

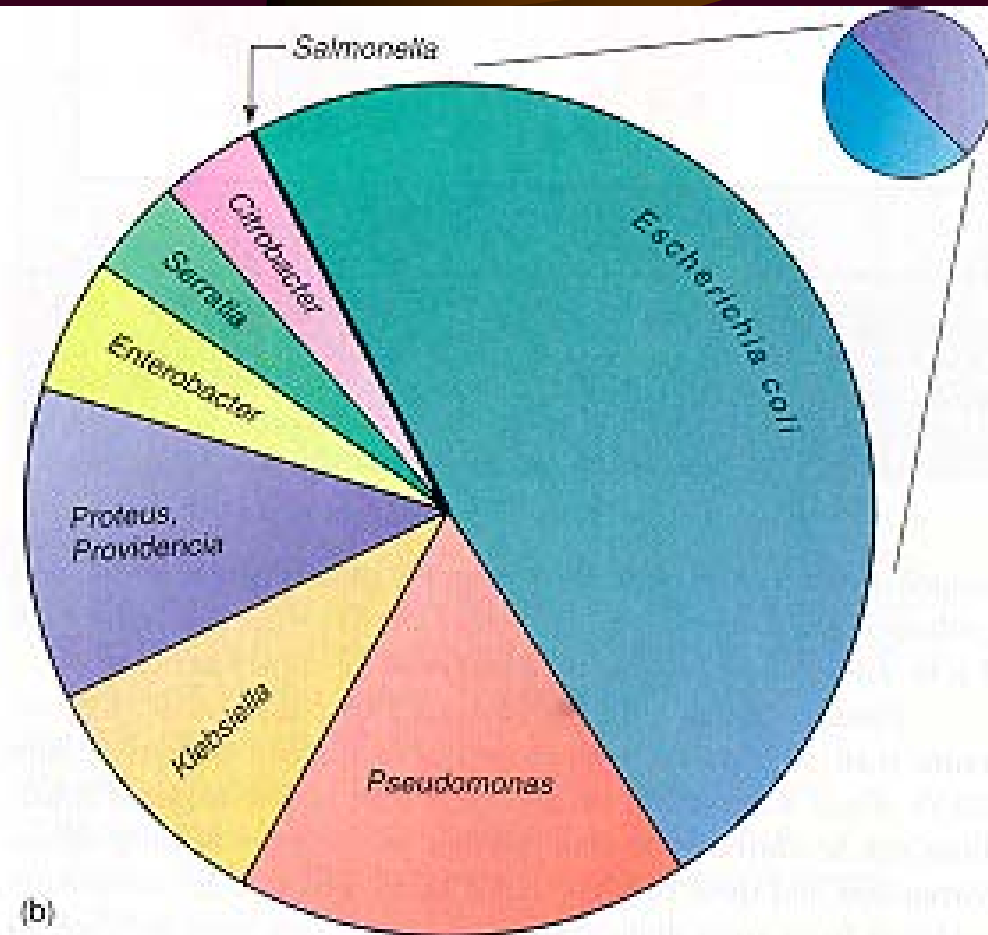
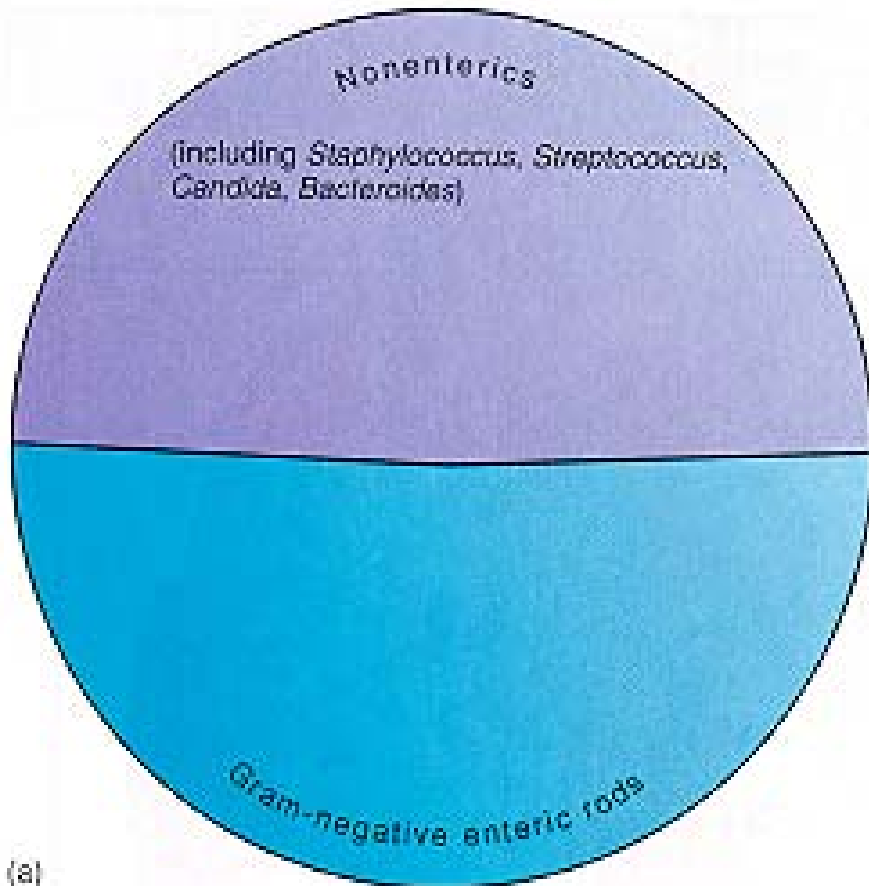
Enterobacteriales



A large family of over 100 spp, Gram negative facultatively aerobic bacilli.

These are common commensals of humans and often part of normal gut flora. They are a major cause of nosocomial infections

Bacteria Responsible for the Majority of Nosocomial Infections:

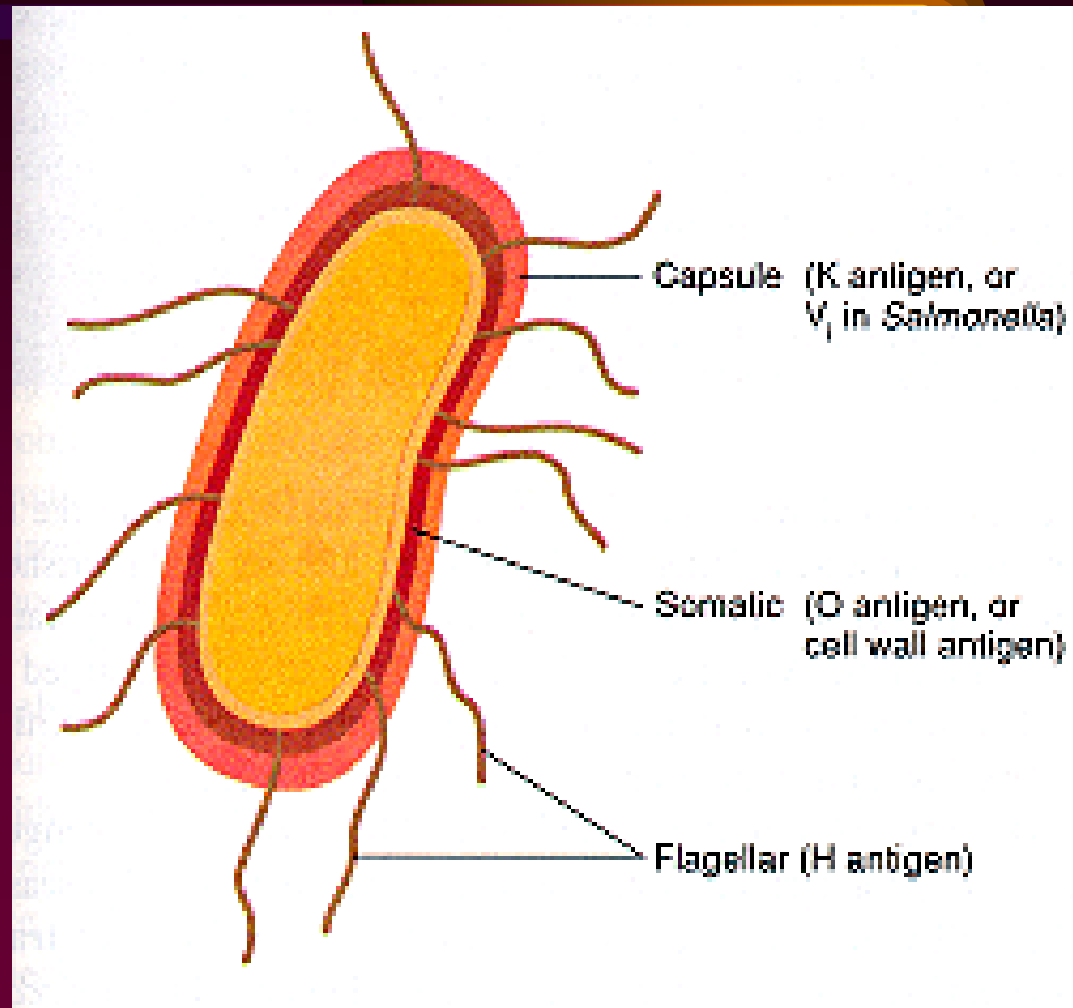


Biology of enteric bacteria

- Produce gas from sugar fermentation (we all know this)
 - degrade formic acid to H_2 and CO_2
- Includes *Escherichia*, *Proteus*, *Salmonella*, *Shigella*, *Klebsiella* et al.
- Produces enteritis and urinary tract infections and pneumonia
- Some are free-living but most are associated with humans or animal gut flora
- Habitat:
 - lower G.I. tract humans & animals
 - female urogenital tract and sometimes on skin
- Widest variety of infections including systemic infections, enteric disease and urinary infections
- Of these, *E. coli* is the most widely studied

Classification of enterobacteria

- LPS contains **O** antigens, Cell surfaces have **K** antigens, and flagellar proteins have **H** antigens:
 - The pathogenic *E. coli* is called **O157:H7** classified by antigenic determinants (more later)

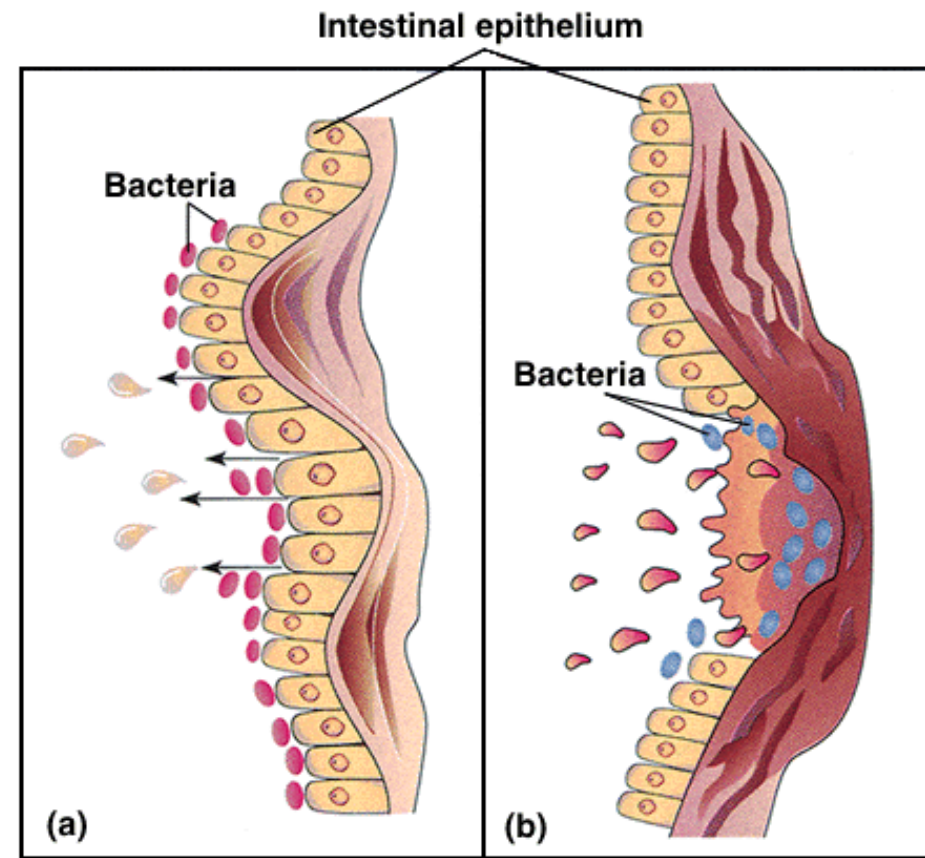


Toxins of enterobacteria

- Gm-- endotoxin, LPS
 - fevers, leukopenia, blood coagulation, etc.
- Exotoxins:
 - Many plasmid based (what does this mean?)
 - **Enterotoxins**
 - induce diarrhea by altering gut function
 - Cytolysins
 - may induce dysentery by tissue erosion

Foundations of Microbiology, 2nd ed., by Talaro & Talaro, ©1996 Times Mirror Higher Education

Mechanisms of Infectious Diarrhea. Figure MF20.2 (T



Diarrhea

Dysentery

Shigella dysenteriae

- Invasive into mucosae
- Virulence factors are plasmid-based
- Acid tolerant, few bacteria needed to establish infection
- Intracellular pathogen from APCs to mucosa
 - intracellular bacteria lead to cell death
 - tissue sloughing
- **Shigella toxin** not only kills gut cells, but induces hemolytic uremic syndrome (**HUS**) a severe anemia with kidney damage & failure.
- A/B toxin--interferes with ribosomal function leading to cell death. Frequent watery stools which become bloody with pus-**Bacterial dysentery**
- Painful cramps with tenesmus
- malaise, headache, convulsions, etc.

Escherichia coli

- Most common of enterobacteria
 - Long ignored as a pathogen (so common in humans & animals)
 - Major cause of traveler's diarrhea
 - Delhi belly, Moctezuma's revenge, Turkey trots, etc.
 - Major cause of **UTI** (what are these?)
 - In UTI, pili important for colonization
 - Pyelonephritis-associated or P-pili
 - cystitis and dysuria, urinary frequency
- **Intestinal Infections:**
 - Symptoms are strain specific ranging from mild to cholera-like dysentery
 - Most virulence factors are plasmid based
 - many mimic cholera, others look like *Shigella*
 - Many different types of *E. coli* gastroenteritis
 - common in 3rd World
 - Pathogenesis of each is different

Escherichia coli (Diarrheagenic)

Enterotoxigenic (ETEC)
cholera-like

Enteroinvasive (EIEC)
Shigella-like

Enteropathogenic (EPEC)
Salmonella-like

Enterohemorrhagic (EHEC) **The RUNS**
Shigella-like toxin



Diffusely adherent & enteroaggregative (EAEC) types

E. coli continued

- **Enterohemorrhagic-**
- *E. coli*
 - A.K.A. **O157:H7**
 - Toxin from *Shigella dysenteriae* (above)
 - On genome in *Shigella*, B-phage in EHEC**
 - Common in cattle, thus found in meat:

Especially ground beef**

- related to modern food processing
- fast foods
- family spread
- Watery diarrhea,
- intense pain, then bloody stools
- HUS cause of death
- **Generally, no antibiotics**

**COOK
UNTILL
160 DEGREES OR
UNTILL JUICES
ARE CLEAR**

GROUND BEEF ROUND

15% FAT

Nutrition Facts

Serving Size 4 oz. (112 g)
Servings Per Container Varied
Calories 240
Fat Cal. 150

*Percent Daily Values (DV) are
based on a diet of 2,000 calories.

Amount Per Serving % DV*		Amount Per Serving % DV*	
Total Fat 17g	25%	Total Carb. 0g	0%
Sat. Fat 7g	33%	Dietary fiber 0g	0%
Cholest. 75mg	25%	Sugars 0g	
Sodium 55mg	2%	Protein 20g	
Vitamin A 0% • Vitamin C 0% • Calcium 0% • Iron 15%			

375.24.34



0 200999 402193

**PRICE
CHOPPER**

LOW PRICE

SAVING

**CERTIFIED GROUND ROUND
85% LEAN (A)**

SELL BY
01-27-99

TOTAL PRICE
\$2.19

NET WT./COUNT UNIT PRICE
1.16 lb \$1.89

COSENTINO'S PRICE CHOPPER #119

SAFE HANDLING INSTRUCTIONS

THIS PRODUCT WAS PREPARED FROM INSPECTED AND POSSED MEAT UNDER FEDERAL, STATE, AND LOCAL
PRODUCTS MAY CONTAIN BACTERIA THAT COULD CAUSE ILLNESS IF THE PRODUCT IS MISHANDLED OR
COOKED IMPROPERLY. FOR YOUR PROTECTION, FOLLOW THESE SAFE HANDLING INSTRUCTIONS:

- KEEP REFRIGERATED OR FROZEN. THAW IN REFRIGERATOR OR MICROWAVE.
- KEEP RAW MEAT AND POULTRY SEPARATE FROM OTHER FOODS, WHEN WORKING SURFACES (INCLUDING CUTTING BOARDS), UTENSILS, AND HANDS AFTER TOUCHING RAW MEAT OR POULTRY.
- COOK THOROUGHLY.
- KEEP HOT FOODS HOT. REFRIGERATE LEFTOVERS IMMEDIATELY OR DISCARD.

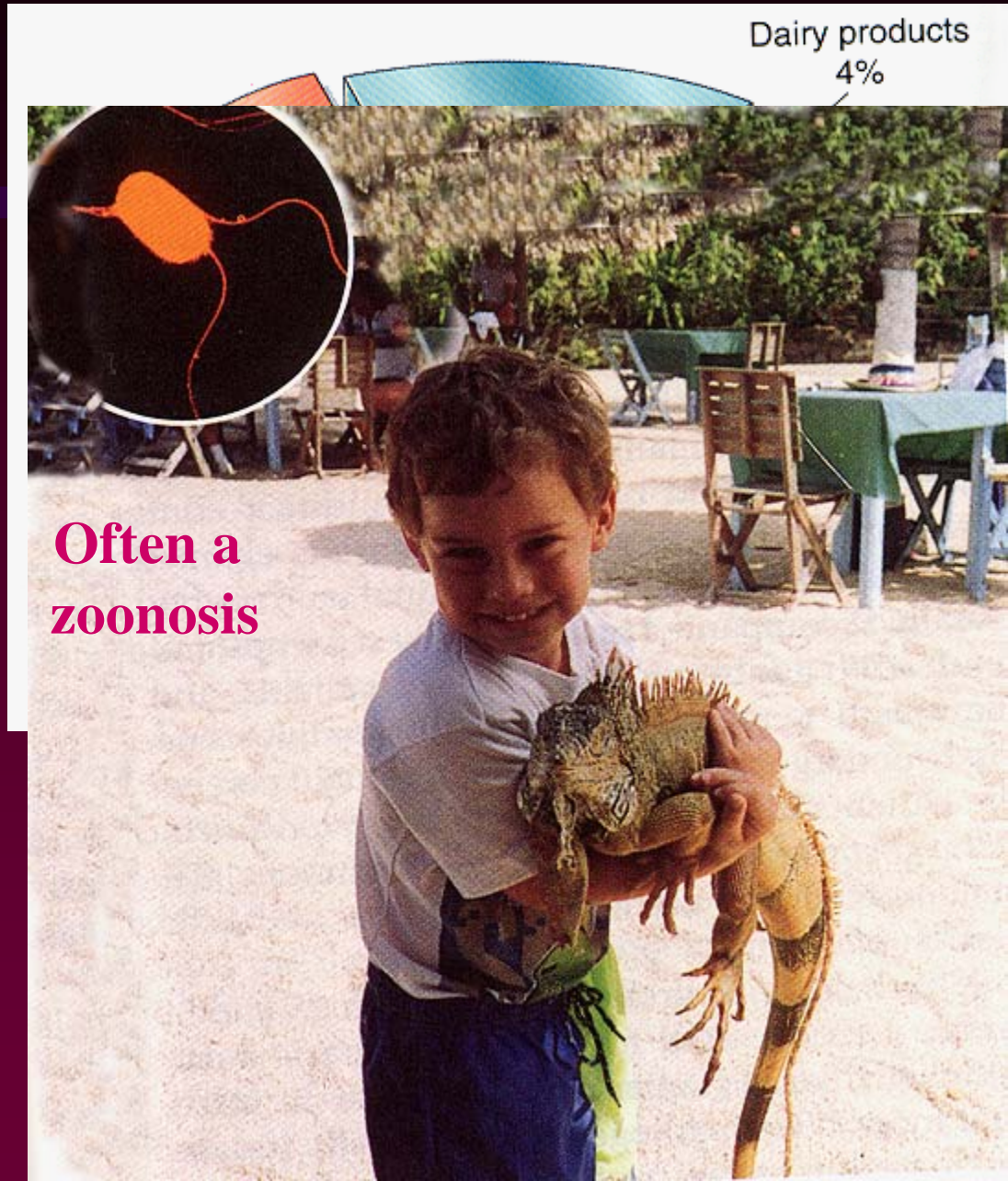


Salmonellosis

- Ubiquitous in humans & animals, a zoonosis
 - chickens, sheep, pigs, rats, reptiles (turtles)
- May induce both gastroenteritis and systemic disease (typhoid fever)
- over 2000 serotypes
- induces intense enteric inflammation due to cytokine induction and tissue invasion
 - toxins less important
- Epidemiology:
 - infections via contaminated food & water
 - cream pastries, ground meats, sausages, poultry especially eggs
 - role of chickens, pets, etc. (zoonosis)
 - mostly transovarian--summer-time foods!!
 - human to human
 - Infected individuals
 - Chronic carriers (Typhoid Mary)

Gastroenteritis

- 15% of food-borne infections
- Specific receptors lead to tissue invasion
 - remain in gut tissues
 - severe inflammation of mucosae
 - nausea, vomiting, cramps diarrhea-(mild to severe)
 - Self-limiting, no antibiotics, but rehydration and support therapy
 - due to enterotoxins and endotoxin



TAQUERIA
SHIRLE
TACOS Y TORTAS DE LONCHOS, POLLO
EMPANIZADO, SALPICÓN Y OTROS MÁS.

POLLOS Luis

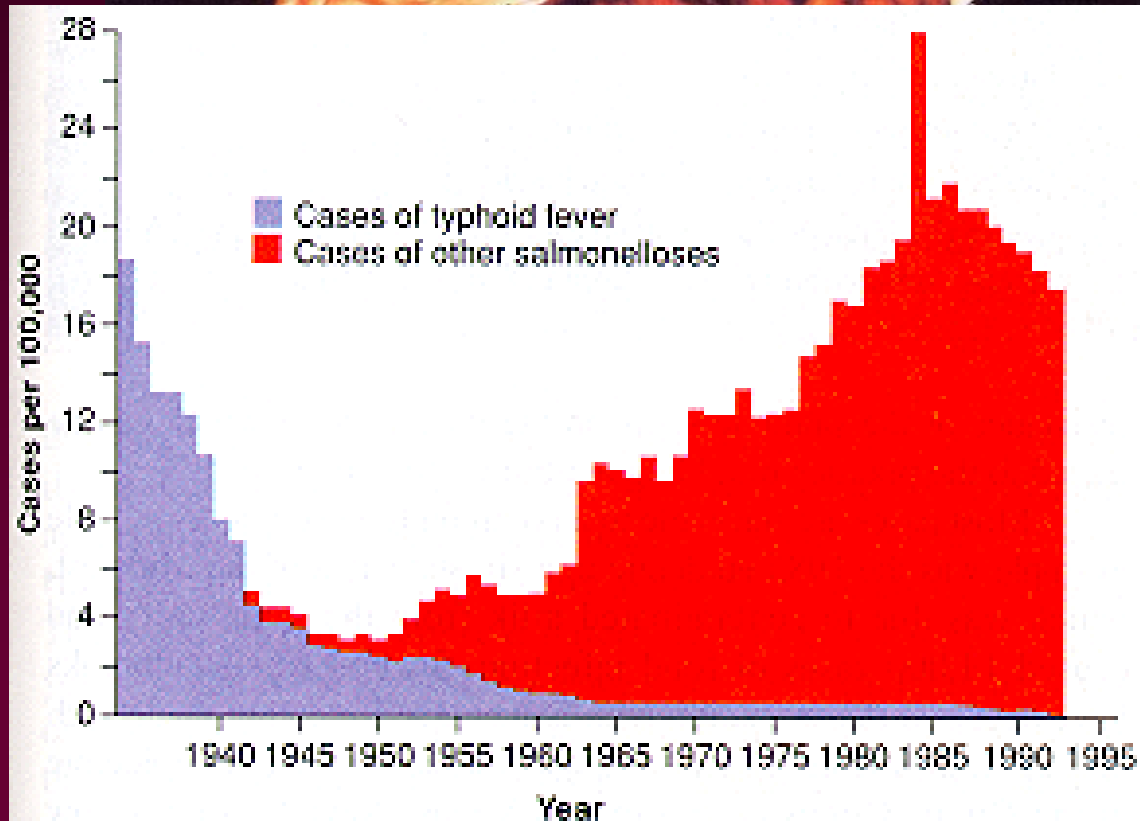


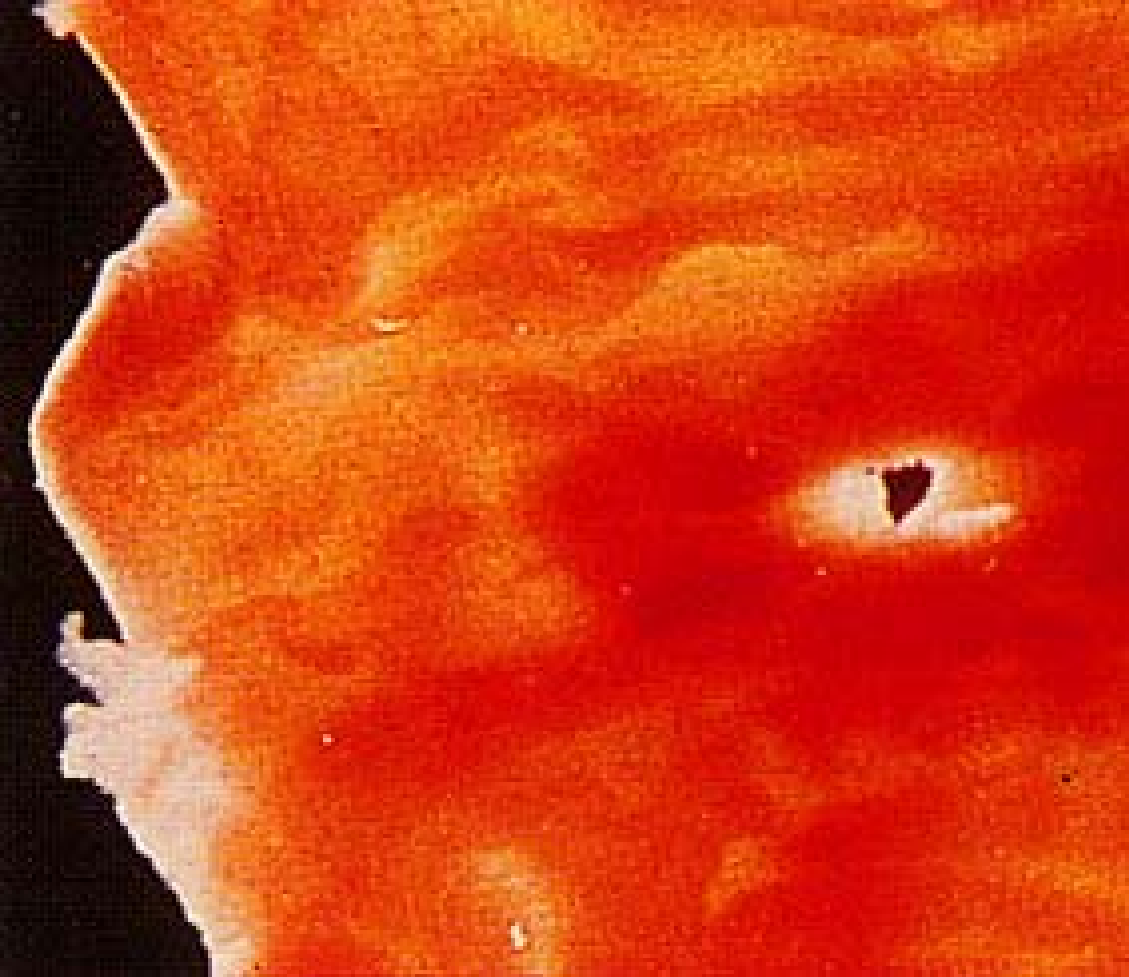
Typhoid Fever

- Enteric Fevers (H_2O borne)

- multi-organ-system infection with *S. typhi*
- tissue invasion, septicemia, liver, gall bladder, kidneys, etc.
- sustained bacteremia
- high fevers (LPS)
- diarrhea/ulcerative colitis
- Gall bladder infection leads to carrier state
- Antibiotic treatment: Chloramphenicol, ampicillin, etc.

Lesions on intestinal lining





Perforated intestine due to typhoid

**Severe, life-threatening dehydration
a common cause of death in children
Usually due to enteric infections**



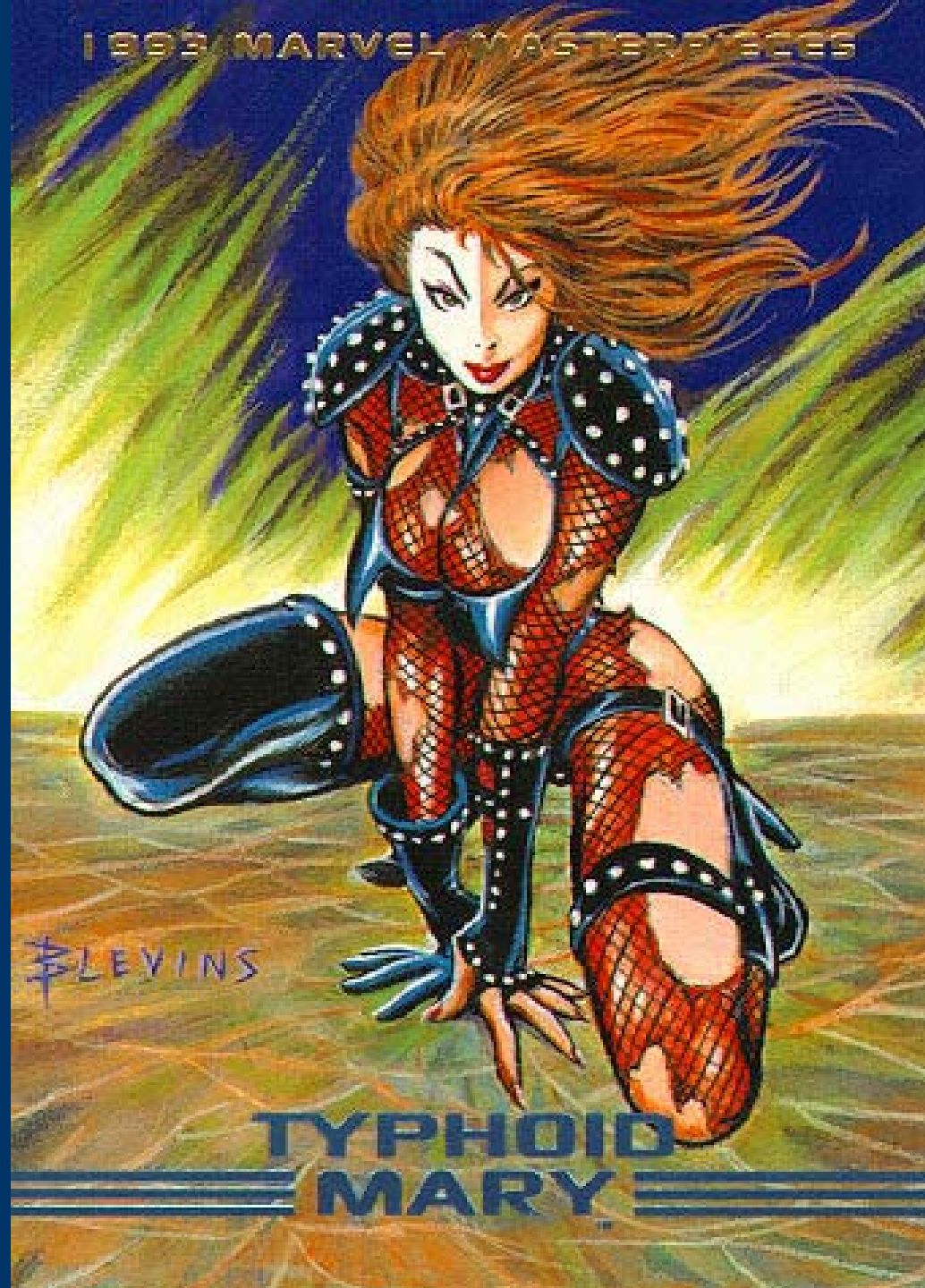


Typhoid Mary *Mary Mallon*

Born 1869 (Ireland)
Died 1938 (NYC)

- House & hospital cook
- Linked to 47 cases
 - (3 deaths)
- Confined for >25 yr

1993 MARVEL MASTERPIECES

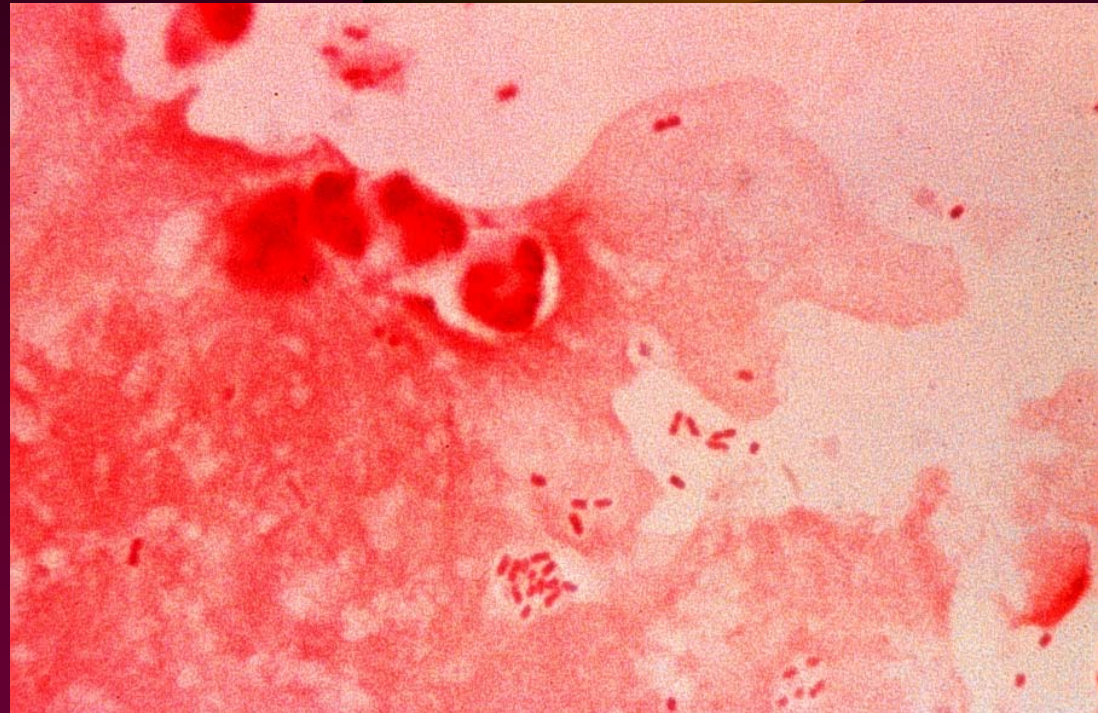


LEVINS

**TYPHOID
MARY**

Other enteropathogens

- *Yersinia pestis*
 - bubonic plague
 - more later
- *Klebsiella pneumoniae*
- *Enterobacter*, *Proteus*, etc.
 - UTIs



Sputum with *Klebsiella*