Gut --
moist, solids -- makes for a much higher bac load than Resp system, nowhere is it sterile

Stomach -- HCl, shift in flora

Upper Alimentary -- mouth physiology to moisten & brake down food

mucus -- to protect lining of mouth

Saliva
1. buffers mouth [neutralizes acids]
2. saturated with calcium and phosphate ions. Crystalize [slows advance of caries]
3. antimicrobial substances: lysozyme, lactoferrin, IgA [spec for bugs already encountered, IgA binds to bug specifically and to mucus, IgA res. digestion]

On the other side:
amylase [more to follow]

1. local immune system [tonsils] STRONG -> protection
2. normal flora
   Streptococci
tongue -- S. salivarius
cheek -- S. mitis all aerobic
teeth -- S. sanguis

deep cleft --[anaerobic] Bacteriodes + Fusobacterium

plaque
1. starts with S. sanguis sticks to pellicle [a thin protein film]
2. bac film of S. sanguis -- followed by Hemophilus & Veillonella & Neisseria & Rothia & Actinomyces
   plaque is colonized Strep mutans, (requires teeth)
   1. binds together the plaque

2. acids from sugars lowers pH 2 units ---eats through enamel
   exposes dentine, dental caries
   plaque near gums --> inflammation: gingivitis (gingivums = gums, soft tissue)
Streptococcus Viridans group
bacterial endocarditis

Vincent’s angina a.k.a. trench mouth, a.k.a. acute necrotizing ulcerative gingivitis=ANUG is an ulceration of gums.
Fusobacterium & Treponema [spirochete]

Fungal -- Candida albicans is a problem in immunocompromised -- superficial, painful, THRUSH-infection of mucous membranes

Viral infections of the mouth
Herpes simplex, an enveloped DNA virus
lytic infection of mucous forming epithelial cells / cold sore
latent, non-lytic infection of neurons

Mumps -- salivary glands -- inflamed
-- ssRNA, paramyxovirus spreads throughout the body, central nervous system, testes
scarring and loss of function result
virus has fusion protein--to fuse cells
necessary to have killer T cells to eradicate mumps

The Stomach
Helicobacter pylori -- critical in peptic ulcer
gram -- motile rod, sheathed completely
Urease -- ammonia which neutralizes acid
Mucinase --
adhesion molecules bind to edges "between" cells
1. Hemolytic toxins --> inflammation, serum, bleeding
2. Hemolysin -- hemin (by degrading hemoglobin)
all this results in inflammation & leak of acid --> peptic ulcer
mix antibiotics with bismuth salts

Lower Gut
duodenum --> small intestine --> large intestine or colon
Why fewer bac in small intestine?

mouth amylase--starches
stomach pepsin--proteins
small intestine--few normal flora
include associated organs and their functions:
1. gall bladder and liver--bile salts
2. pancreas--proteases--lipases

Food Chyme
Colon--resorb water
lubricate for excretion
slower movement forward
300 species of bacteria
1/3 dry weight of feces is bacteria

N ormal flora:
Bacteriodes
Enterbacteriaceae
E. coli
Klebsiella
Proteus
disease
Shigella
Salmonella
Bacteriodes--anaerobic
gram neg
Clostridium difficile

Diarrheas
1. destroy lining
2. induce lining to secrete fluid

Cholera
Vibrio cholerae G- motile curved rod
Cholera toxin--
causes lining cells to secrete vast amounts of fluid,
L/hr water + electrolytes
"rice-water" stools
AB toxin binding -- GM1
gangliosides-->ATP-->cAMP-->secretion--water, sodium, potassium, bicarbonate
actives adlenyl cyclase
replacement of the intestinal cells themselves limits the infection
example:
V cholerae el tor

E. coli
a pathogen with the addition of toxins, invasion factors & adhesion factors
diarrheas caused by different E coli:

entertoxingenic ETEC
toxin ~like~choleratoxin diarrheas
enterohomorrhagic EHEC
Verotoxin (kills a tissue culture line called Vero cells) has acquired a Shigella -[like] toxin--transfer

bloody diarrheas
enteroinvasive EIEC
invades gut wall on a plasmid
bloody diarrheas

enteropathogenic EPEC
stick to brush border, form channels in mb to deliver toxin

enteroaggregative EAggEC
clumps stick to gut surface
diarrheas in infants

ETEC-
adhere [do not invade]
causes traveller's diarrhea
has a cholera toxin-like toxin [heat labile]
and a 2nd diarrheal toxin [heat stable]

bac. dysentery --
watery diarrhea + mucus + blood + pusreal gut [A=ETEC B and C are EPEC]
Shigella
1. Shigella toxin
Shigella adhere to colon -- invade & survive in macrophages. -->escape into cytoplasm
2. invasion properties are necessary to cause disease
Gastro enteritis -- inflammation of the gut [colon]
Campylobacter jejuni -- less 1,000 organisms can cause disease

Salmonella enteriditis -- eggs  
All enterobacteria make endotoxin, specifically LPS  
LPS stimulates macrophages, platelets, smooth muscle, endothelial cells  
LPS is a pyrogen [fever-causing agent] and it activates complement.

Salmonella  
S. typhi -- Goes to Peyer’s Patches  
prevents phago-lysosome fusion in macrophages  
spreads everywhere: brain, spleen, bone marrow, joints, lungs, liver, gall bladder, blood  
generalized effects = typhoid fever  
Human reservoir ONLY, attaches small intestine  
bac toxins  
immune response: makes cytokines  
gall bladder survival of S. typhi results in shedding of S. typhi; thus a carrier can transmit disease but no longer has symptoms Ex: Typhoid Mary ....or maybe Ella

Clostridia--anaerobic, G+ spore forming rods  

C. per -- in gut makes enterotoxin, travelling through acid in stomach  
induces stress response genes and the toxin --is one of those stress genes  
enteric toxinoses  

C. botulinum -- adults -- preformed toxin  
infant botulism -- in foods like honey  
if reheated [15 minutes] toxin -- heat sensitive  
mode of action  
toxin --> bloodstream --> nerves

Three toxins:  
botulinal toxin  
C2 toxin -- diarrhea as cholera toxin  
C3 toxin

Botulinal toxin is a zinc -dependent protease  
synaptobrevens broken up, limp paralysis  
on a plasmid. This has led to "natural" transfer to C. butyricum
Botulinal toxin
surface of neuron -- binding
zinc-dependent protease -- acts on acetylcholine release [so it affects the cholinergic nerves the excitatory synapses]
the zinc-dependent protease digests
synaptobrevins -- no nervous signal
limp paralysis = flaccid

Tetanus -- causes stiff paralysis = spastic
C. tetani --
using same enzymatic activity in its toxinas botulinum toxin-- acts on brain
Why different pathology if same toxin?
1. specificity for different target cells
   (inhibitory synapses for tetanus [GABA, gly) or different parts of synaptobrevins
2. synaptobrevins themselves are different now known--cuts at different sites.

C. difficile
C difficile --
1. enterotoxin -- inflammation & diarrhea
2. cytotoxin -- death of lining cells of the gut.

Food Poisoning -- toxins enterotoxin
1. preformed --> Staphloccus aureus -- heat stableStaph aureus endotoxins
SEA, SEB, c-e
+ superantigens
super antigens --> T cells --> cytokines --> damage
S.EA --> E
SEA, SEB, etc.
2. made in passing
More Spore formers
Bacillus cereus -- rice, meat, vegetables
1. heat sensitive, diarrhea = c.t.
2. heat resistant -- smooth muscle contraction, cramps, nausea, vomiting

Fungal
1. ergot poisoning -- St. Anthony’s fire
contaminate bread --> failure nerve impulses & vascular collapse
2. aflatoxins -- Aspergillus
liver disfuction --> chickens <-- destroy the flock if positive
most recently strawberries from California
3. hallucinogenic fungi
Viral
diarrheas: resistant to drying, acid, detergent

1. rotaviruses -- infantile diarrheas, 5-8 days of symptoms
2. caliciviruses -- ex: Norwalk viruses and astroviruses
both infect gut lining, symptoms for 24-48 hours

Protozoa
Giardia lamblia-- also known as-- G. intestinalis-- giardiasis
entry feco-oral; organism is sealed, acid resistant, quiescent forms -- cysts
(also true for E. Histolytica -causes dysentery)
Giardia pass through stomach:
lower gut -- cyst opens --> active feeding forms
flagellate bug attaches by adhesion disks
Interferes:
1. nutrients + inflammation
2. water secretion balance --> diarrhea

Entamoeba histolytica -- amebiasis
colon, E. histolytica moves using psuedopodia-like PMNs and macrophages
burrows into wall of gut -- with toxins and enzymes, it forms ulcers
perforation of gut wall & inflammation = dysentery
amoebas --
go to blood stream -- cause in other places abcesses -- e.g. liver

Cryptosporidium parvum life cycle

Hepatitis
HAV ss+ RNA picorna feco-oral lining of gut, bloodstream, liver
HBV DNA hepatovirus exchange of blood & body fluids, liver
HCV RNA flavivirus " "
HDV RNA viroid " "
HEV RNA calicivirus feco-oral lining gut to liver

Liver functions
1. Contributes components to digestion [many from gall bladder]
2. remove poisonous byproducts
if liver is not functioning--->nausea, loss of appetite & jaundice
3. clotting factors
if liver is not functioning --> bleed
incidence of different Hepatitis infections in the US
HAV --
direct liver cell damage by immune response--the virus is NOT lytic;
mortality 1% -- 5%, infection is NOT chronic if infected as a child, most have mild illness
and then lifelong protection adult sero-positivity: 13% Sweden, 88% Taiwan, 97%
Yugoslavia, 44% US. virus is resistant to pH 1, ether, chloroform, detergents, drying,
temps to 61•C
HDV -- defective virus,
requires HBV to "help" it--so concurrent infection is mandatory. The HDV uses HBsAg to
make a coat for itself-- direct damage to liver cells as exits
HBV & HCV --
immune response mediated damage [three major pathways]
1. If make a strong cytotoxic T cell response: [most common result of HBV & HCV
infection] then acute hepatitis
2. If no immune response: become a chronic asymptomatic carrier
3. If inadequate immune response: chronic inflammation
--> cell death in liver, happens in 5-10% of patients
chronic regeneration: scarring=cirrhosis-->loss of liver function

Dane particles--decoys, more pathology by immune complexes

Additionally for HBV, HCV:
insert DNA into host’s DNA
 genetic "hit" 1 step transfromation to being cancerous300,000 cases of HepB a year in
US, 4000 deaths, decreasing since there is now a vaccine
HEV -- direct mortality 1% -- 5%, especially pregnant women

Listeria