Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Aeromonas (PP):	*Aeromonas* is a gram-negative rod belonging to the *Vibrionaceae* family. There are at least four species of *Aeromonas* with *A. hydrophilia* being the most common isolated species in the U.S.[1] [2]	Aeromonads are ubiquitous in fresh water environments. The number present is dependant on the extent of sewage pollution and the ambient temperature. Recent studies have directly attributed *Aeromonas* as the cause of food-borne infections. The following foods may harbor the organism: raw meat, freshwater fish, shellfish and other seafood. Raw milk can also be a source of infection.[3]	Definitive experimental evidence for the causative role of *Aeromonas* in gastrointestinal disorders is still lacking. Although human volunteer studies are inconclusive, epidemiological evidence has shown that the presence of these organisms in stools is significantly more often associated with diarrhea than with the carrier state.[4] [5]	*Aeromonas* gastroenteritis may affect both children and adults with the highest seasonal incidence occurring in the summer months. Symptoms tend to be generally mild, self-limiting diseases with watery diarrhea.[6] Bloody stools have been reported. *Aeromonas* infections tend to be more acute in children and more chronic in adults.[7] [8]	Most *Aeromonas species* are generally susceptible to cephalosporins, aminoglycosides, carbapenems, tetracyclines, trimethoprim-sulfamethoxazole and quinolones.[9] Susceptibility must guide testing.
**Aeromonas hydrophilia/caviae*					
**Aeromonas veronii biovar sobria*					
**Aeromonas biovar veronii*					
**Aeromonas species*					

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Bacillus (PP):	*Bacillus species* are spore forming, gram-positive rods belonging to the *Bacillaceae* family.[10 11] There are currently 50 valid species within the genus.[12]	Sources of the diarrheal type of *B. cereus* food poisoning include: meats, pasta, vegetable dishes, desserts, cakes, sauces and milk.[13] The emetic type of infection is predominately associated with oriental rice dishes. Pasteurized cream, milk pudding and pasta have occasionally been implicated.[14] The incidence of *B. cereus* infection is increased during the summer months.[15]	Although part of the normal flora, *B.cereus* has been established as an opportunistic pathogen.[16] The gram-positive spore forming rods of *B.cereus* elaborate enterotoxins.[17] Both types of food poisoning result from spores that have survived cooking, then germinated, producing vegetative cells that have multiplied.[18] *NB, it is estimated that only half the isolated strains of B. cereus are enterotoxin positive.*[19]	*B. cereus* is the etiological agent of two distinct types of food poisoning: 1) The diarrheal type, which is caused by a heat-labile enterotoxic complex. Symptoms include abdominal pain, and diarrhea 8-12 hours after ingestion of the organism.[20 21] 2) The emetic type, caused by a heat-stable enterotoxin. Nausea and vomiting usually occur 1-5 hours after ingestion.[22 23]	*B. cereus* is almost always susceptible to clindamycin, erythromycin and vancomycin.[24]
Bacillus cereus					
Bacillus species		Meat dishes are a common source of infection in other species of *Bacillus* such as *B. subtilis* and *B. licheniformis*.[25]	As yet, no toxins or other virulence factors have been identified in association with the symptoms that accompany non-*B. cereus species*.[26]	*B. licheniformis* and *B. subtilis* are associated with food-borne diarrheal illness.[27]	

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Campylobacter jejuni (P)	*Campylobacter* are gram-negative, non-spore forming rods belonging to the *Campylobacteraceae* family.[28] In total there are 18 species and subspecies within the genus.[29]	Poultry is a key source of infection, in particular chicken. Red meat and shellfish can also harbor the organism.[30] Other sources include unpasteurized milk, and water contaminated by wild birds.[31]	Recognized as the principle cause of diarrhea in humans. *C. jejuni* and *C. coli* are the most common species associated with diarrheal illness.[32] The infective dose as yet has not been clearly defined, but it is thought that as little as 1000 organisms are capable of causing infection.[33]	The incubation period can be 2 to 10 days, though is usually 2 to 5 days.[34] Symptoms can include fever, abdominal cramping, diarrhea (often bloody) abdominal pain and fever. Relapses may occur in 5%-10% of untreated cases.[35]	Erythromycin is the drug of choice for treating *C. jejuni* infections. Ciprofloxacin may be an alternative drug.[36]

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Candida (PP): **Candida albicans* **Candida famata* **Candida glabrata* **Candida guilliermondii* **Candida krusei* **Candida lambica* **Candida lusitaniae* **Candida parapsilosis* **Candida paratropicalis* **Candida pseudotropicalis* **Candida rugosa* **Candida species* **Candida stellatoidea* **Candida tropicalis* **Candida zeylanoides*	The genus *Candida* is comprised of approximately 200 different species.[37] *C. albicans* is the most commonly isolated strain from the GI tract.[38]	Most sources of Candida infection are thought to be of endogenous origin.[39] While yeast are ubiquitous in the environment and are found on fruits, vegetables and other plant materials, contamination from external sources is linked to patients and health care workers.[40 41]	A normal inhabitant of the GI tract. May become an opportunistic pathogen after disruption of the mucosal barrier, imbalance of the normal intestinal flora and/or impaired immunity.[42 43 44 45] Risk factors for colonization include: Antibiotics, corticosteroids, antacids, H2 blockers, oral contraceptives, irradiation, GI surgery, Diabetes mellitus, burns, T cell dysfunction, chronic stress and chronic renal disease.[46 47 48 49]	The most common symptom attributable to non-invasive yeast overgrowth is diarrhea.[50] Symptoms of chronic candidiasis affect four main areas of the body: **Intestinal system** – symptoms include: diarrhea, constipation, abdominal discomfort, distention, flatulence and rectal itching. **Genital Urinary system** – symptoms include: menstrual complaints, vaginitis, cystitis and urethritis. **Nervous system** – symptoms include: severe depression, extreme irritability, inability to concentrate, memory lapses and headaches. **Immune system** – symptoms include urticaria, hayfever, asthma, and external otitis. Sensitivities to tobacco, perfumes, diesel fumes and other chemicals.[51 52]	Currently, standard texts provide no specific antifungal guidelines for GI overgrowth of *Candida*. Oral azoles have been recommended for extra intestinal infections. Susceptibility testing is advised due to increasing drug resistance.[53 54]

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Citrobacter (PP):	*Citrobacter* is a gram-negative rod belonging to the *Enterobacteriaceae* family.[55] Citrobacter contains 9 named species and two unnamed genomospecies.[56]	Common in the environment and may be spread by person-to person contact. Several outbreaks have occurred in babies in hospital units.[57] [58] Isolated from water, fish, animals and food.[59]	*Citrobacter* is considered an opportunistic pathogen and therefore can be found in the gut as part of the normal flora.[60]	*Citrobacter* has occasionally been implicated in diarrheal disease, particularly *C. freundii* and *C. diversus* and *C. koseri*.[61]	Currently, standard texts provide no specific antimicrobial guidelines for GI overgrowth of *Citrobacter*.[62] [63] Carbapenems and fluroquinolones are the recommended antibiotics for extra-intestinal sites.[64] [65]
**Citrobacter amalonaticus*					
**Citrobacter braakii*					
**Citrobacter diversus*					
**Citrobacter freundii*					
**Citrobacter freundii/youngae*					
**Citrobacter freundii complex*					
**Citrobacter koseri*					
**Citrobacter species*					
Clostridium difficile (PP)	The genus *Clostridium* are anaerobic gram-positive, spore-forming bacteria.[66]	The organism has many natural habitats including hay, soil, cows, horses and dogs.[67] Almost 50% of neonates carry this organism asymptomatically as part of their gastrointestinal flora during the first year of life. This rate decreases sequentially to about 3% in adults and less in children over two years of age.[68] [69]	*C. difficile* is the major cause of antibiotic-associated diarrhea and pseudomembranous colitis and the most common cause of hospital-acquired diarrhea.[70] Isolation of *C. difficile* without a positive toxin test has little clinical value. It is important to test for both toxins A and B in the stool. Toxin A is an enterotoxin and toxin B is a cytotoxin that inhibits bowel motility. It is thought that both toxins are important in the pathogenesis.[71] [72]	Mild cases of *C. difficile* disease are characterized by frequent, foul-smelling, watery stools. More severe symptoms, indicative of pseudomembranous colitis, include diarrhea that contains blood and mucous, and abdominal cramps.[73]	Severe *C. difficile* intestinal disease is usually treated with oral vancomycin or metronidazole. However, antimicrobial therapy often results in relapse of the disease.[74] In addition, there is concern that oral vancomycin can lead to the emergence of vancomycin-resistant *Enterococci*.[75]

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Cryptococcus (PP): **Cryptococcus albidus* **Cryptococcus humicolus* **Cryptococcus laurentii* **Cryptococcus luteolus* **Cryptococcus neoformans* **Cryptococcus species* **Cryptococcus terreus* **Cryptococcus uniguttulatus*	*Cryptococcus* is a yeast-like fungus, which closely resembles the genus *Candida*.[76] The genus contains a number of species, of which only *C. neoformans* is considered to be a human pathogen.[77]	Found in the excreta of pigeons and other birds in most parts of the world. The yeast is associated with aged bird droppings that have accumulated over a long period of time on window ledges, vacant buildings and other roosting sites.[78]	Can be an opportunistic pathogen, predominately in the immunocompromised host.[79] *Cryptococcus* is considered one of the defining diseases of AIDS. Patients with *Cryptococcus* and serologic evidence of HIV are considered to have AIDS.[80]	Diarrhea has been associated with Cryptococcal infection.[81] Usually infection occurs in the tissue of the central nervous system but occasionally can produce lesions in the skin, bones, lungs, or other internal organs.[82]	Currently, standard texts provide no specific antimicrobial guidelines for GI overgrowth of *Cryptococcus*.[83] [84] Fluconazole is considered the primary antimicrobial agent in extraintestinal sites.[85]
Edwardsiella tarda(P)	The genus *Edwardsiella* is a gram-negative rod that belongs to the *Enterobacteriaceae* family.[86] To date there are three species, though only *E. tarda* is associated with human disease.[87]	Isolated from cold-blooded animals such as fish and reptiles and their environment.[88] Infection is more common in tropical and subtropical environments and developing countries.[89]	*E. tarda* is considered an opportunistic pathogen, occasionally causing acute gastroenteritis.[90] [91]	Diarrheal disease is associated with infection, with a clinical picture similar to *Salmonella* enteritis.[92] Isolation of the *E. tarda* is more common in young children and the elderly.[93]	If antibiotic treatment is required, ampicillin, trimethoprim-sulfamethoxazole and ciprofloxacin have all been found to be effective agents.[94]

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
E.coli Shiga-like toxin	Shigatoxin-producing *E. coli* strains are referred to as STEC. This includes the 0157 and many other STEC serogroups.[95] **In total, at least 100 serotypes have been isolated from persons with diarrhea.[96]**	0157 STEC colonize dairy and beef cattle, which is why ground beef is the most common infection vehicle. However, raw milk, sausage, roast beef, unchlorinated water, apple cider, and raw vegetables have also been implicated.[97]	*E. coli* 0157:H7 and 0157:non-motile (0157 STEC) produce one or more Shiga toxins and, are the most commonly identified diarrheagenic *E.coli* isolates in North America and Europe.[98] Non-toxin-producing strains are normal in the human intestine. 0157 STEC spreads easily from person to person because the infectious dose is low.[99]	The STEC strains cause a spectrum of illness that can present as mild non-bloody diarrhea, severe bloody diarrhea (hemorrhagic colitis), and hemolytic uremic syndrome (HUS).[100] About 6% of 0157 STEC patients develop HUS.[101]	Antimicrobial therapy for 0157 STEC has NOT been demonstrated to be effective or safe, except for cases of cystitis and pyelonephritis.[102] Antimicrobial therapy for intestinal disease may enhance toxin release and predispose for HUS.[103]
Enterobacter cloacae (PP)	Gram-negative rod that is part of the *Enterobacteriaceae* family.[104] There are 14 species in the genus, though only *E. cloacae* has been associated with GI infection.[105 106]	Widely distributed in the environment. Water, soil, sewage and cornstalks have all been identified as sources of contamination.[107 108]	Usually considered a commensal organism; however, strains of *E. cloacae* have been shown to produce a heat-stable toxin similar to that produced by *E.coli*.[109]	Has been associated with diarrhea in children.[110 111]	Currently, standard texts provide no specific antimicrobial guidelines for GI overgrowth of *Enterobacter*.[112 113] Carbapenems are recommended for extra-intestinal sites.[114]
Geotrichum (PP): **Geotrichum candidum* **Geotrichum capitum* **Geotrichum species*	*Geotrichum* are yeast belonging to the *Endomyceteaceae* family. There are several species within the genus, of which *G. candidum* is the most common.[115]	This organism can be found in soil, dairy products and in human skin and mucosae.[116]	Usually only considered an opportunistic pathogen in immune-compromised hosts.[117 118] *Geotrichum candidum* is the etiological agent of Geotrichosis.[119] *Geotrichum* may also play a role in IBS.[120]	Symptoms of *Geotrichum* infection have been associated with diarrhea and enteritis.[121 122] Symptoms of Geotrichosis may resemble those of candidiasis.[123]	Currently, standard texts provide no specific antifungal guidelines for GI overgrowth of *Geotrichum*. Oral azoles and have been recommended for extra intestinal infections. Susceptibility testing is advised owing to increasing drug resistance.[124 125]

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Hafnia alvei (PP)	*Hafnia* is a gram-negative rod considered part of the *Enterobacteriaceae* family. There is only one species of Hafnia– *H. alvei*–which was previously a member of the *Enterobacter* genus.[126]	Commonly found in warm-blooded animals, particularly birds. Other environmental sources include contaminated water, sewage, food, and dairy products.[127]	This organism is a natural inhabitant of the GI tract in humans. *Hafnia* strains are opportunistic pathogens; community and hospital outbreaks have been associated with GI infection.[128]	Diarrheal illness has been associated with outbreaks and virulence factors similar to toxigenic *E.coli* have been described.[129]	*Hafnia* strains are usually susceptible to piperacillin, imipenum, quinolones and the newer cephalosporins.[130]
Helicobacter pylori (P)	The genus *Helicobacter* are gram-negative, non-spore forming rods. There are currently 19 species within the genus.[131] Seroprevalence of *H. pylori* varies from 20% in young adults in developed countries to sometimes more than 90% in developing countries.[132]	Reservoirs of infection include the intestinal tract of mammals and birds. Mode of transmission is usually via the fecal-oral or oral-to-oral route.[133]	*H. pylori* causes chronic gastritis and predisposes to gastric and duodenal ulcers. Increased risk of gastric carcinoma is associated with infection.[134] It is estimated that 50% of the world's population is infected with *H. pylori*.[135]	Those infected with *H. pylori* may develop acute gastritis with symptoms of abdominal pain, nausea and vomiting, usually within two weeks of infection. Many patients have recurrent abdominal symptoms (non-ulcer dyspepsia) without ulcer disease.[136]	Cure rates require multi-drug regimens along with antacid medications.[137] The most successful treatment includes a combination of metronidazole, omeprazole and clarithromycin.[138]

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Klebsiella (PP):	*Klebsiella* is part of the *Enterobacteriaceae* family and as such is a gram-negative rod.[139] There are 7 species of *Klebsiella* within the genus, though only 2 have been associated with GI infection.[140]	Isolated from foods and environmental sources.[141] *Klebsiella* appears to thrive in individuals on a high starch diet. Avoiding carbohydrates such as rice, potatoes, flour products and sugary foods reduces the amount of *Klebsiella* in the gut.[142]	Part of the normal GI flora in small numbers, but can be an opportunistic pathogen. *Klebsiella* is capable of translocating from the gut when in high numbers.[143 144] Certain strains of *K. oxytoca* have demonstrated cytotoxin production.[145 146 147 148 149] Of the 77 *Klebsiella* capsular polysaccharides, only 3 are associated with ankylosing spondylitis: K26, K36 and K50.[150 151]	*K. pneumoniae* and *K. oxytoca* have been associated with diarrhea in humans.[152 153 154 155 156 157] Cytotoxin-producing strains are associated with acute hemorrhagic enterocolitis.[158 159 160 161 162] Increased colonization of *Klebsiella* in the stool has been found in HLA-B27 + AS patients.[163 164]	Currently, standard texts provide no specific antimicrobial guidelines for GI overgrowth of *Klebsiella*.[165 166] Third generation cephalosporins and fluroquinolones are the recommended antimicrobial agents for extra-intestinal sites.[167]
*Klebsiella ornithinolytica					
*Klebsiella oxytoca					
*Klebsiella ozaenae					
*Klebsiella pneumoniae					
*Klebsiella rhinoscleromatis					
*Klebsiella species					

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Listeria monocytogenes (PP)	The genus *Listeria* are gram-positive cocciod- to rod-shaped bacteria of which there are 7 species in total.[168] The only species associated with infection in humans is *L. monocytogenes*.[169]	Dairy products are sources of *Listeria* infection. The organism has been found in raw milk, pasteurized milk, cream, butter, cheese and ice cream.[170] The use of manure as fertilizers on salad and vegetable crops have been associated with *Listeria* infection.[171] Fish and seafood may also be a reservoir of infection.[172]	GI symptoms have been associated with infection, though are not usually related to the ingestion of contaminated food.[173] A transient intestinal carrier state exists in 2%-20% of humans.[174] Development of an invasive infection depends on several factors, namely: host susceptibility, gastric acidity and the virulence of the organism.[175]	Symptoms of diarrhea have been noted with *Listeria* infection.[176]	*Listeria* is usually susceptible to penicillin, ampicillin, gentamycin, erythromycin, and tetracycline.[177]
Moellerella wisconsensis (PP)	*Meollerella* is a gram-negative rod that is part of the *Enterobacteriaceae* family.[178] Currently, there is only one species in the genus.[179]	Contaminated water supplies are the main reservoir of infection.[180]	The exact role of *Moellerella* in causing diarrhea has not yet been fully elucidated.[181]	Diarrhea and gastroenteritis have been associated with *M. wisconsensis*.[182] [183]	Currently, standard texts provide no specific antimicrobial guidelines for GI overgrowth of *Moellerella*.[184] [185] MIC studies have demonstrated susceptibility to cephalothin, gentamicin and naladixic acid.[186]

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Morganella morganii (PP)	*Morganella* is gram-negative rod belonging to the *Enterobacteriaceae* family.[187] Currently, there are 3 species within the genus.[188]	*M. morganii* originates from the gill and skin of fish. It is possible that it may cross-contaminate during handling of fish in processing plants and restaurants.[189]	The role of *Morganella* as an etiological agent in diarrheal disease is controversial. Although *Morganella* constitutes part of the normal flora, in certain hosts it may be a potential pathogen.[190 191] Recently it was shown that the majority of clinical isolates of *Morganella* belonged to the *subsp Morganii*.[192]	Diarrhea has been associated with infection of this organism.[193 194]	Currently, standard texts provide no specific antimicrobial guidelines for GI overgrowth of *Morganella*.[195 196] Carbapenems, 3rd and 4th generation cephalosporins and fluroquinolones are the agents recommended for extra-intestinal infections.[197]
Plesiomonas shigelloides (PP)	*Plesiomonas* is a gram-negative rod belonging to the *Vibrionaceae* family, though it does contain the *Enterobacteriaceae* antigen. *P. shigelloides* is the only species in the genus.[198 199]	Usually found in fresh water or estuarine water. Occurs in fish, shellfish, oysters, toads, snakes, monkeys, dogs, cats, goats, pigs, poultry, and cattle.[200] There is a low incidence of *Plesiomonas shigelliodes* in the US and Europe.[201] In Asia, however, the organism contributes to a significant proportion of traveler's diarrhea.[202 203]	*P. shigelloides* is not a natural inhabitant of the GI tract.[204] Although feeding studies with humans resulted in the excretion of the organism (but not diarrhea) from about one third of the volunteers, several epidemiological studies suggest that *Plesiomonas* is a possible agent in GI disease. It has been isolated from human stool specimens in the absence of symptoms and may be difficult to attribute as the cause of diarrhea in some cases.[205]	Symptoms range from short-lived episodes of watery stools to several days of dysentery-like diarrhea. Has not been reported to affect specific age groups more often than others.[206 207] Accompanying symptoms vary and may include abdominal pain, nausea, vomiting, chills, headaches and dehydration..[208] Infections with *P. shigelloides* are usually self-limiting, lasting up to 7 days and occasionally longer.[209 210]	*P. shigelliodes* is susceptible to most major classes of antibiotics, including trimethoprim, cephalosporins, and quinolones.[211]

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Proteus (PP): **Proteus mirabilis* **Proteus penneri* **Proteus vulgaris*	*Proteus* is a gram-negative rod belonging to the *Enterobacteriaceae* family.[212] 10 species in total are attributed to the genus of which *P. mirabilis* is considered the most important.[213]	Food has been implicated as a vehicle of infection.[214]	Part of the normal flora of the GI tract, though has been shown to be an independent causative agent of intestinal disorders.[215] May also play a role as an opportunistic organism in enteric infection due to other pathogens.[216]	Occasionally implicated in diarrheal disorders.[217 218] Recently, it has been suggested that *P. mirabilis* may be an etiological agent in rheumatoid arthritis. The mechanism may be related to the molecular cross reactivity between *P. mirabilis* and the HLA antigens, specifically HLA-DR4.[219]	Currently, standard texts provide no specific antimicrobial guidelines for GI overgrowth of *Proteus*.[220 221] Ampicillin is recommended for extra-intestinal infections of *P. mirabilis*, followed by trimethoprim-sulfamethoxazole.[222]
Provedencia alcalifaciens (PP)	*Provedencia* is a member of the *Enterobacteriaceae* family of which there are 5species.[223 224]	GI tract infection with *P. alcalifaciens* has been associated with overseas travel.[225]	*Provedencia* is not normally present in a healthy GI tract.[226] Its pathogenic role may lie in the ability of the organism to take advantage of conditions created by other infectious microbes.[227]	This organism has been implicated as a cause of diarrhea.[228 229] *P. alcalifaciens* is thought to induce invasive diarrhea in patients by invading cells in the intestine, thus producing inflammatory changes in the ileum.[230]	Currently, standard texts provide no specific antimicrobial guidelines for GI overgrowth of *Providencia*.[231 232] 3rd generation cephalosporins and fluroquinolones are recommended for extra-intestinal sites.[233 234]

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Pseudomonas (PP): **Pseudomonas aeruginosa* **Pseudomonas species*	*Pseudomonas species* are aerobic, non-spore forming gram-negative rods.[235] There are 10 species in the genus, though *P. aeruginosa* is considered the most important pathogen.[236]	Found in water and soil as well as fruits and vegetables. Bottled water can be a common source of infection. Because the organism is able to survive aqueous environments, it is an important nosocomial pathogen. *Pseudomonas* can also be found on a number of surfaces and in aqueous solutions.[237]	*Pseudomonas* is considered an opportunistic pathogen.[238] Animal studies have isolated an enterotoxin thought to be responsible for causing diarrhea.[239]	Associated with diarrheal infection, particularly in the immunocompromised host.[240] [241] *Pseudomonas* can also be an etiological agent of antibiotic-associated diarrhea.[242]	Ciprofloxacin is recommended for the treatment of *Pseudomonas*-induced antibiotic-associated colitis.[243] *Pseudomonas* is usually susceptible to antipseudomonal penicillins, aminoglycosides, carbapenems, 3rd generation cephalosporins and gentamycin.[244] [245]
Saccharomyces cerevisiae (PP)	*Saccharomyces* are yeast belonging to the *Sacccharomycetaceae* family. Currently there are 18 species within the genus of which *S. cerevisiae* is the most common.[246] [247]	*S. cerevisiae* is a commonly used industrial microorganism and is ubiquitous in nature, being present on fruits and vegetables. Also known as Baker's Yeast or Brewer's Yeast, this organism has been used for centuries as leavening for bread and as a fermenter of alcoholic beverages.[248] [249]	*S. cerevisiae* commonly colonizes mucosal surfaces, and is rarely considered an opportunistic pathogen.[250] [251] [252] Severe immunosuppression, prolonged hospitalization, and antibiotic therapy are all associated with*Saccharomyces* infection..[253] Overgrowth may be associated with dietary ingestion of *S. cerevisiae* and/or *S. boulardii* as part of a "health food" regimen.	Studies have shown that patients with *S. cerevisiae* overgrowth usually have an underlying disease.[254] Disseminated infections are thought to arise from the gastrointestinal tract.[255]	Currently standard texts provide no specific antifungal guidelines for GI overgrowth of *Saccharomyces*.

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Salmonella (P):	*Salmonella* are members of the *Enterobacteriaceae* family and as such are gram-negative rods.[256]	Animals and birds utilized for meat are subject to contamination with *Salmonella*. Eggs, cereals and cereal products are other sources of contamination.[257] The incidence of infection increases over the summer, and is predominantly associated with acute diarrhea in infants.[258]	*Salmonella* are considered frank pathogens in humans. These organisms are NOT part of the normal bowel flora. *Salmonella species* are acid-sensitive, invasive, and produce enterotoxins in the GI tract. Several thousand cells may be needed to cause infection.[259]	Gastroenteritis and diarrhea are caused by more than 2000 serotypes producing infections limited to the mucosa and submucosa of the GI tract. *S. typhimurium* and *S. enteritidis* are the serotypes most common in the US. Bacteremia and extraintestinal infections occur by spread from the GI tract, and any serotype is capable of causing bacteremia.[260] [261]	Antimicrobial therapy is not recommended for uncomplicated *Salmonella* gastroenteritis.[262] Antimicrobial therapy is warranted in cases of bacteremia. Enteric fever (typhoid fever) is characterized by prolonged fever and multisystem involvement. This is a life-threatening infection caused by *S. typhi* or *S. paratyphi*. Antimicrobial therapy is needed in cases of typhoid fever.[263]
*Salmonella Group C and D					
*Salmonella arizonae					
*Salmonella group A					
*Salmonella group B					
*Salmonella group C					
*Salmonella group D					
*Salmonella group E					
*Salmonella group E + G					
*Salmonella paratyphi A					
*Salmonella paratyphi B					
*Salmonella paratyphi C					
*Salmonella species					
*Salmonella typhi					

Pathogenic Organism Chart

Serratia marcesens (PP)	*Serratia* is a gram-negative rod belonging to the *Enterobacteriaceae* family.[264]	*Serratia* is more often associated with nosocomial infection, and seldom occurs in the community. The most common route of transmission is hand-to-hand spread via nurses, physicians and other healthcare workers.[265]	A natural inhabitant of the GI tract, though on occasion can become an opportunistic pathogen.[266]	In neonates the gastrointestinal system is an important source of the organism.[267]	Currently, standard texts provide no specific antimicrobial guidelines for GI overgrowth of *Serratia*.[268] [269] Third generation cephalosporins, carbapenems, and fluroquinolones are the recommended antibiotics for extra-intestinal infections.[270]

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
***Shigatoxin-producing E.coli (STEC)-* See E.coli Shiga-like toxin.**					
Shigella (P): **Shigella boydii* **Shigella dysenteriae* **Shigella flexneri* **Shigella sonnei* **Shigella species*	*Shigella* are members of the *Enterobacteriaceae* family. There are 4 serogroups that have historically been treated as species: -*S. dysenteriae* (Serogroup A) -*S. flexneri* (Serogroup B) -*S. boydii* (Serogroup C) -*S. sonnei* (Serogroup D).[271]	Spread from person to –person by the fecal-oral route, especially in overcrowded areas and areas with poor sanitary conditions. Ingestion is also a primary source of infection.[272] A predominant organism responsible for acute diarrheal disease in infants and children.[273]	*Shigella* is only found in humans at times of infections and is NOT part of the normal bowel flora. All species are considered frank pathogens in humans.[274]	Symptoms can range from mild to explosive diarrhea. It is somewhat acid-resistant, invades epithelial cells, and produces toxins. Less than 100 cells are required to initiate infection.[275] [276] *S. dysenteriae* is rare in the US and causes classic dysentery, producing the Shiga toxin. *S. sonnei* is most common in the US, and usually produces only a watery diarrhea.[277]	*Shigella* infections are often treated with antibiotics, and antimicrobial susceptibility testing is recommend owing to widespread resistance.[278] Resistant strains are usually susceptible to the fluroquinolones.[279]

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Staphylococcus aureus (PP)	Members of the genus *Staphylococcus* are gram-positive cocci. Currently, the genus is composed of 32 species and 15 subspecies.[280]	Foods that require considerable handling during preparation or that are kept at slightly elevated temperatures after preparation are frequently involved in staphylococcal food poisoning. The key foods associated with staphylococcal food poisoning include meat and meat products; poultry and egg products; salads such as egg, tuna, chicken, potato, and macaroni; bakery products such as cream-filled pastries, cream pies, and chocolate éclairs; sandwich fillings; and milk and dairyproducts.[281 282]	Food poisoning is often attributed to the staphylococcal enterotoxin.[283] The toxin produced by the bacteria is very heat-stable and therefore not easily destroyed by heat at normal cooking temperatures. The toxin can remain, despite the organism being destroyed.[284] There is considerable variation in susceptibility to the enterotoxin in adults. Children and the elderly have the highest degree of susceptibility.[285]	Symptoms of staphylococcal food poisoning usually appear within 1 to 6 hours after ingestion. The individual response to the toxin may vary and depends upon the amount of contaminated food eaten, the amount of toxin ingested, and general health status.[286] Nausea, vomiting, abdominal cramping, and diarrhea are the most common symptoms. In more severe cases, headache, muscle cramping, and changes in blood pressure and pulse rate may occur.[287] Recovery generally takes two days. It is not unusual for complete recovery to take three days and sometimes longer.[288 289]	In most cases, treatment for *S. aureus* infection is not necessary and complete recovery usually occurs after cessation of symptoms.[290]

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Vibrio (PP):	*Vibrio* are members of the *Vibrionaceae* family and as such are gram negative rods.[291] There over 35 species within the genus, of which only about one third are pathogenic for humans.[292]	Pathogenic *Vibrio* are part of the autochthonous microbial flora in brackish and marine environments in temperate or tropical regions. *V. cholerae* and *V. mimicus* may be found in fresh water and in birds and herbivores.[293]	*Cholera* is caused by *V. cholerae* 01.[294] Gastroenteritis is classically associated with *V. cholerae* non-01, *V. parahaemolyticus*, *V. hollisae*, *V. mimicus*, *V. fluvialis*, *V metschnikovii*, and *V. furnissii*.[295]	While classic cholera is rare in the US, the rice-water stool remains the characteristic symptom, among others and its infectious dose is quite large.[296] Gastroenteritis caused by other *Vibrio* sp. presents as diarrhea and may be accompanied by cramps, nausea, vomiting and fever.[297]	Antimicrobial therapy reduces the frequency and duration of the diarrhea and shortens the post-infective period of shedding of *V.cholerae*.[298] Tetracycline or less commonly furazolidone are drugs of choice, though antibiotic resistance is increasing.[299] [300]
**Vibrio cholerae*					
**Vibrio fluvialis*					
**Vibrio furnissii*					
**Vibrio hollisae*					
**Vibrio metschnikovii*					
**Vibrio mimicus*					
**Vibrio parahaemolyticus*					
**Vibrio species*					
Yeast not candida (PP):	Yeast are unicellular, budding cells and are usually round to oval in shape, though some forms have demonstrated elongated and irregular shapes.[301]	Yeast are ubiquitous in the environment and can be found on fruits, vegetables and other plant materials.[302] They can also live as normal inhabitants both within and on the body.[303]	Less common yeast such as those outlined in this section should only be considered opportunistic pathogens in the immunocompromised host.[304] [305] [306] [307] [308] [309] [310] [311] [312]	Disseminated infections may include the intestinal tract and are usually associated with immunosuppressive diseases or conditions such as leukemia, organ transplant, multiple myeloma, aplastic anemia, diabetes mellitus with ketoacidosis, ICU patients, lymphoma, solid tumors and AIDS.[313] [314] Immunosuppressive therapy such as corticosteroids, chemotherapeutic agents and cyclosporine can also enhance fungal overgrowth.[315]	Currently, standard texts provide no specific antifungal guidelines for GI overgrowth of the fungi mentioned.[316] [317] Treatment is at the discretion of the practitioner, and should be based upon clinical symptoms and a positive reculture of the organism.
Blastoschizomyces:					
**Blastoschizomyces capitatus*					
Hansenula anomala					
Pichia ohmeri					
Rhodotorula					
**Rhodotorula glutinis*					
**Rhodotorula rubra*					
**Rhodotorula species*					
Trichosporon					
**Trichosporon pullulans*					
**Trichosporon species*					

Pathogenic Organism Chart

Genus/Organism	Description	Habitat/Sources of Isolation	Pathogenicity	Symptoms	*Treatment
Yersinia (PP): **Yersinia enterocolitica* **Yersinia pseudotuberculosis* **Yersinia species*	*Yersinia* are gram-negative enteropathogenic bacilli that belong to the *Enterobacteriaceae* family.[318] At present, there are at least 10 species within the *Yersinia* genus.[319]	*Y. pseudotuberculosis* is found naturally in numerous wild and domestic mammals and birds. *Y. enterocolitica* can be found in all warm-blooded wild, domestic and pet animals and occasionally in some fish. Pigs are important reservoirs for the human strains of *Y. enterocolitica*.[320] Infections may be acquired by ingestion of contaminated food or water, or, rarely by direct person-to-person transmission in schools and hospitals.[321]	Intestinal yersiniosis may present in three clinical forms: enteritis, terminal ileitis, or mesenteric lymphadenitis causing "pseudoappendicitis" and septicemia.[322] *Y. entercolitica* and *Y. pseudotuberculosis* are most commonly isolated from cases of gastroenteritis. Both would be considered significant isolates from stool. Both of these organisms show preference for lymphatic tissue and can spread via the bloodstream.[323] *Yersinia* infection has been shown to induce chronic inflammatory bowel disorders such as chronic diarrhea and IBD. Rheumatoid arthritis, reactive arthritis and unspecified arthralgias have also been noted after *Yersinia* infection.[324 325]	Watery and sometimes bloody stools, fever, vomiting, abdominal pain are common with *Y. enterocolitica*, particularly in adults and less frequently in children but rarely in *Y. pesudotuberculosis* infection which is more common in children exhibiting terminal ileitis, lymphadenitis, and pseudoappendicitis.[326] Animal and in-vitro studies have isolated an antigen designated *Yersinia pseudotuberculosis* mitogen (YPM) that is capable of increasing epithelial permeability.[327] Chronic GI disease (eg intermediate colitis, UC, CD may follow *Y. enterocolitica* infection, though the exact role this organism plays has not been fully elucidated.[328 329 330 331]	Intestinal infections with *Y. enterocolitica* and *Y. pseudotuberculosis* are usually self-limiting and do not require antibiotic therapy. In cases of complicated gastroenteritis, doxycycline or trimethoprim-sulfmethoxazole are the antibiotics of choice.[332]

* Susceptibility testing must guide treatment for all microbial and fungal organisms.

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