**ORDER: SAMPLE REPORT**
**PATIENT: Sample Patient**
**ID:**
**SEX: Female**
**AGE: 35**

**CLIENT #: 12345**
**DOCTOR: Sample Doctor**
**Doctor's Data, Inc.**
**3755 Illinois Ave.**
**St. Charles, IL 60174**

**Comprehensive Stool Analysis**

## BACTERIOLOGY CULTURE

| Expected/Beneficial flora | Commensal (Imbalanced) flora | Dysbiotic flora |
|---|---|---|
| NG *Bacteroides fragilis* group | 2+ Alpha hemolytic strep | 4+ *Enterobacter cloacae* complex |
| 1+ *Bifidobacterium* spp. | 1+ *Bacillus* spp., not *cereus* or *anthracis* | |
| NG *Escherichia coli* | 2+ Beta hemolytic strep, group B | |
| 2+ *Lactobacillus* spp. | | |
| NG *Enterococcus* spp. | | |
| 3+ *Clostridium* spp. | | |

MALDI-TOF

NG = No Growth

## BACTERIA INFORMATION

**Expected / Beneficial bacteria** make up a significant portion of the total microflora in a healthy & balanced GI tract. These beneficial bacteria have many health-protecting effects in the GI tract including manufacturing vitamins, fermenting fibers, digesting proteins and carbohydrates, and propagating anti-tumor and anti-inflammatory factors.

**Clostridia** are prevalent flora in a healthy intestine. Clostridium spp. should be considered in the context of balance with other expected/beneficial flora. Absence or overabundance of clostridia relative to other expected/beneficial flora may indicate bacterial imbalance. If C. difficile associated disease is suspected, review the Clostridium difficile toxin A/B results from the GI Pathogens PCR section of this report.

**Commensal (Imbalanced) bacteria** are usually neither pathogenic nor beneficial to the host GI tract. Imbalances can occur when there are insufficient levels of beneficial bacteria and increased levels of commensal bacteria. Certain commensal bacteria are reported as dysbiotic at higher levels.

**Dysbiotic bacteria** consist of known pathogenic bacteria and those that have the potential to cause disease in the GI tract. They can be present due to a number of factors including: consumption of contaminated water or food, exposure to chemicals that are toxic to beneficial bacteria; the use of antibiotics, oral contraceptives or other medications; poor fiber intake and high stress levels. Aeromonas, Plesiomonas, Salmonella, Shigella, Vibrio, Yersinia, & Edwardsiella tarda have been specifically tested for and found absent unless reported.

## YEAST CULTURE

| Normal flora | Dysbiotic flora |
|---|---|
| 1+ *Candida parapsilosis* | |
| 1+ *Saccharomyces cerevisiae/boulardii* | |

MALDI-TOF

## YEAST INFORMATION

Yeast may normally be present in small quantities in the skin, mouth, and GI tract as a component of the resident microbiota. Their presence is generally benign. Recent studies, however, show that high levels of yeast colonization is associated with several inflammatory diseases of the GI tract. Animal models suggest that yeast colonization delays healing of inflammatory lesions and that inflammation promotes colonization. These effects may create a cycle in which low-level inflammation promotes fungal colonization and this colonization promotes further inflammation. Consideration of clinical intervention for yeast should be made in the context of other findings and presentation of symptoms.

## SPECIMEN DATA

**Comments:**

**Date Collected:** 05/10/2021
**Date Received:** 05/11/2021
**Date Reported:** 05/12/2021
**Specimens Collected:** 3
**Methodology:** Culture and identification by MALDI-TOF and conventional biochemicals

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## GI Pathogens; Multiplex PCR

| Viruses | Result | Reference Interval |
|---|---|---|
| Adenovirus F40/41 | Negative | Negative |
| Norovirus GI/GII | Negative | Negative |
| Rotavirus A | Negative | Negative |

| Pathogenic Bacteria | Result | Reference Interval |
|---|---|---|
| *Campylobacter* (*C. jejuni*, *C. coli* and *C. lari*) | Positive | Negative |
| *Clostridioides difficile* (Toxin A/B) | Negative | Negative |
| *Escherichia coli* O157 | Negative | Negative |
| Enterotoxigenic *Escherichia coli* (ETEC) lt/st | Negative | Negative |
| *Salmonella* spp. | Negative | Negative |
| Shiga-like toxin-producing *Escherichia coli* (STEC) stx1/stx2 | Negative | Negative |
| *Shigella* (*S. boydii*, *S. sonnei*, *S. flexneri* & *S. dysenteriae*) | Negative | Negative |
| *Vibrio cholerae* | Negative | Negative |

## SPECIMEN DATA

**Comments:**

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**Date Received:** 05/11/2021
**Date Reported:** 05/12/2021
**Methodology:** Multiplex PCR

**Specimens Collected:** 3

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## Stool Chemistries

| Digestion / Absorption | Result | Unit | Reference Interval |
|---|---|---|---|
| Elastase | 300 | µg/mL | > 200 |
| Fat Stain | Not Detected | | None – Few |
| Carbohydrates† | Negative | | Negative |

| Inflammation | Result | Unit | Reference Interval |
|---|---|---|---|
| Lactoferrin | 5.0 | µg/mL | < 7.3 |
| Calprotectin | 16 | µg/g | ≤ 50 |
| Lysozyme* | 225 | ng/mL | ≤ 500 |

| Immunology | Result | Unit | Reference Interval |
|---|---|---|---|
| Secretory IgA* | 124 | mg/dL | 30 – 275 |

| Short Chain Fatty Acids | Result | Unit | Reference Interval |
|---|---|---|---|
| % Acetate‡ | 50 | % | 50 – 72 |
| % Propionate‡ | 27 | % | 11 – 25 |
| % Butyrate‡ | 32 | % | 11 – 32 |
| % Valerate‡ | 2.4 | % | 0.8 – 5.0 |
| Butyrate‡ | 4.2 | mg/mL | 0.8 – 4.0 |
| Total SCFA's‡ | 16 | mg/mL | 5.0 – 16.0 |

| Intestinal Health Markers | Result | Unit | Reference Interval |
|---|---|---|---|
| pH | 7.0 | | 5.8 – 7.0 |
| Occult Blood | Negative | | Negative |

| Macroscopic Appearance | Result | Unit | Reference Interval |
|---|---|---|---|
| Color | Brown | | Brown |
| Consistency | Soft | | Soft |

### Chemistry Information

**Elastase** findings can be used for the diagnosis or the exclusion of exocrine pancreatic insufficiency. Correlations between low levels and chronic pancreatitis and cancer have been reported.

**Fat Stain:** Microscopic determination of fecal fat using Sudan IV staining is a qualitative procedure utilized to assess fat absorption and to detect steatorrhea.

**Carbohydrates:** The presence of reducing substances in stool specimens can indicate carbohydrate malabsorption.

### SPECIMEN DATA

**Comments:**

**Date Collected:** 05/10/2021
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**Specimens Collected:** 3

**Methodology:** Elisa, Microscopy, Colormetric, Gas Chromotography, ph Electrode, Guaiac, Macroscopic Observation

*This test was developed and its performance characteristics determined by Doctor's Data Laboratories in a manner consistent with CLIA requirements. The U. S. Food and Drug Administration (FDA) has not approved or cleared this test; however, FDA clearance is not currently required for clinical use. The results are not intended to be used as a sole means for clinical diagnosis or patient management decisions.

†This test has been modified from the manufacturer's instructions and its performance characteristics determined by Doctor's Data Laboratories in a manner consistent with CLIA requirements.

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**Lactoferrin** and **Calprotectin** are reliable markers for differentiating organic inflammation (IBD) from function symptoms (IBS) and for management of IBD. Monitoring levels of fecal lactoferrin and calprotectin can play an essential role in determining the effectiveness of therapy, are good predictors of IBD remission, and can indicate a low risk of relapse.

**Lysozyme** is an enzyme secreted at the site of inflammation in the GI tract and elevated levels have been identified in IBD patients.

**Secretory IgA** (sIgA) is secreted by mucosal tissue and represents the first line of defense of the GI mucosa and is central to the normal function of the GI tract as an immune barrier. Elevated levels of sIgA have been associated with an upregulated immune response.

**Short chain fatty acids (SCFAs):** SCFAs are the end product of the bacterial fermentation process of dietary fiber by beneficial flora in the gut and play an important role in the health of the GI as well as protecting against intestinal dysbiosis. Lactobacilli and bifidobacteria produce large amounts of short chain fatty acids, which decrease the pH of the intestines and therefore make the environment unsuitable for pathogens, including bacteria and yeast. Studies have shown that SCFAs have numerous implications in maintaining gut physiology. SCFAs decrease inflammation, stimulate healing, and contribute to normal cell metabolism and differentiation. Levels of **Butyrate** and **Total SCFA** in mg/mL are important for assessing overall SCFA production, and are reflective of beneficial flora levels and/or adequate fiber intake.

**Color:** Stool is normally brown because of pigments formed by bacteria acting on bile introduced into the digestive system from the liver. While certain conditions can cause changes in stool color, many changes are harmless and are caused by pigments in foods or dietary supplements.

**Consistency:** Stool normally contains about 75% water and ideally should be formed and soft. Stool consistency can vary based upon transit time and water absorption.

## SPECIMEN DATA

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**Methodology:**

**Specimens Collected:** 3

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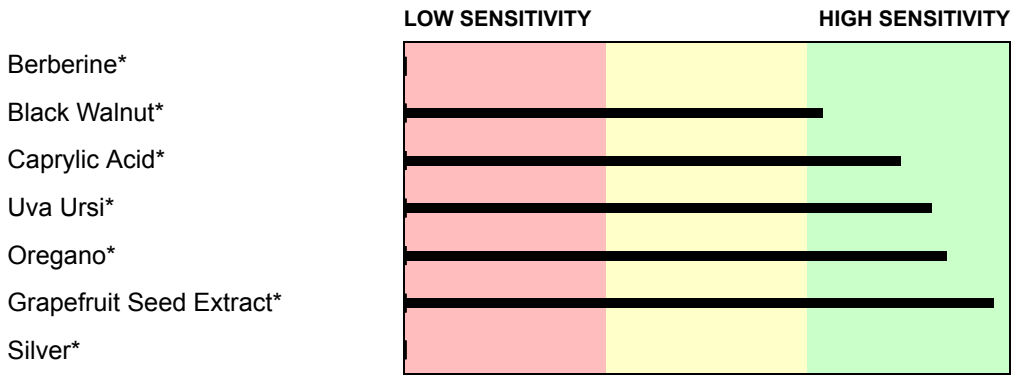
**Bacterial Susceptibilities**

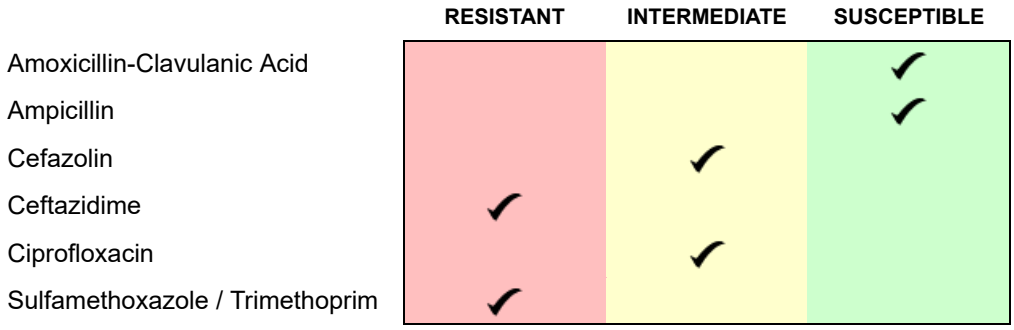
# *Enterobacter cloacae complex*

## NATURAL ANTIBACTERIALS




**Natural antibacterial** agents may be useful for treatment of patients when organisms display in-vitro sensitivity to these agents. The test is performed by using standardized techniques and filter paper disks impregnated with the listed agent. Relative sensitivity is reported for each natural agent based upon the diameter of the zone of inhibition surrounding the disk. Data based on over 5000 individual observations were used to relate the zone size to the activity level of the agent. A scale of relative sensitivity is defined for the natural agents tested.

## PRESCRIPTIVE AGENTS




**Susceptible** results imply that an infection due to the bacteria may be appropriately treated when the recommended dosage of the tested antimicrobial agent is used. **Intermediate** results imply that response rates may be lower than for susceptible bacteria when the tested antimicrobial agent is used. **Resistant** results imply that the bacteria will not be inhibited by normal dosage levels of the tested antimicrobial agent.

## SPECIMEN DATA

**Comments:**

**Date Collected:** 05/10/2021
**Date Received:** 05/11/2021
**Date Reported:** 05/12/2021
**Methodology:** Disk Diffusion

**Specimens Collected:** 3

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**St. Charles, IL 60174**

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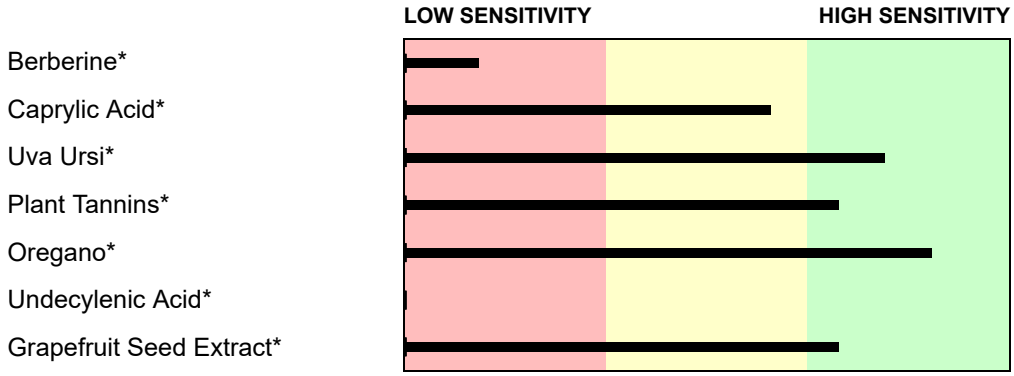
**Yeast Susceptibilities**

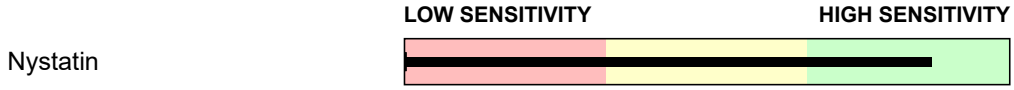
# *Candida parapsilosis*

## NATURAL ANTIFUNGALS



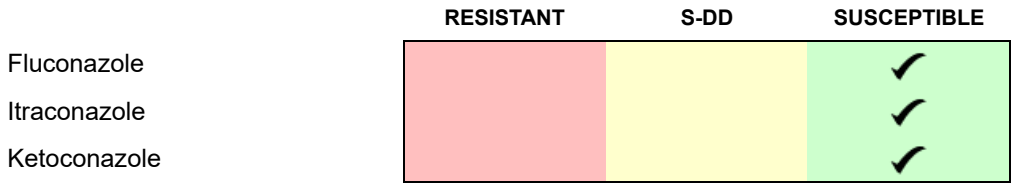

**Natural antifungal** agents may be useful for treatment of patients when organisms display in-vitro susceptibility to these agents. The test is performed by using standardized techniques and filter paper disks impregnated with the listed agent. Relative activity is reported for each natural agent based upon the diameter of the zone of inhibition or no growth zone surrounding the disk. Data based on over 5000 individual observations were used to relate the zone size to the activity level of the agent. A scale of relative activity is defined for the natural agents tested.

## NON-ABSORBED ANTIFUNGALS




**Non-absorbed antifungals** may be useful for treatment of patients when organisms display in-vitro susceptibility to these agents. The test is performed using standardized commercially prepared disks impregnated with Nystatin. Relative activity is reported based upon the diameter of the zone of inhibition or no growth zone surrounding the disk.

## AZOLE ANTIFUNGALS




**Susceptible** results imply that an infection due to the fungus may be appropriately treated when the recommended dosage of the tested antifungal agent is used. **Susceptible - Dose Dependent (S-DD)** results imply that an infection due to the fungus may be treated when the highest recommended dosage of the tested antifungal agent is used. **Resistant** results imply that the fungus will not be inhibited by normal dosage levels of the tested antifungal agent.

**Standardized test interpretive categories established for *Candida* spp. are used for all yeast isolates.**

## SPECIMEN DATA

**Comments:**

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**Methodology:** Disk Diffusion

**Specimens Collected:** 3

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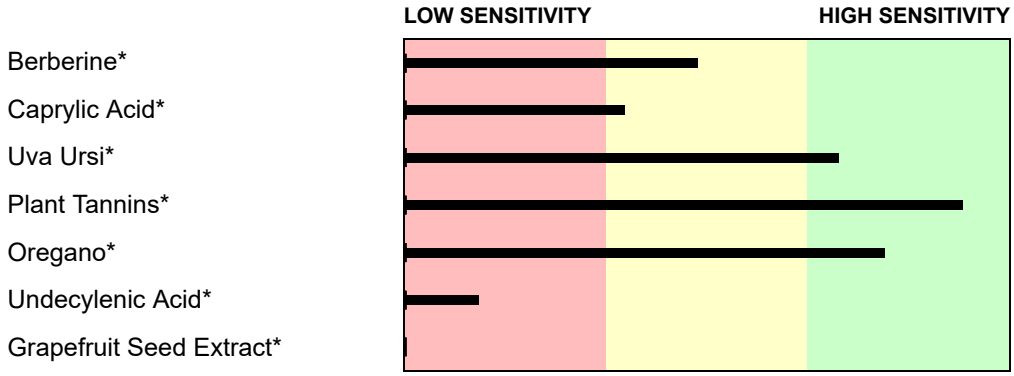
**Yeast Susceptibilities**

# *Saccharomyces cerevisiae/boulardii*

## NATURAL ANTIFUNGALS

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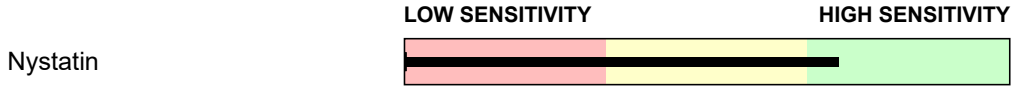
## NON-ABSORBED ANTIFUNGALS




**Non-absorbed antifungals** may be useful for treatment of patients when organisms display in-vitro susceptibility to these agents. The test is performed using standardized commercially prepared disks impregnated with Nystatin. Relative activity is reported based upon the diameter of the zone of inhibition or no growth zone surrounding the disk.

## SPECIMEN DATA

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## Introduction

This analysis of the stool specimen provides fundamental information about the overall gastrointestinal health of the patient. When abnormal microflora or significant aberrations in intestinal health markers are detected, specific commentaries are presented. If no significant abnormalities are found, commentaries are not presented.

## Microbiology

### Beneficial Flora

One or more of the expected or beneficial bacteria are low in this specimen. Normally abundant bacteria include Lactobacillus spp, Bifidobacteria spp, Clostridium spp, Bacteroides fragilis group, Enterococcus spp, and Escherichia coli. The beneficial flora have many health-protecting effects in the gut, and as a consequence, are crucial to the health of the whole organism. Some of the roles of the beneficial flora include digestion of proteins and carbohydrates, manufacture of vitamins and essential fatty acids, increase in the number of immune system cells, break down of bacterial toxins and the conversion of flavonoids into anti-tumor and anti-inflammatory factors. Lactobacilli, bifidobacteria, clostridia, and enterococci secrete lactic acid as well as other acids including acetate, propionate, butyrate, and valerate. This secretion causes a subsequent decrease in intestinal pH, which is crucial in preventing an enteric proliferation of microbial pathogens, including bacteria and yeast. Many GI pathogens thrive in alkaline environments. Lactobacilli also secrete the antifungal and antimicrobial agents lactocidin, lactobacillin, acidolin, and hydrogen peroxide. The beneficial flora of the GI tract have thus been found useful in the inhibition of microbial pathogens, prevention and treatment of antibiotic associated diarrhea, prevention of traveler's diarrhea, enhancement of immune function, and inhibition of the proliferation of yeast.

In a healthy balanced state of intestinal flora, the beneficial bacteria make up a significant proportion of the total microflora. Healthy levels of each of the beneficial bacteria are indicated by either a 2+, 3+ or 4+ (0 to 4 scale). However, in some individuals there is an imbalance or deficiency of beneficial flora and an overgrowth of non-beneficial (imbalance) or even pathogenic microorganisms (dysbiosis). This can be due to a number of factors including: consumption of contaminated water or food; daily exposure of chemicals that are toxic to beneficial bacteria; the use of antibiotics, oral contraceptives or other medications; poor fiber intake and high stress levels.

A number of toxic substances can be produced by the dysbiotic bacteria including amines, ammonia, hydrogen sulfide, phenols, and secondary bile acids which may cause inflammation or damage to the brush border of the intestinal lining. If left unchecked, long-term damage to the intestinal lining may result in leaky gut syndrome, fatigue, chronic headaches, and sensitivities to a variety of foods. In addition, pathogenic bacteria can cause acute symptoms such as abdominal pain, nausea, diarrhea, vomiting and fever in cases of food poisoning.

Antibacterial and antifungal susceptibility testing to a variety of prescriptive and natural agents may be provided for the pathogenic organisms that are cultured from this patient's specimen. This testing is intended to provide the practitioner with useful information to help plan an appropriate treatment regimen. A comprehensive program may be helpful in individuals in whom a dysbiotic condition has caused extensive GI damage.

Note: Not all genera or species can be tested for susceptibilities in the laboratory due to their specific growth requirements. In addition, the Centers for Disease Control and Prevention recommend not testing certain organisms such as those associated with food poisoning. If a practitioner has specific questions, please contact customer service.

### Clostridium spp

Clostridia are expected inhabitants of the human intestine. Although most clostridia in the intestine are not virulent, certain species have been associated with disease. Clostridium perfringens is a major cause of food poisoning and is also one cause of antibiotic-associated diarrhea. Clostridioides difficile is a causative agent in antibiotic-associated diarrhea and pseudomembranous colitis. Other species reported to be prevalent in high amounts in patients with Autistic Spectrum Disorder include Clostridium histolyticum group, Clostridium cluster I, Clostridium bolteae, and Clostridium tetani.

### Imbalanced Flora

Imbalanced flora are those bacteria that reside in the host gastrointestinal tract and neither injure nor benefit the host. Certain dysbiotic bacteria may appear under the imbalanced category if found at low levels because they are not likely pathogenic at the levels detected. Imbalanced bacteria are commonly more abundant in association with insufficiency dysbiosis, and/or a fecal pH more towards the alkaline end of the reference range (5.8 - 7.0). Treatment with antimicrobial agents is unnecessary unless bacteria appear under the dysbiotic category.

### Pathogenic/Dysbiotic Flora

In a healthy balanced state of intestinal flora, the beneficial bacteria make up a significant proportion of the total microflora. However, in many individuals there is an imbalance or deficiency of beneficial flora (insufficiency dysbiosis) and an overgrowth of non-beneficial (imbalance) or even pathogenic microorganisms. This can be due to a number of factors including: consumption of contaminated water or food; daily exposure of chemicals that are toxic to beneficial bacteria; the use of antibiotics, oral contraceptives or other medications; poor fiber intake and high stress levels.

A number of toxic substances can be produced by the dysbiotic bacteria including amines, ammonia, hydrogen sulfide, phenols, and secondary bile acids which may cause inflammation or damage to the brush border of the intestinal lining. If left unchecked, long-term damage to the intestinal lining may result in leaky gut syndrome, allergies, autoimmune disease (e.g. rheumatoid arthritis), irritable bowel syndrome, fatigue, chronic headaches, and sensitivities to a variety of foods. In addition, pathogenic bacteria can cause acute symptoms such as abdominal pain, nausea, diarrhea, vomiting, and fever in cases of food poisoning.

***Microbiology continued...***

Bacterial sensitivities to a variety of prescriptive and natural agents have been provided for the pathogenic bacteria that were cultured from this patient's specimen. This provides the practitioner with useful information to help plan an appropriate treatment regimen. Supplementation with probiotics or consumption of foods (yogurt, kefir, miso, tempeh, tamari sauce) containing strains of lactobacilli, bifidobacteria, and enterococci may help restore healthy flora levels. Soluble fiber and polyphenols derived from chocolate, green tea, blackcurrant, red wine and grape seed extracts have been found to increase the numbers of beneficial bacteria. Hypochlorhydria may also predispose an individual to bacterial overgrowth, particularly in the small intestine. Nutritional anti-inflammatories can aid in reversing irritation to the GI lining. These include quercetin, vitamin C, curcumin, gamma-linoleic acid, omega-3 fatty acids (EPA, DHA), and aloe vera. Other nutrients such as zinc, beta-carotene, pantothenic acid, and L-glutamine provide support for regeneration of the GI mucosa. A comprehensive program may be helpful in individuals in whom a dysbiotic condition has caused extensive GI damage.

***Enterobacter cloacae complex***

*Enterobacter cloacae* complex is part of the *Enterobacteriaceae* family. *E cloacae* complex is a group of six closely related species with similar resistance patterns: *E. cloacae, E. asburiae, E. hormaechei, E. kobei, E. ludwigii,* and *E. nimipressuralis*. This gram-negative bacterium is considered dysbiotic at levels of 3+ or greater. *E. cloacae* complex is considered an opportunistic pathogen associated with diarrhea in children. A Shiga-like toxin-producing *E. cloacae* was isolated from the feces of an infant with hemolytic-uremic syndrome. However, *E. cloacae* complex is most often involved in extraintestinal infections including the urinary tract, respiratory tract, and cutaneous wounds.

Widely distributed in the environment, *Enterobacter* spp. is commonly isolated from both human and animal feces. Environmental strains of *Enterobacter* spp. are capable of growth in foods at refrigeration temperature.

*E. cloacae* complex is known to possess inducible ß-lactamases. Isolates may become resistant to all cephalosporins after initiation of therapy. Avoid ß-lactam-inhibitor drugs such as amoxicillin/ clavulanate, ampicillin/sulbactam, and piperacillin/tazobactam.

Antibiotics may be indicated in systemic infections if symptoms are prolonged. Refer to the antimicrobial susceptibilities for treatment.

**Cultured Yeast**

Small amounts of yeast (+1) may be present in a healthy GI tract. However higher levels of yeast (> +1) are considered to be dysbiotic. A positive yeast culture and sensitivity to prescriptive and natural agents may help guide decisions regarding potential therapeutic intervention for yeast overgrowth. When investigating the presence of yeast, disparity may exist between culturing and microscopic examination. Yeast grows in colonies and is typically not uniformly dispersed throughout the stool. Further, some yeast may not survive transit through the intestines rendering it unviable for culturing. This may lead to undetectable or low levels of yeast identified by culture, despite a significant amount of yeast visualized microscopically. Therefore, both microscopic examination and culture are helpful in determining if abnormally high levels of yeast are present.

**Stool Chemistries**

**Short Chain Fatty Acids (SCFAs)**

The total concentration and/or percentage distribution of the primary short chain fatty acids (SCFAs) are abnormal in this specimen. Beneficial bacteria that ferment non-digestible soluble fiber produce SCFAs that are pivotal in the regulation of intestinal health and function. Restoration of microbial abundance and diversity, and adequate daily consumption of soluble fiber and polyphenols can improve SCFA status.

The primary SCFAs butyrate, propionate and acetate are produced by predominant commensal bacteria via fermentation of soluble dietary fiber and intestinal mucus glycans. Key producers of SCFAs include *Faecalibacterium prausnitzii*, *Akkermansia muciniphila*, *Bacteroides fragilis*, *Bifidobacterium*, *Clostridium* and *Lactobacillus* spp. The SCFAs provide energy for intestinal cells, and regulate the actions of specialized mucosal cells that produce anti-inflammatory and antimicrobial factors, mucins that constitute the mucus barriers, and gut active peptides that facilitate appetite regulation and euglycemia. The SCFAs also contribute to a more acidic and anaerobic microenvironment that disfavors dysbiotic bacteria and yeast. Abnormal SCFAs may be associated with dysbiosis (including insufficiency dysbiosis), compromised intestinal barrier function (intestinal permeability) and inappropriate immune and inflammatory conditions.

"Seeding" with supplemental probiotics may contribute to improved production and status of SCFAs, but it is imperative to "feed" the beneficial microbes. Sources of soluble fiber that are available to the microbes include chick peas, beans, lentils, oat and rice bran, fructo- and galacto- oligosaccharides, and inulin.

**GI Pathogens**

***Campylobacter***

Most *Campylobacter* infections in industrialized countries are caused by *C. jejuni, C. coli*, and *C. lari* with an estimated 1.5 million cases of foodborne illness due to *Campylobacter* per year in the US. *Campylobacter* spp. are responsible for approximately 15% of hospitalizations resulting from foodborne infections. Generally, campylobacteriosis presents as one to three days of fever, vomiting, and headaches followed by three to seven days of watery or bloody diarrhea and may include abdominal pain, cramping, nausea, headache, and/ or muscle pain within 2-5 days of infection. Contaminated water, pets, food, unpasteurized milk and undercooked poultry, are sources of infection. Use of antibiotics is controversial but may benefit children whom have had symptoms for less than 7 days, and immunocompromised individuals. Recommendations potentially include Azithromycin 500 mg daily for 3 days or Fluoroquinolone for 3 days, but infection may resist fluoroquinolones. Extracts of *Acacia nilotiac* show in vitro antibacterial activities against *Campylobacter* spp. isolated from sheep. Oral rehydration therapy is recommended to prevent dehydration, along with symptomatic treatment of fever and muscle aches.