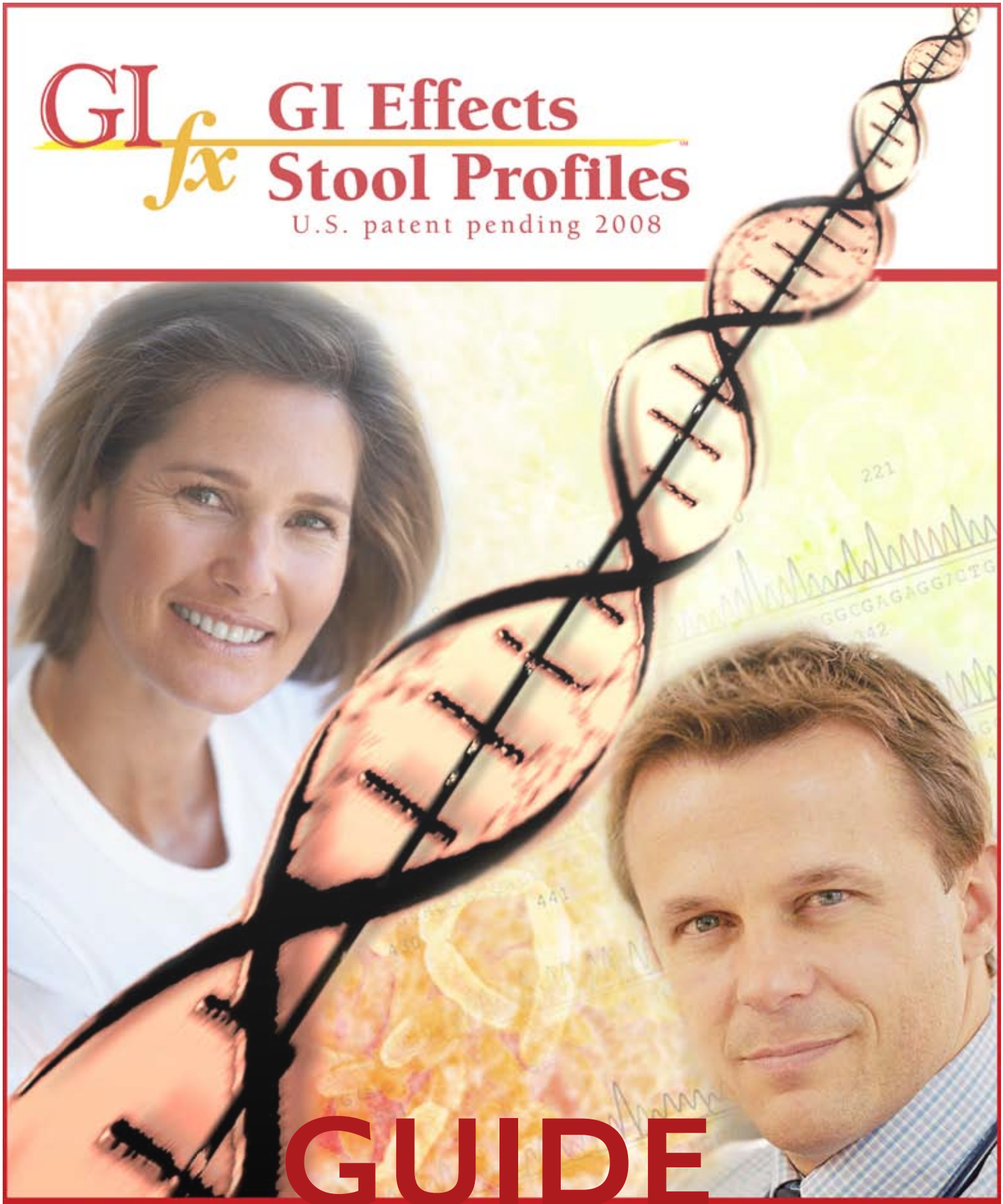
GI Effects™ Stool Profiles

U.S. patent pending 2008



GUIDE

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Introduction

Proper gastrointestinal (GI) function is critical to adequate nutritional status and can impact all aspects of body function. The GI Effects℠ Stool Profiles address key components of proper GI health including measurement of beneficial microbial flora, opportunistic bacteria, yeast, parasitic infection, markers of inflammation, immune function, and digestion and absorption. The microbial population is measured using PCR amplification of the genetic material of each organism, allowing for sensitive detection, and the ability to detect and identify organisms that cannot be cultured or are extremely difficult to grow under laboratory conditions.

Reference Range Interpretation

Standard microbiological results are reported as Colony Forming Units per gram of feces (CFU/gram). One CFU is equivalent to one microorganism. Metametrix detects microorganisms by DNA analysis. Each genome detected represents one cell, or one CFU. Because there are very large numbers of microorganisms in stool, results are expressed in standard scientific notation. For example, *Bacteroides sp.* may be reported as 2.57 E7, or 2.5 x 107, or 25,000,000 CFU/gram, which is read as 25 million CFU per gram of feces. The exponent is kept constant within a section of the report to facilitate direct comparisons between organisms. The cutoff for clinical significance for predominant bacteria has been set at 1E7 (1 x 10^7), for opportunistic bacteria 1E5 (1 x 10^5), and for pathogens at 1E3 (1 x 10^3). Rather than semi-quantitative results (+1 to +4), the new methodology provides full quantitative analysis.

Abnormal Bacteria, Fungi and/or Parasites

Suspect:

1. Inadequate physical and immune barrier functions

- Food sensitivities/leaky gut syndrome (elevated IgG)
- Low intestinal secretory IgA
- Gluten intolerance/Celiac disease
- Inflammatory bowel disease
- Decreased colonic short-chain fatty acids

2. Medication history

- Antibiotics
- NSAIDs
- Antacids, proton pump inhibitors, and acid-blockers

3. Inadequate digestive and absorptive function

- Hypochlorhydria
- Pancreatic insufficiency
- Intestinal inflammation
- Rapid transit time
- Nutrient insufficiencies
- Diet high in red meat, saturated fat, or refined carbohydrates

4. Pathogenic invasion and gut flora imbalances (dysbiosis)

- Exposure to pathogens (water/food contamination/foreign travel/depressed immune system)
- Inadequate predominant flora

Treatment Using Four "R" program for intestinal health

Remove offending foods, medications, gluten (if sensitive) and reduce poor quality fats, refined carbohydrates, sugars, and fermented foods (if yeast is present). Consider antimicrobial, antifungal, and/or antiparasitic therapies in the case of opportunistic/pathogenic bacterial, yeast, and/or parasite overgrowth (see below for specific recommendations).

Replace what is needed for normal digestion and absorption such as betaine HCl, pancreatic enzymes, herbs that aid in digestion such as deglycyrrhizinated licorice and marshmallow root, dietary fiber, and water.

Reinoculate with favorable microbes (probiotics such as *Lactobacillus sp.*, *Bifidobacter sp.*, and *Saccharomyces boulardii).* To enhance the growth of the favorable bacteria, supplement with prebiotics such as inulin, xylooligosaccharides, larch arabinogalactans, beta glucan, and fiber.

Repair mucosal lining by giving support to healthy intestinal mucosal cells, goblet cells, and to the immune system. Consider L-glutamine, essential fatty acids, zinc, pantothenic acid and vitamin C.

Predominant Bacteria

Microorganisms in the GI tract perform a host of useful functions, such as fermenting unused energy substances, communicating with the immune system, preventing growth of harmful species, regulating the development of the gut, producing vitamins for the host (such as biotin and vitamin K), and producing hormones to direct the host to store fats.[1] Intestinal microflora are also thought to have many beneficial local and systemic roles such as improving lactose tolerance, supplying short chain fatty acids (SCFA) as an energy substrate for the host, anti-tumor properties, neutralizing certain toxins, stimulating the intestinal immune system, reducing blood lipid levels and preventing obesity and type II diabetes.[2] Under normal homeostatic conditions, the intestinal microflora are of central importance in preventing colonization by pathogens, termed "colonization resistance."[3] Predominant organisms are considered to be beneficial when they are in balance.

Low Predominant Bacteria

Significance:

- Dysbiosis: Predominant bacteria should be present at normal levels in the healthy gut. *Bacteroides sp.* and *Bifidobacter sp.* should be present in the greatest amounts.[4]
- Low levels of beneficial fecal bacteria such as *Bifidobacter sp., Lactobacillus sp.* and *E. coli* have been associated with irritable bowel syndrome, characterized by alternating diarrhea, cramps, and food intolerance.[5]
- Low levels of predominant bacteria increase the likelihood of acquiring opportunistic and pathogenic organisms.[3]

Treatment Options:

- Probiotics
- Prebiotics such as psyllium, oat bran, oligofructose, xylooligosaccharide, inulin, beta-glucan, and/or arabinogalactan[6]
- Increase intake of fresh vegetables and fibers
- Address other GI Effects abnormalities

High Predominant Bacteria

Significance:

- Dysbiosis: Predominant bacteria should be present at normal levels in the healthy gut. *Bacteroides sp.* and *Bifidobacter sp.* should be present in the greatest amounts[4].
- Blood infections of *Mycoplasma* have been linked to chronic fatigue syndrome and fibromyalgia.[7]
- *Fusobacterium* increases putrification in the colon.
- Overgrowth of *Lactobacillus sp.* could produce D-lactic aciduria in those with short bowel syndrome. Limit intake of simple carbohydrates.[8]
- Overgrowth of certain *Clostridia sp.* clusters may play a role in certain cases of autism.[9, 10]
- If *Prevotella sp.* is in the 5th quintile suspect possible oral/throat infection.[11]

Treatment Options:

- Reduce poor quality fats, refined carbohydrates and sugars, and encourage intake of fresh vegetables. High fiber foods might exacerbate patient symptoms.
- For *Lactobacillus sp.* or *Clostridia sp.* overgrowth, supplement with *Bifidobacter sp.* or *Saccharomyces boulardii* probiotics, respectively.
- May need to use anti-microbial agents
- Address other GI Effects abnormalities
- Balance flora using appropriate probiotics

Opportunistic Bacteria

Opportunistic Bacteria present

Significance:

- Generally self-limiting and not normally considered pathogenic
- Often exacerbated by low predominant bacteria, pathogen or parasite infection, poor diet, antibiotic use, and lowered gut immunity.

Treatment Options:

- Probiotics
- Prebiotics: Do not use fructooligosaccharide (FOS) if *Klebsiella sp.* or *Citrobacter sp.* are present.
- May need to use anti-microbial agents followed by pre- and probiotics
- Herbal agents include goldenseal, citrus seed extract, garlic, uva ursi, oregano oil, and olive leaf extract
- Visit **www.emedicine.com** to search for the pathology of the individual opportunistic bacteria and treatment options.
- Address other GI Effects abnormalities

Pathogenic Bacteria

Pathogenic Bacteria present

Helicobacter pylori

Helicobacter pylori (H. pylori) bacterium causes peptic ulcer disease and has been associated with increased gastric cancer risk. *H. pylori* is a Type I carcinogen. It is estimated that 50% of the world's population is infected with *H. pylori*.

Symptoms:

- Acute gastritis with abdominal pain, nausea and vomiting, usually within two weeks of infection. Recurrent abdominal symptoms (non-ulcer dyspepsia) without ulcer disease are common.

Treatment Options (Adult Dosages):

- Standard treatment for *H. pylori* consists of a combination of 3 or 4 drugs, antibiotics, and proton pump inhibitors, for 7-14 days. Current recommendations can be found at **www.acg.gi.org**. Eradication does not generally exceed 80%.
- Supplementation with lactoferrin (200 mg/d), prebiotics, and vitamin C (up to 5 grams), may improve treatment efficacy, while reducing adverse reactions.[12][13]
- Botanical combination treatments have also been shown to be effective in eradicating *H. pylori* from the GI tract.
- Botanicals* (see page 7)

Clostridium difficile

Suspect recent antibiotic use, especially the cephalosporins, ampicillin/amoxicillin, and clindamycin.

Symptoms:

- Cramping, lower abdominal pain, fever and diarrhea usually decreases once antibiotics are stopped, though can continue for up to 4 weeks

Treatment Options (Adult Dosages):

- Do not treat if patient is asymptomatic. Stop use of causative antibiotics.
- In severe cases: Vancomycin 125 mg PO qid for 10-14d; Metronidazole 500 mg PO tid or 250 mg PO qid for 10-14d
- Herbal antibiotics such as berberine or oregano oil
- Replete beneficial bacteria, esp. *S. boulardii*

Campylobacter sp.

Contaminated animal food sources are the primary cause, especially poultry and red meat. Dogs may also become infected from rodents and birds and infect humans. Suspect hydrochloric acid insufficiency and/or secretory IgA deficiency.

Symptoms:

- Symptom onset is generally abrupt. Influenza-like symptoms are common, including headache and malaise. GI symptoms include abdominal pain, nausea, and vomiting. The degree of diarrhea varies. *Campylobacter sp.* has been associated with reactive arthritis.

Treatment Options (Adult Dosages):

- Generally self-limiting infection not requiring treatment
- Support rehydration if diarrhea is present
- If infection persists treat with Erythromycin: 500 mg erythromycin stearate, base, or estolate salts (or 400 mg ethylsuccinate) every 6h PO.

Entero-hemorrhagic Escherichia coli (EHEC)

Also referred to as Shiga toxin-producing E. Coli (STEC). Suspect ingestion of contaminated food, especially undercooked ground beef, raw milk, unpasteurized apple juice, water, and lettuce.

Symptoms:

- Typical symptoms include severe abdominal cramping, watery or bloody diarrhea, and vomiting. In some cases (up to 10%) it can cause hemorrhagic colitis or hemolytic uremic syndrome.

Treatment Options:

- The infection is generally self-limiting
- Rehydrate if diarrhea is present
- Antibiotic therapy hasn't proven useful in EHEC infection and can predispose to development of hemolytic uremia
- Streptomycin, sulfonamides, and tetracycline have demonstrated resistance to many EHEC strains
- Probiotic/prebiotic therapy

Yeast/Fungi

Yeast/Fungi present

Commonly identified species: *Candida, Rhodotorula, Geotrichum, Sacchoromyces, Trichosporon, Candida* are detailed below. If other commonly identified species are reported, consider patient symptoms and degree of infection to decide if anti-fungal therapy is warranted. *Saccharomyces sp.* may be reported if patient is supplementing with *S. boulardii.* Restore proper predominant microflora populations and address all other imbalances found on the GI Effects test report.

Candida sp.

Candida sp. is a normal inhabitant of the gastrointestinal flora and is present in 40-65% of the human population with no harmful effects. However, in conditions allowing for overgrowth, *Candida sp.* is the most common causal agent of opportunistic fungal infections. The esophagus is the most commonly infected site, followed by the stomach then the small and large bowel. Approximately 15% of people develop systemic candidiasis.

Symptoms:

- Gastric pain, nausea and vomiting, gas, bloating, intestinal permeability, imbalance in gut microflora, opportunistic bacterial infection

Treatment Options:

- Reduce intake of refined carbohydrates and sugars
- Prescriptive agents: fluconazole, intraconazole, ketoconazole, nystatin
- Herbal agents (use in combination for greater efficacy): oregano oil, berberine, goldenseal, undecylenic acid, caprylic acid, grapefruit seed extract, uva ursi, garlic (allicin)
- *S. boulardii* aids in the growth of beneficial bacteria, crowds out yeast, and helps with immune support
- Avoid fructooligosaccharide (FOS) as it may feed the yeast

Yeast/Fungi Present: taxonomy unavailable

Uncommon yeast/fungi is present, and one that likely colonizes other animals, or has not been identified as pathogenic to humans. Infection with *Candida, Rhodotorula, Geotrichum, Saccharomyces*, and *Trichosporon* species have been ruled out. If present at +2 or below, it is likely that this yeast is transient due to ingestion of molds or other yeasts, and is not problematic to humans. Consider patient symptoms before treating.

Treatment Options:

- Reduce intake of refined carbohydrates and sugars
- If presentation is consistent with a fungal infection, use antifungals followed by prebiotics and probiotics
- Avoid FOS powder as it may feed the yeast
- Address other abnormal results on the GI Effects test first, with the expectation that rare yeast/fungi will be crowded out when healthy conditions are restored

Parasites

Parasite present

Pharmaceutical recommendations for each parasite are from the 2007 publication in The Medical Letter, "Drugs for Parasitic Infections."[14]

Blastocystis sp.

Blastocystis sp. is transmitted via fecal-oral route or from contaminated food or water. Seven subspecies have been identified and *Blastocystis sp.* 4 infection has been correlated with disease. *Blastocystis sp.* 2 is considered to be asymptomatic.[15-17]

Symptoms:

- May include diarrhea, cramps, nausea, fever, vomiting, abdominal pain or fatigue. *Blastocystis sp.* has been associated with irritable bowel syndrome, infective arthritis and intestinal obstruction. In certain cases, chronic fatigue may be the only complaint.

Treatment Options:

- *Blastocystis sp.* can be prevented by personal hygiene and sanitary conditions
- Clinical significance of infection by these organisms is controversial
- Metronidazole 750 mg PO tid x 10d or iodoquinol 650 mg PO tid x 20d or trimethoprim/sulfamethoxazole 1 DS tab PO bid x 7d have been reported to be effective
- Infection is difficult to get rid of, botanicals may not be strong enough. Use of broad spectrum antiparasitic botanicals is most effective.*
- Botanicals* (see page 7)

Clonorchis sinensis (Chinese Liver Fluke)

Clonorchis sinensis is found in pickled, smoked, salted, imported, or undercooked freshwater fish.

Symptoms :

- Frequently asymptomatic. Inflammation and intermittent obstruction of the biliary ducts. Acute abdominal pain, nausea, diarrhea and eosinophilia can occur. In long-standing infections, cholangitis, cholelithiasis, pancreatitis and cholangiocarcinoma can develop.

Treatment Options:

- Praziquantel, 75 mg/kg/d PO in 3 doses x 2d
- Albendazole 10 mg/kg/d PO x 7d
- Botanicals* (see page 7)

Cryptosporidium

Water, including swimming pools, is a common source of contamination as it is resistant to chlorine. Outbreaks are associated with raw milk and meat, and *Cryptosporidium* is a likely cause of traveler's diarrhea.

Symptoms:

- Watery diarrhea is the most frequent symptom, and can be accompanied by dehydration, weight loss, abdominal pain, fever, nausea and vomiting. May be very severe in immunocompromised patients.

Treatment Options:

- Usually self-limiting in an immunocompetent person, with symptoms lasting 1-2 weeks
- If symptoms persist look for possible water contamination
- Nitazoxanide, 500 mg PO bid x 3d for persistent infections
- Botanicals* (see page 7)

Dientamoeba fragilis

Fecal-oral transmission and water contamination are common sources. Often accompanies pinworm.

Symptoms:

- Diarrhea, fatigue and abdominal bloating, although often asymptomatic. In chronic infections, abdominal tenderness, nausea and weight loss may be present.

Treatment Options:

- Iodoquinol, 650 mg PO tid x 20d; Paromomycin, 25-35 mg/kg/d PO in 3 doses x 7d; Tetracycline, 500 mg PO qid x 10d or Metronidazole, 500-750 mg PO tid x 10d
- Botanicals* (see page 7)

Endolimax nana or Entamoeba hartmanni

Endolimax nana and *Entamoeba hartmanni* are considered to be non-pathogenic amoeba. Detection is significant in that it means the patient has ingested something contaminated with fecal material. Increased personal hygiene is recommended.

Entamoeba histolytica

Entamoeba histolytica is the only amoeba considered pathogenic. Contaminated food or water, pets, sexual contact, and fecal-oral route are possible sources of transmission. Cysts are sensitive to chlorinated water.

Symptoms:

- Range from asymptomatic to fulminating colitis (resembling ulcerative colitis), dysentery, and extraintestinal lesions on the liver, lung, brain, skin and other tissues

Treatment Options:

- Asymptomatic carriers should be treated in order to avoid spread
- For asymptomatic patients: Iodoquinol, 650 mg PO tid x 20d; Paromomycin, 25-35 mg/kg/d PO in 3 doses x 7d or Diloxanide furoate, 500 mg PO tid x 10d
- For mild to moderate intestinal disease: Metronidazole, 500-750 mg PO tid x 7-10d or Tinidazole, 2 g once PO daily x 3d followed by either Iodoquinol, 650 mg PO tid x 20d or Paromomycin, 25-35 mg/kg/d PO in 3 doses x 7d
- For severe intestinal and extraintestinal disease: Metronidazole, 750 mg PO tid x 7-10d or Tinidazole, 2 g once PO daily x 5d followed by either Iodoquinol, 650 mg PO tid x 20d or Paromomycin, 25-35 mg/kg/d PO in 3 doses x 7d
- Botanicals* (see page 7)

Enterobius vermicularis (pinworm)

Enterobius vermicularis is transmitted from fecal-oral route. Females emerge from the anus and lay eggs on the perianal surface. Eggs can survive on bed linens and fabrics for 2-3 weeks.

Symptoms:

- Nocturnal perianal pruritus which can lead to skin bacterial infection, abdominal pain and anorexia. It may enter the vagina and has been associated with some cases of cystitis.

Treatment Options:

- Mebendazole, 100 mg PO once, repeat in 2 weeks; Pyrantel pamoate, 11 mg/kg base PO once (max. 1 g), repeat in 2wks
- Albendazole, 400 mg PO once; repeat in 2wks
- Botanicals* (see page 7)

Giardia lamblia

Giardia lamblia is a flagellate considered to be a pathogen and the most common cause of diarrheal disease worldwide. Transmitted via contaminated water, food or the fecal-oral route.

Symptoms:

- Often asymptomatic. Incubation period is 1-3 weeks and symptoms range from acute diarrhea, to chronic diarrhea with bloating, intestinal malabsorption, steatorrhea (possibly due to bile salt deconjugation) and weight loss. Generally self-limiting, however 30-60% develop chronic giardiasis. Unusual presentations include allergic manifestations such as urticaria, reactive arthritis, and biliary tract disease. May induce lactose intolerance, B12 deficiency and reduced sIgA.

Treatment Options:

- Metronidazole 250 mg PO tid x 5-7d
- Avoid fatty foods as giardia feeds on bile salts
- Paromomycin, 25-35 mg/kg/d PO in 3 doses x 5-10d; or Furazolidone, 100 mg PO qid x 7-10d; or Quinacrine, 100 mg PO tid x 5d
- Botanicals* (see page 7)

Necator americanus and *Ancylostoma duodenale* (hookworm)

Necator americanus and *Ancylostoma duodenale* are transmitted via skin contact with contaminated soil, or oral ingestion of the larvae. Worms can travel to the lungs or attach to the mucosa of the GI and suck blood.

Symptoms:

- Itching and a rash at the site of penetration. While a light infection may cause no symptoms, heavy infection can cause anemia, abdominal pain, diarrhea, loss of appetite and weight loss. Has been associated with reactive arthritis.

Treatment Options:

- Albendazole, 400 mg PO once; Mebendazole, 100 mg PO bid x 3d or 500 mg once, or Pyrantel pamoate, 11 mg/kg (max. 1g) PO x 3d
- Botanicals* (see page 7)

Schistosoma mansoni

Schistosoma mansoni is transmitted through skin contact with contaminated water or oral ingestion. Larvae can migrate to the lungs and liver and can live for 25-30 years. Eggs secrete an enzymatic substance that destroys surrounding tissues.

Symptoms:

- Infection is generally asymptomatic unless there is repeated exposure leading to heavy worm burden. Severe infection can lead to myalgias, abdominal pain, diarrhea, cough, tender liver, ulceration of the intestinal mucosal layer. It has been linked with reactive arthritis and sacroilitis.

Treatment Options:

- Praziquantel 40 mg/kg/d in 2 doses x 1d, or Oxamniquine 15 mg/kg once
- Botanicals* (see below)

Strongyloides sp.

Strongyloides sp. is transmitted via skin contact with contaminated soil, or oral ingestion of the larvae. Larvae are carried to the lungs or are swallowed and mature in the small intestine.

Symptoms:

- Itching and a rash at the site of penetration. While a light infection may cause no symptoms, heavy infection can cause epigastric pain, nausea and vomiting, gas, and alternating constipation and diarrhea. Has been associated with reactive arthritis.

Treatment Options:

- Thiabendazole 50 mg/kg/d in two doses x 2d; Ivermectin 200 mcg/kg/d x 1-2d, or Albendazole 400 mg/d x 3d
- Eradication is difficult, recheck stool in 3 months
- Botanicals* (see below)

Taenia sp. (tapeworm)

Taenia sp. is transmitted by undercooked, infected beef. Maturation from cyst to worm takes 2 months. *Taenia sp.* can grow 4-8 meters long and can live 25 years.

Symptoms:

- Often asymptomatic. Symptoms include GI complaints such as abdominal pain, anorexia, weight loss or malaise. Vitamin B12 deficiency may result.

Treatment Options:

- Praziquantel, 5-10 mg/kg PO once, Niclosamide, 2 g PO once
- Botanicals* (see below)

Trichuris trichiura (whipworm)

Trichuris trichiura is transmitted from ingested feces contaminated soil, or underwashed vegetables. It is the most common helminth infection. *T. trichiura* can become embedded in the intestinal villi, feeds on tissue secretions and can cause eosinophilin. Larvae hatch in the small intestine and take up residence in the large intestine. Adult female lay eggs for up to five years.

Symptoms:

- Often asymptomatic and self-limiting. Symptoms depend on the amount of worms present and the degree of mucosal involvement. Severe infection can result in bloody diarrhea, abdominal pain, nausea and iron-deficiency anemia.

Treatment Options:

- Mebendazole, 100 mg PO bid x 3d or 500 mg once; Albendazole, 400 mg PO x 3d, or Ivermectin, 200 mcg/kg PO daily x 3d
- Botanicals* (see below)

Parasite Present: taxonomy unavailable

The DNA probe identified kingdom protozoan, but genus and species probes for known human pathogens were negative. Suspect that the protozoan identified is likely NOT a human pathogen, and probably a transient, non-colonizer of the human GI. Evaluate patient symptoms and inflammatory markers on the GI Effects test. If symptoms are consistent with a parasite infection, consider treatment.

Treatment Options:

Address other abnormal results in the GI Effects test first, with the expectation that a rare parasite will be crowded out when healthy conditions are restored.

- Consider exposures such as pets, sushi, camping, or foreign travel
- If presentation is consistent with parasite infestation, use a broad spectrum antiparasitic treatment followed by pre- and probiotics
- Botanicals* (see below)

*Botanical Treatment

Individualized pharmaceutical interventions are listed below each parasite. Common botanical anti-parasitic herbs for each parasite listed include black walnut, quassia, garlic, berberine, grapefruit seed extract, oil of oregano, barberry, and artemesia. When treating parasites with botanicals, it is recommended to use a blend of several, to lengthen treatment duration, and to rotate antiparasitic agents

Adiposity Index

Adiposity Index imbalanced: high firmicutes and low bacteroidetes

Research has indicated that obesity has a microbial component that alters caloric yield from ingested food.[18] Altering the gut microbiota may also improve insulin sensitivity and oral glucose tolerance.[19] Treatments for obesity that result in lowering the percentage of Firmicutes may assist in weight control.

Cause:

- Bacteria classes known to increase caloric extraction from food are present
- Dysbiosis
- The Firmicutes class consist of *Clostridia sp.*, *Streptomyces sp.*, *Lactobacillus sp.*, *Mycoplasma sp.*, *Bacillus sp.* (see results under "Predominant Bacteria")
- The Bacteroidetes class consist of *Bacteroides sp.* and *Prevotella sp.* (see results under "Predominant Bacteria")

Treatment Options:

- Balance predominant bacteria using 4R protocol
- Remove opportunistic bacteria, especially *Bacillus sp.*
- Supplement with *Bifidobacter sp.* and *S. boulardii*
- Reduce refined carbohydrates
- Address all GI Effects imbalances

Drug Resistance Genes

Cause:

- Bacterial resistance to antibiotic class

Treatment Options:

- Avoid using class of antibiotics for which patient has drug resistance gene

Drug resistance names and antibiotics

aacA/aphD
Antibiotic:
Gentamicin, Kanamycin, Tobramycin (aminoglycosides)
Target Organism:
Gram-positive bacteria (cocci), namely Enterococci

mecA
Antibiotic:
Methicillin (Beta-Lactam)
Target Organism:
Aerobic, Gram-negative

vanA, vanB, vanC
Antibiotic:
Vancomycin and Teicoplanin (glycopeptides)
Target Organism:
Gram-positive bacteria, particularly beta-lactamase-producing organisms such as Staphylococcus

gyrB, ParE
Antibiotic
Ciprofloxacin and later generation quinolones
Target Organism
Gram-positive and Gram-negative bacteria

PBP1a, PBP2B
Antibiotic:
Penicillin (Beta-Lactam)
Target Organism:
Broad spectrum

Short Chain Fatty Acids (SCFA)

Depressed total SCFA or N-Butyrate

Beneficial SCFA come from dietary carbohydrates that have escaped digestion or absorption in the small bowel, or from prebiotics that have undergone fermentation in the colon. They are also produced by fermentation of fiber by anaerobic bacteria in the large bowel. Production of SCFA in the intestinal lumen plays an important role in the maintenance of the intestinal barrier. Short chain fatty acids and specifically n-butyrate serve as the fuel for the colonocytes.[20] Butyrate has been shown to be protective against colon cancer.

Cause:

- Low anaerobic bacteria (see "Predominant Bacteria")
- Antibiotic treatment
- Insufficient fiber intake/poor diet
- Slow transit time (more time for SCFA absorption)

Treatment Options:

- Consider pre- and probiotic supplementation if the predominant bacteria are low
- Psyllium, oat bran, oligofructose, inulin xylooligosaccharide, beta-glucan, or arabinogalactan
- Increase dietary intake of fruits and vegetables
- In ulcerative colitis, Crohn's or those at risk for colon cancer, consider butyrate enemas or enteric-coated butyrate supplements
- Enemas are contraindicated for those with GI bleeds

Elevated total SCFA or N-Butyrate

Presence of short chain fatty acids and n-butyrate are essential for the health of the colon. In general, high-normal levels of these in the stool could mean that there is optimal fiber intake and a balanced bacterial population. However, extremely elevated SCFAs and n-butyrate in the stool could indicate underlying GI abnormalities and need to be evaluated in conjuction with the other GI Effects markers. Values of 184 mM/g or greater are above the 95% confidence interval.

Cause:

- Bacterial overgrowth[21]
- Rapid transit time (less time for SCFA absorption)[22]
- Malabsorption[23]
- Pancreatic insuffiency resulting in carbohydrate maldigestion and increased bacterial fermentation
- Bacterial fermentation of blood[24]

Treatment Options:

- Address all GI imbalances including bacterial overgrowth, parasite infection, gluten intolerance, food allergy, vitamin, mineral, or essential fatty acid (EFA) deficiency, or chronic NSAID usage.
- Normalize transit time
- Pancreatic enzymes, betaine HCl, or digestive herbs.

Inflammation

Elevated Lactoferrin, WBCs, or Mucus present

Lactoferrin is an iron-binding glycoprotein released from neutrophils during inflammation. It is a marker of leukocyte activity and is a primary component of the host's first line immune defense against infection.

Cause:

- Mucosal inflammation
- Bacterial or yeast overgrowth
- Parasite infection
- Inflammatory bowel disease, e.g. Crohn's, ulcerative colitis

Treatment Options:

Due to infection:

- Remove pathogens
- Probiotics and prebiotics to replenish beneficial bacteria and establish proper balance
- Enhance the endogenous immune (sIgA) defense by supplementing with L-glutamine, *S. boulardii* and/or colostrum

Due to non-infectious inflammation, e.g. Inflammatory Bowel Disease:

- Balance the intestinal flora, if indicated
- Anti-inflammatory herbs and nutrients, e.g. turmeric, ginger, EPA/DHA, quercetin, antioxidants
- Mucosa support, e.g. vitamin A, zinc, folic acid, aloe vera, licorice, L-glutamine, butyrate (for UC), N-acetyl glucosamine, slippery elm
- Rule out food sensitivities

Test Interferences:

- Colostrum has a high concentration of lactoferrin, so those breast feeding or supplementing with colostrum could show false positives
- False negatives can be seen in those with severe immune compromise

Immunology

Depressed Fecal sIgA

Cause:

- Chronic stress
- Immunocompromise
- Dysbiosis
- Immuno-suppressing medication

Treatment Options:

- Support gut mucosa, e.g. glutamine, probiotics (*S. boulardii, Bifidobacteria*), colostrum, immunoglobulins, essential fatty acids, zinc, and stress reduction
- Support immune function

Elevated Fecal sIgA

Cause:

- Immune response to eliminate pathogenic organisms in GI tract
- Sensitivities to foods

Treatment Options:

- Support immune function
- Remove pathogens, parasites, opportunistic bacteria, virus
- Rule out food sensitivities
- Elimination diet

Elevated Anti-Gliadin Antibody

Cause:

- Gluten enteropathy or sensitivity in colon

Treatment Options:

- Remove gluten on trial basis
- Consider **Celiac Profile**
- Consider nutrients and herbs for mucosal healing
- Additional Tests

Additional Tests

Depressed pH

Cause:

- Bacterial overgrowth
- Carbohydrate maldigestion (increases bacterial proliferation and the production of SCFAs)
- Lipid malabsorption
- Rapid transit time (less time for SCFA absorption)

Treatment Options:

- Support digestion and absorption
- Supplementary plant or pancreatic enzymes, betaine HCl, disaccharidases (if needed)
- Normalize transit time
- Address all GI Effects imbalances

Elevated pH

Cause:

- Decreased bacterial production of SCFAs
- Insufficient flora, dietary fiber, or water
- Inadequate acid-producing organisms such as *Lactobacillus sp.*
- Hypochlorhydria
- A high meat diet can stimulate ammonia production in the bowel
- Slow transit time (more time for SCFA absorption)
- Elevated pH increases risk for colon cancer

Treatment Options:

- Supplement with probiotics
- Increase dietary fiber (esp. soluble) and water to increase SCFA production and normalize transit time
- Support digestion
- Supplementation with betaine HCl or herbs to stimulate gastric acid production, including ginger, peppermint, etc.
- Address all GI Effects imbalances

Positive Occult Blood

Cause:

- Bleeding in upper GI tract due to peptic ulcer, inflammatory bowel disease, parasite infection, colon cancer, hemorrhoids [25, 26]
- Rule out false positive from red meat

Treatment Options:

- Repeat occult blood test on two more occasions
- Address all GI Effects imbalances
- Rule out iron deficiency anemia
- Consider sigmoidoscopy or colonoscopy to identify source, treat accordingly
- Anti-inflammatory medical food
- Anti-inflammatory diet
- Food allergens

Positive RBCs

Cause:

- Bleeding in lower GI from hemorrhoids, intestinal polyps, or tears around the anus due to constipation
- Those with compromised liver function are more likely to develop hemorrhoids

Treatment Options:

- Treat constipation if present
- Consider colonoscopy to identify source, treat accordingly
- Assess liver function
- Soothe and repair gut mucosa
- RBCs, occult blood

Digestion

Depressed Elastase 1

Elastase 1 is a digestive enzyme excreted by the pancreas, exclusively, and has a direct correlation with pancreatic function. Elastase 1 results are not affected by pancreatic enzyme replacement therapy.[27,28] **Optimal levels are > 500.**

Cause:

- Suppressed pancreatic function
- Gallstones or post-cholecystectomy
- Chronic pancreatitis
- Diabetes
- Hypochlorhydria
- Cystic fibrosis

Treatment Options:

- Support digestion with betaine HCl with pepsin, or plant or pancreatic enzymes or digestive herbs
- Bile salts, taurine, or cholagogues (esp. if high triglycerides and constipation)
- Relax while eating and chew thoroughly
- Support diabetes regulation

Elevated Vegetable Fibers, Triglycerides

Cause:

- Maldigestion
- Hypochlorhydria
- Pancreatic insufficiency
- Bile salt insufficiency (if elevated triglycerides)
- Inadequate chewing (if elevated vegetable fibers)

Treatment Options:

- Support digestion with betaine HCl with pepsin, plant or pancreatic enzymes or digestive herbs
- Bile salts, taurine, or cholagogues (esp. if high triglycerides and constipation)
- Relax while eating and chew thoroughly

Elevated Putrefactive SCFA

Cause:

- Protein maldigestion
- Hypochlorhydria
- Pancreatic insufficiency
- Malabsorption, esp. if elevated long chain fatty acids or cholesterol
- Bacterial overgrowth of the small intestine

Treatment Options:

- Support digestion with betaine HCl with pepsin, plant or pancreatic enzymes or digestive herbs
- Treat any underlying pancreatitis
- Consider nutrients and herbs for mucosal support: L-glutamine, Zn, EFAs, Vitamins A, E, and C, pantothenic acid, N-acetyl glucosamine, glycyrrhiza, aloe vera, slippery elm, etc.
- Eliminate infection, address gluten intolerance, and food sensitivities

Absorption

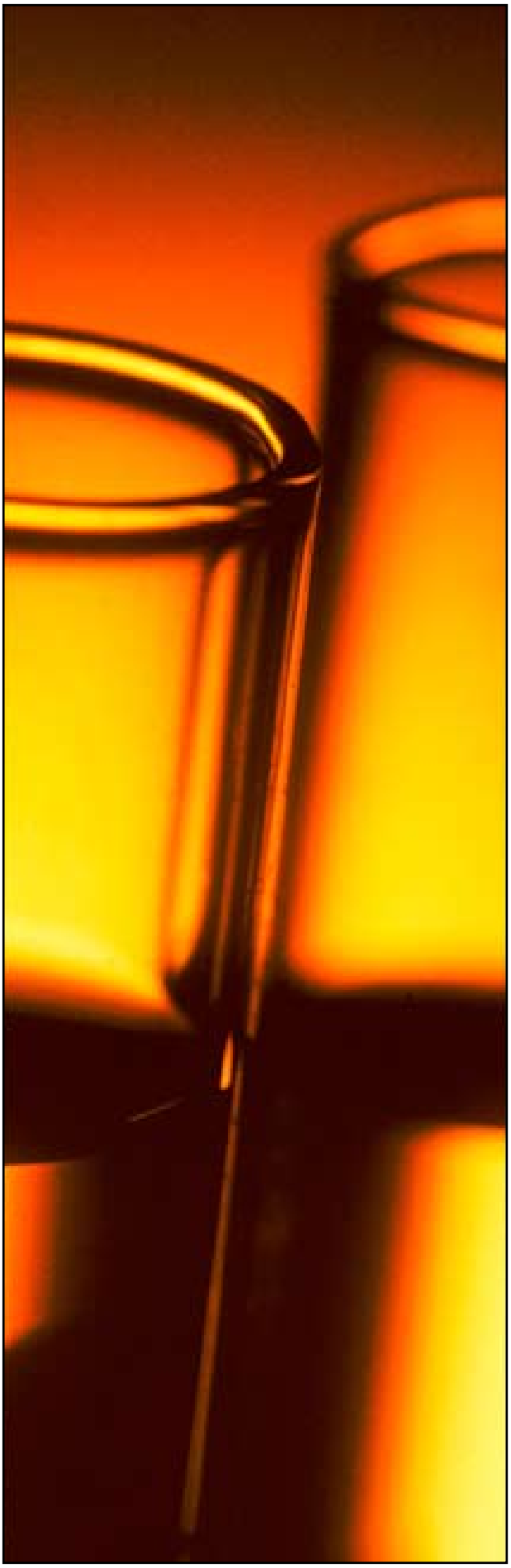
Elevated LCFA, Total Fat, or Cholesterol

Cause:

- Malabsorption due to diarrhea, intestinal dysbiosis, parasites, colitis, gluten intolerance, food allergy, essential fatty acid deficiency, pancreatic or bile salt insufficiency and/or chronic NSAID usage [29]
- High dietary fat intake
- Medications designed to bind and eliminate fats
- If elevated cholesterol, suspect malabsorption, high dietary intake or increased mucosal cell turnover resulting from inflammation [30, 31]
- Bacterial overgrowth of the small intestine (esp. if elevated SCFAs)
- Bacterial enzymes can also impair micelle formation, resulting in lipid malabsorption

Treatment Options:

- Support digestion with supplementary plant or pancreatic enzymes, betaine HCl, digestive herbs, bile salts or cholagogues, taurine or glycine, if indicated
- Address food sensitivities or gluten intolerance
- Check vitamin (esp. fat-soluble), mineral, and EFA status
- Support mucosal health with nutrients such as L-glutamine, Zn, EFAs, Vitamins A, E, and C, pantothenic acid, N-acetyl glucosamine, glycyrrhiza, aloe vera, slippery elm, etc.
- Address all GI Effects imbalances



Botanical Sensitivities

When treating with botanicals, it is recommended to use a broad spectrum product. Treatment with botanicals might also require a longer duration than treatment with pharmaceuticals. Antimicrobial botanicals may be rotated and/or administered in a pulsatile fashion to improve efficacy. Listed below are the active ingredients tested for each botanical used in antimicrobial blends.

Botanical	Active ingredient
Wormwood (Artemesia)	Artemisinin
Olive leaf	Oleuropein
Uva Ursi (Bearberry)	Arbutin
Garlic	Alliin
Undecylenic acid (from castor bean)	Undecylenic acid
Oil of thyme	Thymol
Oil of oregano	Carvacrol
Goldenseal	Berberine
Cat's Claw	Quinic acid
Black Walnut	5-hydroxy-1,4-naphthoquinone

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