material

- Washing solutions include:
- Potassium Hydroxide
 - Quarternary Ammonium
 - Sodium Carbonate
 - Sodium Hydroxide

Egg Cleaning - Washing

1. Washing
2. Sanitizing
3. Rinsing
4. Drying

Constantly running water

Water must be potable

Water must not have significant iron

Low iron in eggs is a defense against
bacterial growth

No more than 2ppm

Well water or pipe concern



Egg Cleaning - Washing

1. Washing
2. Sanitizing
3. Rinsing
4. Drying

Any chemicals must be Generally Recognized as Safe (GRAS) by FDA
And approved for food surfaces
Unscented, dye-free dishwashing detergent a valid consideration
for backyard flocks



Egg Cleaning - Sanitizing

1. Washing
2. Rinsing
3. Sanitizing
4. Drying

Dilute chlorine bleach (Sodium hypochlorite) most common agent

Between 50 and 200 ppm

½ tablespoon bleach per gallon water = 100 ppm

Organic materials inactivate chlorine therefore change solution every few hours

Eggs post-sanitizer are not sterile: they have around 100 cells/egg (~ 50%/50% Gram negative to Gram positive bacteria)

Vs.

Pre-sanitizer levels which are $\sim 10^5$

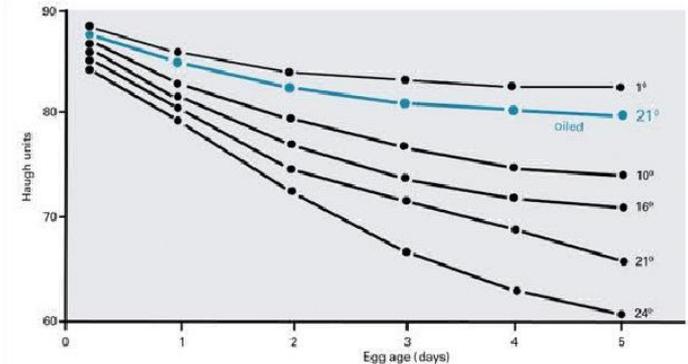


Egg Sanitizing

1. Washing
2. Sanitizing
3. Rinsing
4. Drying

Bloom = waxy cuticle naturally found on all eggs
Decreases exchange of gas, etc across shell
Slows loss of quality

Act of cleaning +/- sanitizing removes bloom



Egg Cleaning - Rinsing

1. Washing
2. Sanitizing
3. Rinsing
4. Drying

Same principles still apply

Safe water

20 degrees warmer

Constantly running water

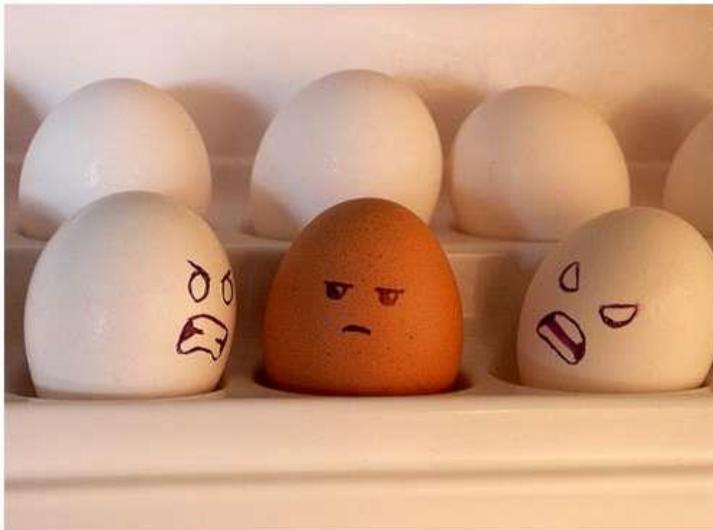


Egg Cleaning – Drying

1. Washing
2. Rinsing
3. Sanitizing
4. Drying

Ensure eggs are dried then returned to refrigerator

Typical egg cartons or refrigerator storage areas would trap any surface moisture



So how would I do it if I was selling eggs from my BY Flock?

1. Washing
2. Sanitizing
3. Rinsing
4. Drying

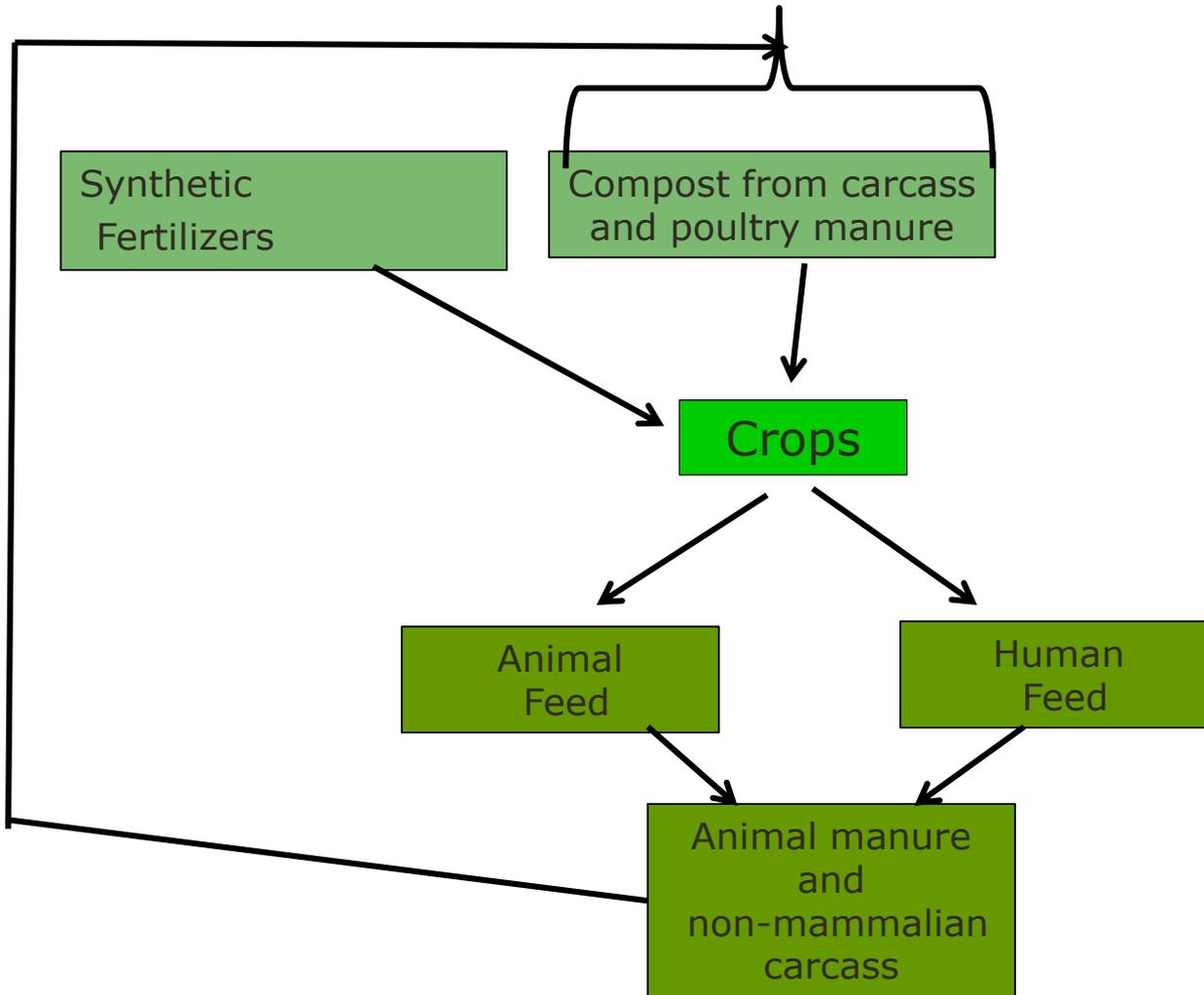
Take eggs out of fridge and temper to room temp for up to 36 hrs

Washing: ½ cap of Clorox in 1.5L of water at ~ 90-95°F. Dip in washcloth and wipe off egg

Rinsing: Wipe with washcloth in water

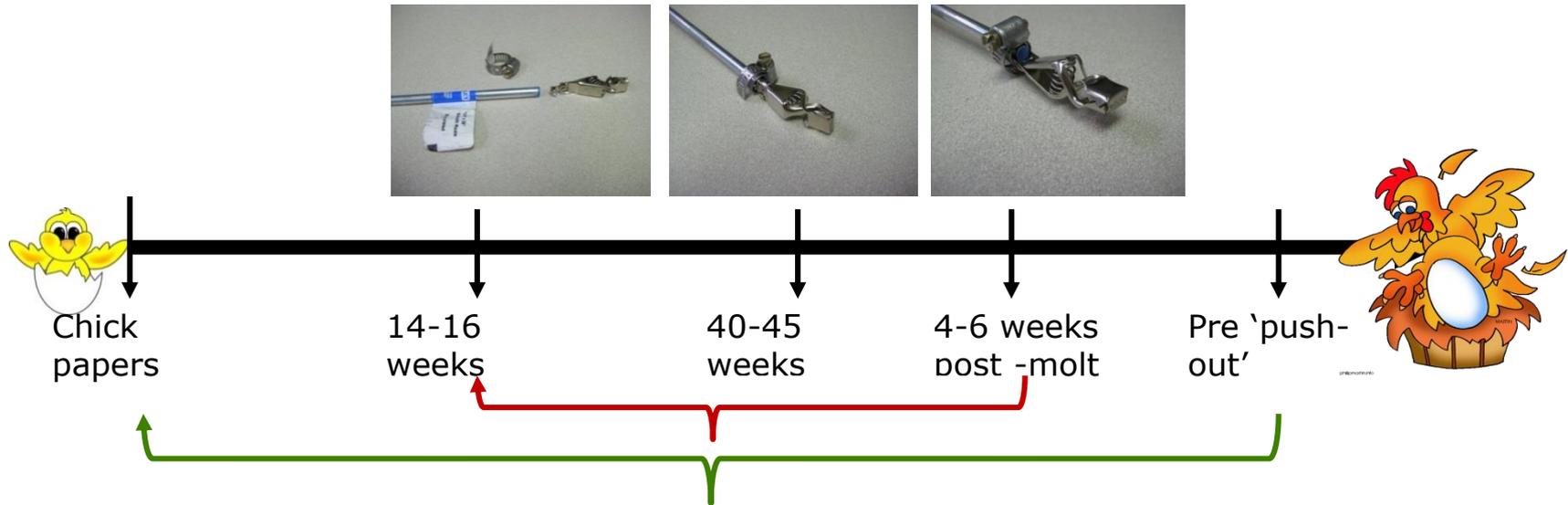
Dry: Wipe dry and place in fridge

Composting and Food Safety/Touch vs. No-Touch Crops



Point: Be careful with using compost from animal sources as a soil amendment on touch crops (i.e. cantaloupe, lettuce etc).

SE Surveillance in the Environment



FDA

Environmental sampling

- 1) 14-16 week of age; pre-production samples
- 2) 40-45 week production samples
- 3) 4-6 week post-molt samples

CEQAP

Environmental sampling

- 1) Chick papers
- 2) 14-16 week of age; pre-production samples
- 3) 40-45 week production samples
- 4) 4-6 week post-molt samples
- 5) 2-4 week pre-pushout samples

% environmental SE positives by stage of production

	Chick papers	Pre-production	Mid-production	Post-molt	Pre-market	Unknown	Total
SE negative	621	382	370	194	251	560	2378
SE positive	13	8	13	7	34	44	119
Total	634	390	383	201	285	604	2497
% Positive	2.05%	2.05%	3.39%	3.48%	11.92%	7.28%	4.80%

Pearson chi-square tests showed significant differences ($p < 0.05$) between the six

Trend showing > SE in environments with older birds consistent with the literature

Campylobacter

- Gram negative thermophilic (grow around 42°C) bacteria
- Typically non-host adapted.
- The high levels of of Campylobacter in the intestinal tract of poultry can result in contamination of the carcass during evisceration.
- Campylobacteriosis is one of the leading causes of human foodborne illness (depending on the year common than Salmonella).
- Primarily linked to consumption of chicken
- In humans has been associated with Guillain-Barre syndrome (post-infection auto-immune dz characterized by progressive neuromuscular paralysis)
- FQ resistant Campylobacter

Questions?

