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Acute Gastrointestinal Infections

Syndromic Approach

Manuel R. Amieva, M.D., Ph.D.
Department of Pediatrics, Infectious Diseases
Department of Microbiology & Immunology
Stanford University School of Medicine

Sharon F. Chen, M.D.
Department of Pediatrics, Infectious Diseases
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Learning Objectives

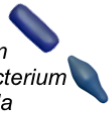
- Introduce the major pathogens that cause gastrointestinal infections including viruses, bacteria, and protozoa.
- Describe the different clinical syndromes associated with acute infections of the gastrointestinal tract

Major Human Pathogens

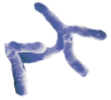
Gram positive Bacteria

Cocci
Staphylococcus
Streptococcus
Enterococcus

Rods
Listeria
Bacillus
Clostridium
Corynebacterium
Gardnerella
Propionibacterium



Branching
Actinomyces
Nocardia



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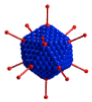
Acid Fast Bacilli

Mycobacterium tuberculosis
Mycobacterium leprae
Non-tuberculous *Mycobacteria*

Viruses



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Coxsackie
Enteroviruses
Poliovirus
Rotavirus
Norovirus
Hepatitis A
Hepatitis C
HIV
HTLV-1
Measles
Mumps
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Human metapneumovirus
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Ebola
Rabies

Vector borne
West Nile
Dengue
Chickengunya
Yellow Fever

DNA

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Mold
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Dimorphic
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Dermatophytes
Microsporum, Epidermophytum Trichophytum

Protozoa

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Blood
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Babesia

Tissue
Trypanosoma
Leishmania
Toxoplasma
Naegleria

Gram negative Bacteria

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Enteric flora
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Klebsiella
Proteus
Serratia
Enterobacter

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Bordatella
Legionella

Spiral
Campylobacter
Helicobacter

Opportunistic
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Enteric pathogens
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Salmonella
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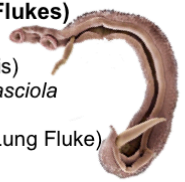

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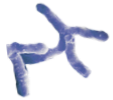

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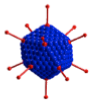

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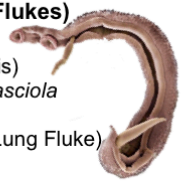

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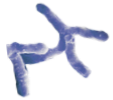

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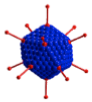

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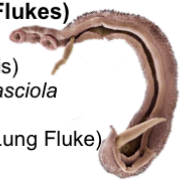

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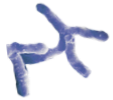

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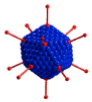

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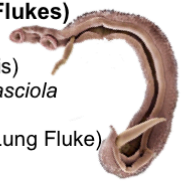

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Trichinella (Trichinosis)
Onchocerca (River Blindness)
Loa Loa (Eye Worm)
Wuchereria & Brugia (Elephantiasis)

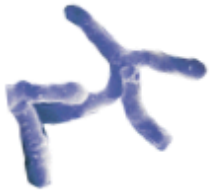
nogens

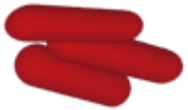
cteria

Branching

Actinomyces

Nocardia





culosis

obacteria

Viruses

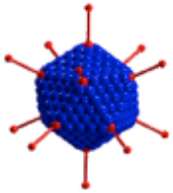
RNA

Rhinovirus
Coxsackie
Enteroviruses
Poliovirus
Rotavirus
Norovirus
~~Hepatitis A~~
Hepatitis C
HIV
HTLV-1
Measles
Mumps
Rubella
Astrovirus

Influenza A, B
Parainfluenza
RSV
Human metapneumovirus
Coronavirus (MERS, SARS)
Ebola
Rabies

Vector borne

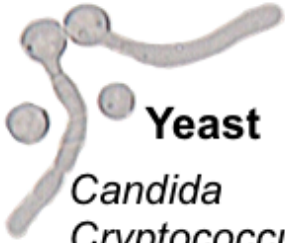
West Nile
Dengue
Chickengunya
Yellow Fever



DNA

Adenovirus
Herpes simplex
Varicella zoster
Cytomegalovirus
Epstein Barr virus
HHV6, HHV7, HHV8
Smallpox
Molluscum contagiosum
Hepatitis B
Parvovirus
Human papillomavirus
BK polyomavirus

Fun



Yeast

Candida

Cryptococcu

Pneumocys

Malassezia

Microsporid

Microsp

GI/G

Entamo

Giardia

Cryptos

Trichon

Zoonotic

Arthropods

Gram negative Bacteria

Rods

Enteric flora

E. coli
Klebsiella
Proteus
Serratia
Enterobacter

Respiratory Pathogens

Haemophilus
Bordatella
Legionella

Opportunistic

Pseudomonas

Enteric pathogens

Shigella
Salmonella
Yersinia

Anaerobic

Bacteroides
Prevotella
Fusobacterium

Spiral

Spiral

Campylobacter
Helicobacter

Comma

Vibrio cholerae

Diplococci

Neisseria
Moraxella

Zoonotic

Brucella
Francisella
Campylobacter
Pasteurella
Bartonella
Yersinia
Coxiella
Chlamydophila psittaci
Rickettsia
Ehrlichia
Anaplasma
Borrelia
Leptospira

Spirochaetes

Treponema
Borrelia
Leptospira

Intracellular

Chlamydia
Chlamydophila
Rickettsia
Coxiella
Legionella
Ehrlichia
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Pathogenic *Escherichia coli*

Strain	Syndrome	Site	Pathology	Source
ETEC	Watery Diarrhea	Small Intestine	None	Humans
EPEC	Prolonged watery diarrhea	Small Intestine	Attachment and Effacement	Humans & Animals
StEC EHEC	Hemorrhagic colitis and HUS	Large Intestine	Attachment and Effacement	Animals
EIEC	Dysentery	Large intestine	Invasive	Humans

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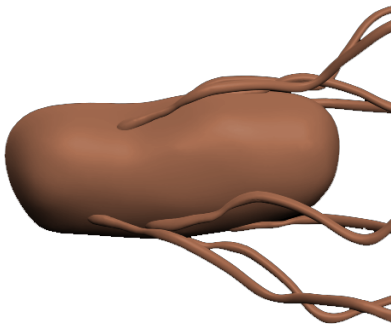

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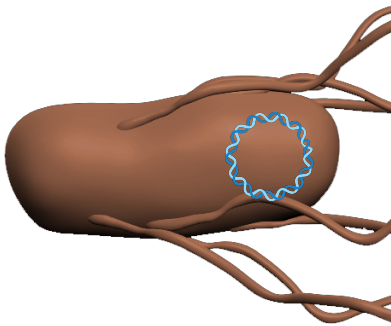

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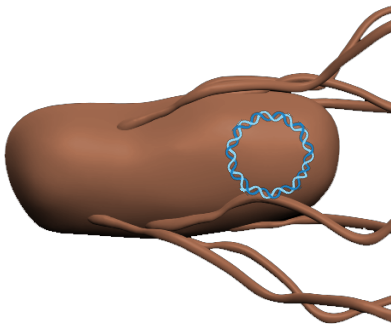

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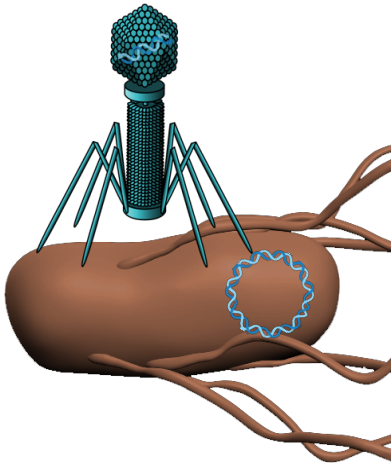


Major Human Pathogens

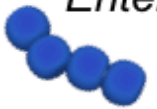
Gram positive Bacteria

Cocci

Staphylococcus aureus

Streptococcus

Enterococcus



Rods

Listeria

Bacillus

Clostridium

Corynebacterium

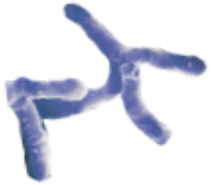
Gardnerella

Propionibacterium

Branching

Actinomyces

Nocardia



No cell wall
Pleomorphic

Mycoplasma

Acid Fast Bacilli

Mycobacterium tuberculosis

Mycobacterium leprae

Non-tuberculous *Mycobacteria*

RNA

Rhinovirus
Coxsackie
Enteroviruses
Poliovirus
Rotavirus
Norovirus
Hepatitis A
Hepatitis C
HIV
HTLV-1
Measles
Mumps
Rubella

Influe
Parai
RSV
Huma
meta
Coron
(MER
Ebola
Rabie

Vecto

West
Deng
Chick
Yellow

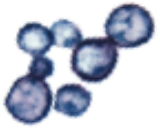
mplex
oster
lovirus
arr virus
V7, HHV8

n contagiosum
3
s
pillomavirus
navirus

Cryptococcus
Pneumocystis
Malassezia
Microsporidia

Rhizopus
Fusarium

Histoplasmosis
Blastomyces
Paracoccidioides
Sporothrix



Dermatophytes

Microsporum, Epidermophytum Trichophytum

Protozoa

GI/GU

Entamoeba
Giardia
Cryptosporidium
Trichomonas

Blood

Plasmodium
Babesia

Tissue

Trypanosoma
Leishmania
Toxoplasma
Naegleria

hropods

f: Lyme borreliosis,
Fever, RMSF,
kettsia, *Babesia*,

Helminths

Trematodes (Flukes)

Schistosoma

Nematodes (Roundworms)

Syndromes of Acute Gastrointestinal Infection

- Watery Diarrhea
- Inflammatory Diarrhea (bloody diarrhea, dysentery, colitis)
- Antibiotic Associated Diarrhea
- Enteric Fever
- Intoxication

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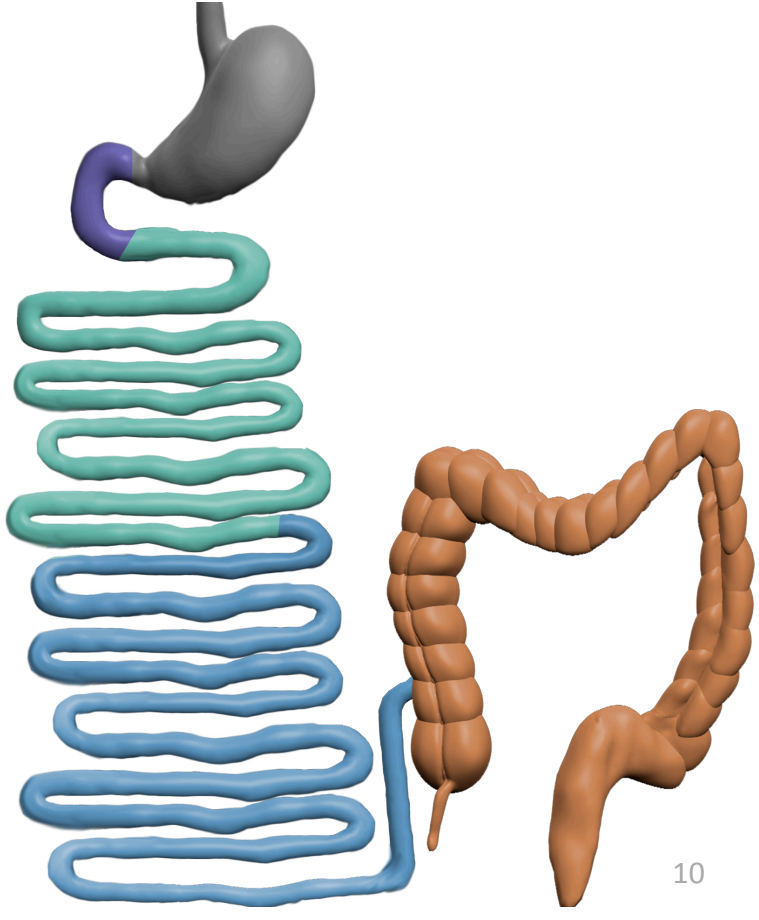
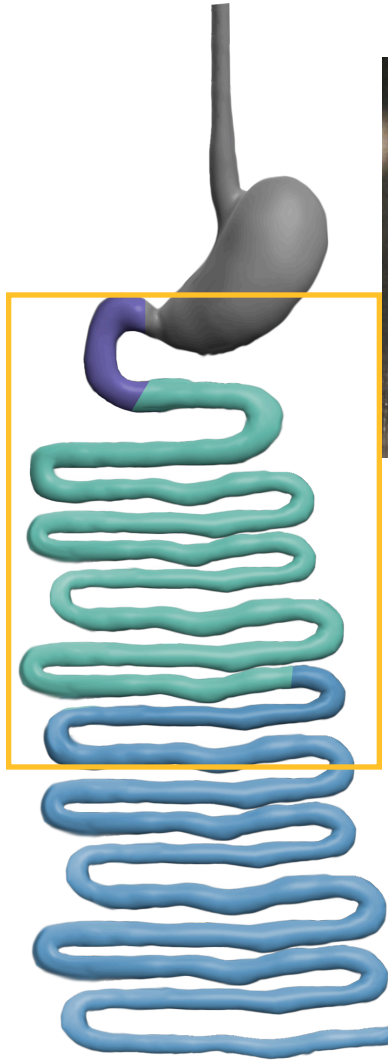
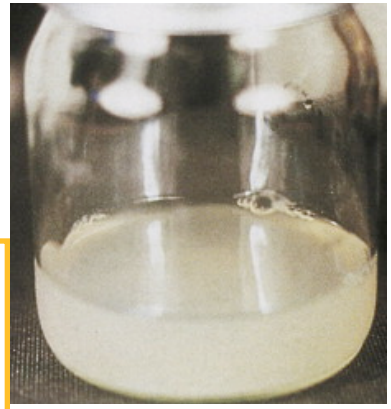
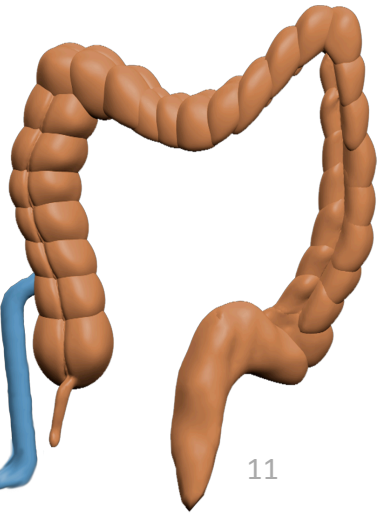


Watery Diarrhea

Clinical Features	Large volume watery stools without inflammatory cells or blood. Can lead to dehydration. Possibly accompanied by nausea, vomiting, bloating, colicky abdominal pain
Complications	Dehydration, electrolyte abnormalities, malnutrition
Management	Assess degree of dehydration, consider DDx, rehydrate, maintenance hydration
Anatomical Location	Proximal Small Intestine
Pathogenesis	Non-invasive, several are toxin mediated, secretory vs malabsorptive
Viruses	Rotavirus, Norovirus, Adenovirus (all non-enveloped capsids)
Bacteria	*Vibrio cholerae*, Enterotoxigenic *E. coli* (ETEC), EPEC, EAEC
Protozoa	*Giardia*, *Cryptosporidium*

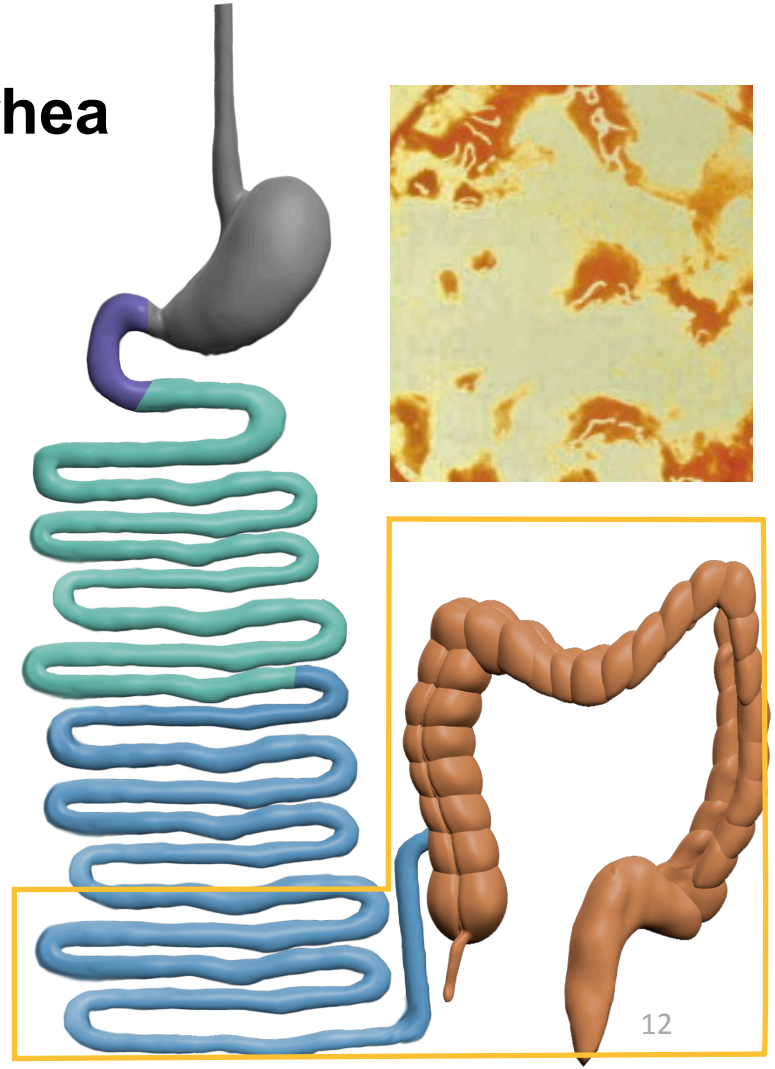






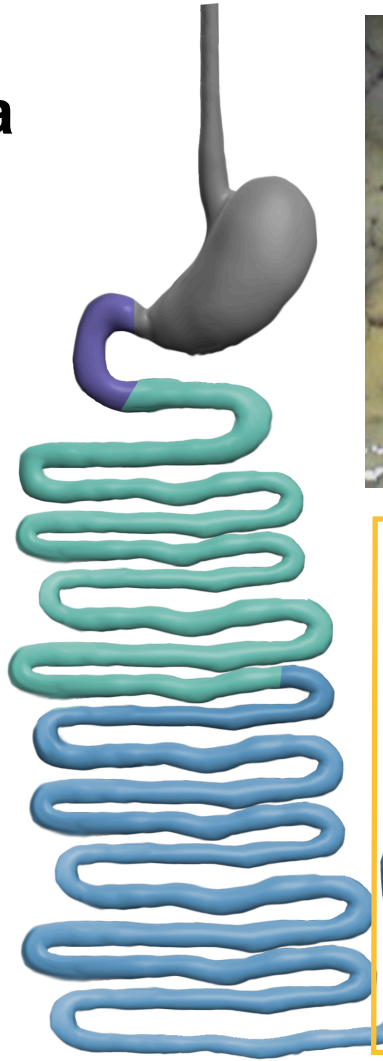
Inflammatory or Bloody Diarrhea

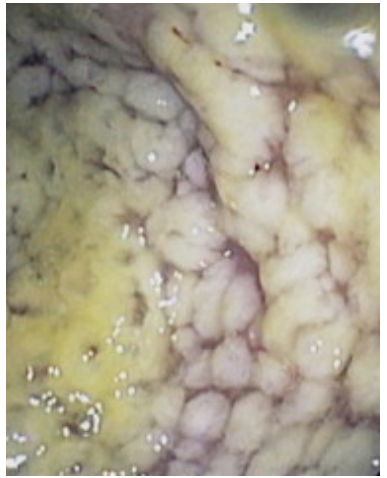
Clinical Features	Frequent small volume stools. May have streaks of blood, mucosy from pus. Pain on defecation (tenesmus), ileocolitis, colitis. Fever may be present.
Complications	Depend on etiology and host features- Hemolytic Uremic Syndrome, Bacteremia
Management	Consider stool cultures, antibiotics for some etiologies but may worsen others
Anatomical Location	Distal ileum and colon
Pathogenesis	Damage to enterocytes with local inflammatory responses, direct invasion and cytotoxin damage- Locally invasive
Viruses	none in immunocompetent
Bacteria	*Shigella,* Shiga-toxigenic *E. coli (*EHEC, StEC*),* EIEC*, Campylobacter jejuni, non-Typhi-Salmonella, Yersinia*
Protozoa	*Entamoeba histolytica*

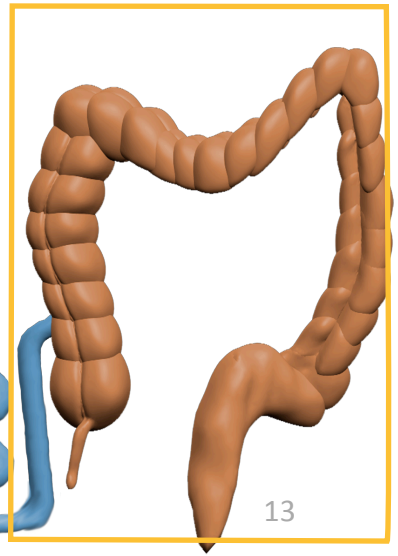


Antibiotic associated diarrhea

Clinical Features	May be watery, can also be inflammatory with pus and blood when due to *C. difficile*.
Complications	*C. difficile* - pseudomembranous colitis, toxic megacolon, sepsis
Management	Test for *C. difficile* toxins, stop offending antibiotics, if *C. difficile* treat with metronidazole or oral vancomycin
Anatomical Location	colon
Pathogenesis	Antibiotics kill normal flora and may affect gut absorptive functions, *C. difficile* produces toxins that damage colonic mucosa and are proinflammatory
Viruses	none
Bacteria	*Clostridium difficile* in the context of antibiotic damage to normal microbiota
Protozoa	*none*

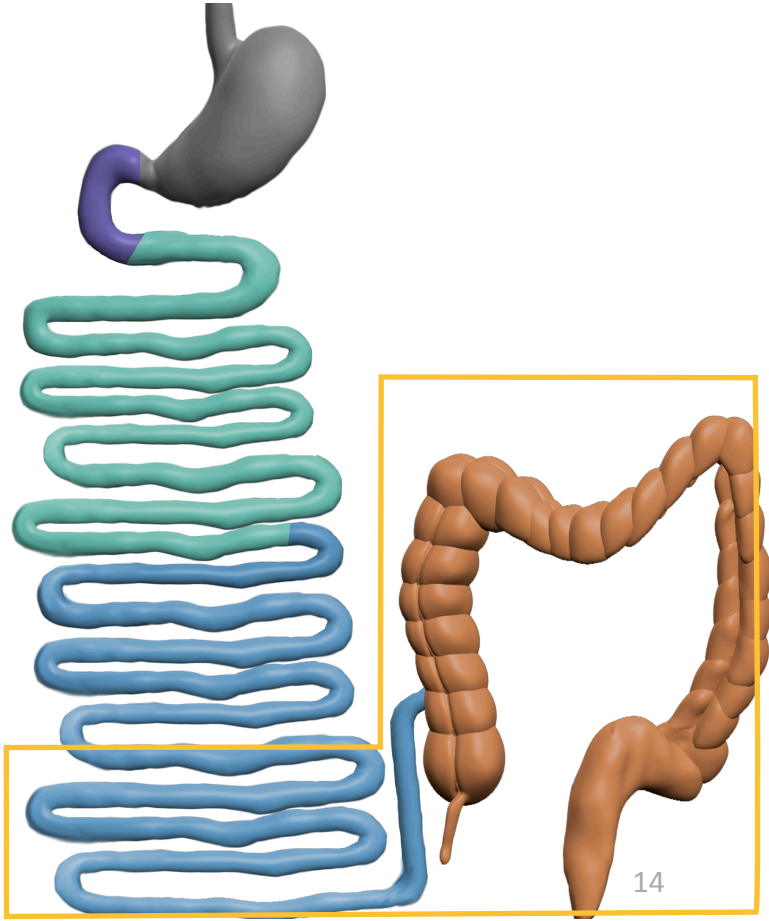






Enteric Fever

Clinical Features	Prolonged fever of unknown origin with chills, hepatosplenomegaly, ± constipation, ±rose spots
Complications	Bowel perforation, osteomyelitis, septic arthritis, meningitis, chronic carriage
Management	Blood cultures essential. Stool cultures may be negative. Requires antibiotic therapy
Anatomical Location	Systemic disease
Pathogenesis	Spread systemically, survives in macrophages, may reseed the bowel and transmit through feces. Survives in lymph nodes, liver, spleen, bone marrow, gall bladder
Viruses	none
Bacteria	*Salmonella Typhi and para-Typhi* (other systemic invasive enteropathogens- *Listeria, Brucella, non-Typhi Salmonella, Yersinia)*
Protozoa	none



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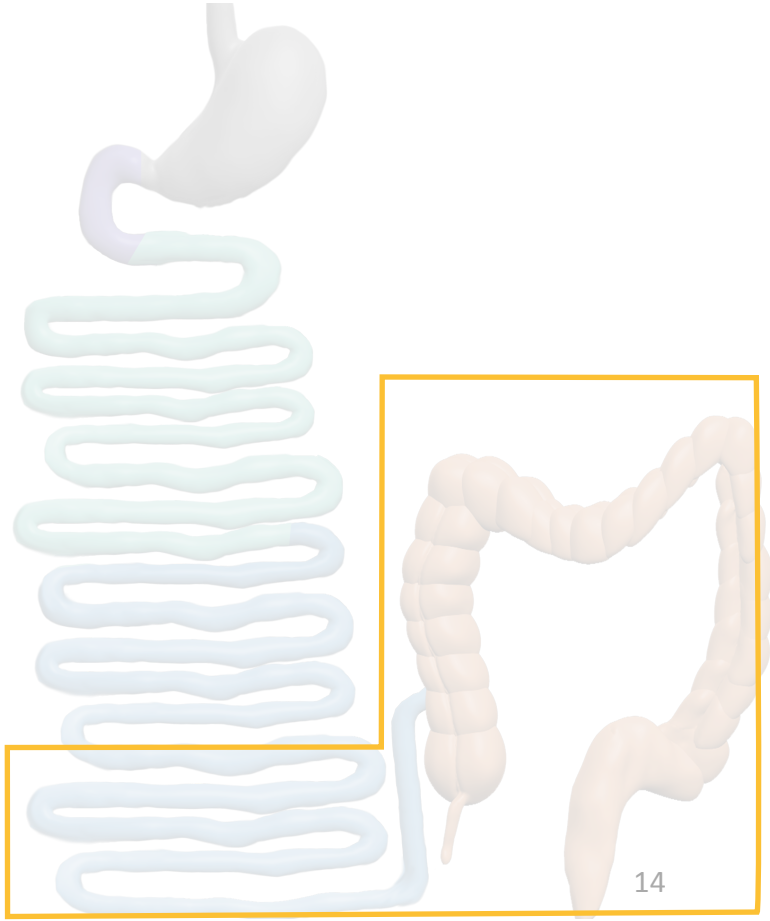

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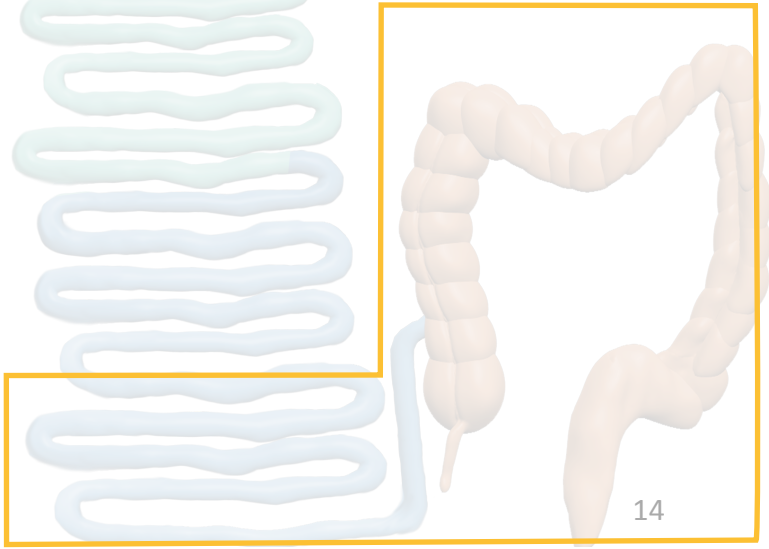
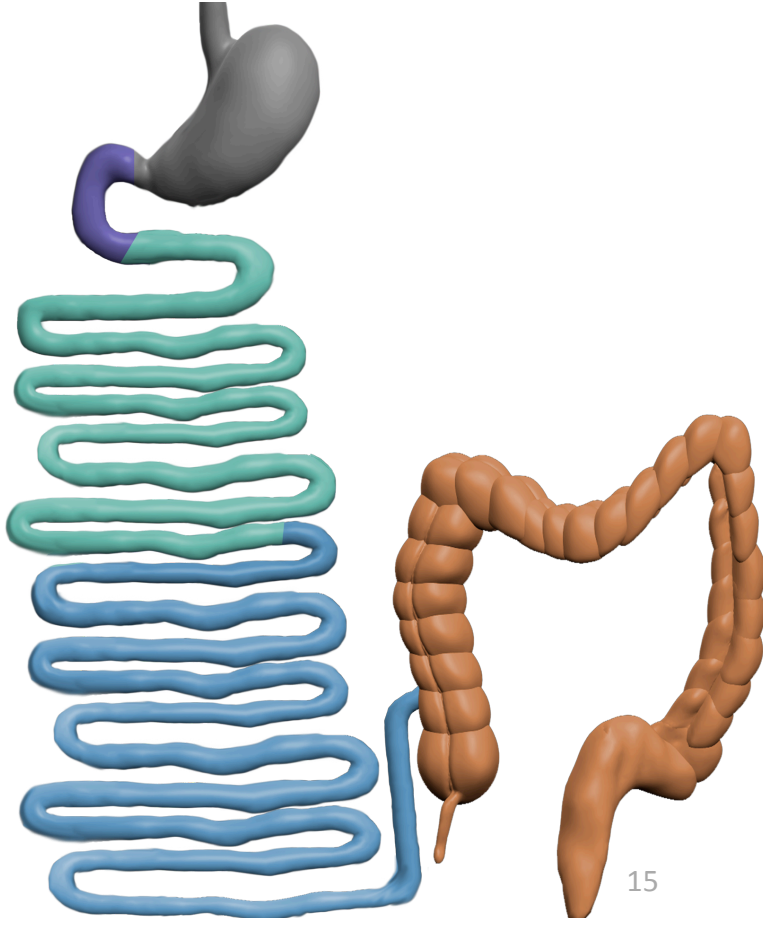


Intoxication

Clinical Features	Food Poisoning- Nausea, vomiting, followed by diarrhea, rapid onset in hours after ingestion, not contagious. Short duration
Complications	Dehydration
Management	Hydration, anti-emetics
Anatomical Location	Depends on toxin
Pathogenesis	Preformed toxins made by bacteria
Viruses	none- mimicked by Norovirus
Bacteria	*Staphylococcus aureus* enterotoxins, *Bacillus cereus* enterotoxins
Protozoa	none



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Credits: Acute Gastrointestinal Infections- Syndromic Approach

Slide 11: Rice Water Stools. From: Gastrointestinal tract infections. Mims' Medical Microbiology. Goering, Richard V., BA MSc PhD. January 1, 2013. Pages 269-302. © 2013. Figure 22.13.
https://www.clinicalkey.com

Slide 12: Dysenteric stool. Figure 18.6 Typical dysenteric stool is a small-volume mix of blood and pus. Such stools may be passed 30 or more times per day, often with increased pain (tenesmus). From: Shigellosis. Tropical Infectious Diseases: Principles, Pathogens and Practice. Keusch, Gerald T.; Salam, Mohammed A.; Kopecko, Dennis J. January 1, 2011. Pages 137-144. © 2011.
https://www.clinicalkey.com

Slide 13: *Clostridium difficile* Infection. Fig. 1 Confluent pseudomembranes in a patient with *Clostridium difficile* colitis Medical Clinics of North America. Knight, Christopher L., MD; Surawicz, Christina M., MD. June 30, 2013. Volume 97, Issue 4. Pages 523-536. © 2013.
https://www.clinicalkey.com

Slide 14: Mary Mallon (1870-1938) was nicknamed "Typhoid Mary". Illustration that appeared in 1909 in The New York American. June 20, 1909). This media file is in the public domain in the United States because its first publication occurred prior to January 1, 1923
http://commons.wikimedia.org/wiki/File:Mallon-Mary_01.jpg

Slide 15: Pumkin Puking
http://oddity.quirkdesign.co.uk/wp-content/uploads/2010/10/pumpkin-puking.jpg