



# Inflammatory Bowel Disease (IBD)

## Intestinal Anatomy

To understand IBD, a review of gastrointestinal (GI) tract anatomy is helpful. This explanation is not complete, but it covers the basics.

The digestive system consists of a long tube (alimentary canal) that varies in shape and purpose as it winds its way through the body from the mouth to the anus (see diagram). The size and shape of the digestive tract varies according to the individual (e.g., age, size, gender, and disease state). The dimensions mentioned below are for an average adult male.

The upper part of the GI tract includes the mouth, throat (pharynx), esophagus, and stomach. When food enters the mouth, chewing mechanically breaks down and mixes food, while saliva begins to modify the food chemically, thus beginning the digestive process. Chewing and swallowing (ingesting) require conscious effort, but once food reaches the esophagus, an automatic, rhythmic motion (peristalsis) takes over, propelling the contents along. A number of body systems provide the chemicals necessary to complete digestion, absorption, and elimination. If all is going well, the passage of food from one area of the intestines to the next is precisely coordinated, so that food stays in each area just the right amount of time.

Transit time is the duration between when food enters the mouth and when leftover waste finally passes out as stool. A meal could take anywhere from 12-72 hours to travel through the digestive tract. Each person is unique; a normal bowel movement pattern for one person may be very different from those of family members or friends. Some individuals have an irregular pattern, never knowing what to expect. The composition and quantity of dietary intake, the presence of a GI disease or disorder, and other factors influence transit time.

Following the esophagus, and located within the left side of the abdominal cavity, is the stomach, a sac-like organ about 25cm (~10") long. It increases in diameter as it receives food,

holding up to a maximum of about 4 litres (although it's not recommended to eat so much as to extend the stomach fully). Strong chemicals bathe food to break it down into simpler forms, while the stomach's thick walls keep these chemicals from entering the body as it squeezes its contents with strong circular and longitudinal muscles.

The lower part of the GI tract includes the small and large intestines. The names of these parts are a bit confusing, as the small intestine is about three times as long as the large intestine. Small and large refer to the diameter, which for the small intestine is about 2.5-3cm (~1") compared to 6.5-7cm (~2.5") for the large intestine.

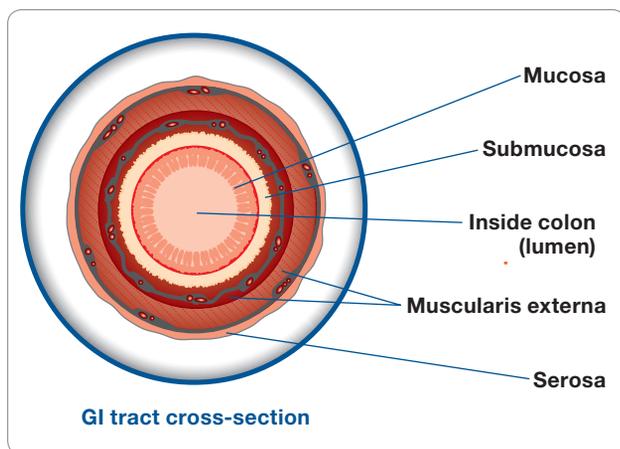
The small intestine is a long and narrow coiled tube that extends from the stomach to the large intestine, winding around within the abdomen. It has an enormous internal surface area due to the presence of millions of tiny finger-like protrusions called villi, which are covered in hair-like protrusions called microvilli. This is where most digestion and absorption of food takes place. The first section of the small intestine, the duodenum, is the smallest segment, which is about the same length as the stomach (25cm/~10"), followed by the jejunum (2.5m/~8') and the ileum (3.5m/~11.5'), for a combined total of a little more than 6m (~20'). Functions of the small intestine include secreting digestive enzymes and buffers, and absorbing nutrients. IBD patients should know that iron is absorbed in the duodenum and vitamin B12 and bile salts are absorbed in the last part of the ileum (terminal ileum).

The mucosa is the innermost layer of the GI tract wall; it is responsible for both the secretion of digestive juices and the absorption of nutrients. The second layer is the submucosa, which consists of a dense layer of connective tissue with blood vessels, lymphatic vessels, and nerves. Outside of the submucosa is a layer of muscle, the muscularis externa. As these muscles contract, they propel food along the digestive tract. The

outermost layer is the serosa, a thin layer of cells that secrete fluid, which reduces the friction caused by muscle movement.

The first part of the colon, the cecum, connects to the small intestine in the lower right area of the abdomen, at the ileocecal valve. The rest of the large bowel consists of the ascending colon (going upward on the right side of the abdomen), transverse colon (going leftward across the abdomen), and descending colon (going downward on the left side of the body), followed by the sigmoid colon. Altogether, the large intestine (colon) is about 1.25m (~4') long. The main function of the colon is to absorb water, form stool, and eliminate waste. The large intestine does not secrete digestive enzymes and does not have villi. The colon contains many varieties of friendly bacteria and yeasts to aid digestion and to prevent proliferation of harmful bacteria and yeasts. The colon ends in the rectum (about 15-20cm/~6-8" long), which briefly stores waste material until it is eliminated via the anus as stool, usually as a conscious choice.

Although not directly part of the digestive tract, the liver, gallbladder, and pancreas serve as accessory organs that are vital to the digestive process.



## Inflammatory Bowel Disease

Since each individual is unique, issues discussed here will not apply to every person with IBD; however, we hope this information helps you understand this complex and chronic disease. Please be sure to discuss your particular circumstances with the health care professionals involved in your care.

Inflammatory bowel disease is a term that primarily refers to two diseases of the intestines: Crohn's disease and ulcerative colitis. These diseases have a few similarities but do differ significantly in two key ways: the area of the digestive tract affected and the extent of the inflammation.

**Area Affected:** Ulcerative colitis only involves the colon and always begins at the anus, with the disease continuously progressing upward. In some cases, it can involve the entire

large intestine. In ulcerative proctitis, a milder form of ulcerative colitis, inflammation reaches up from the anus no more than about 20cm (~7-8"). In Crohn's disease, the inflammation can be in multiple patches or one large patch, and may involve any area throughout the entire digestive tract, often affecting the last part of the small intestine (terminal ileum).

**Extent of Inflammation:** In ulcerative colitis, inflammation only involves the inner mucosa, while in Crohn's disease, inflammation can extend right through the entire thickness of the bowel wall, from the mucosa, through the muscle, and can even include the thin outermost layer of digestive tract cells (serosa).

The inflammatory process causes dilation of blood vessels with increased warmth, oozing of fluid into the tissue, infiltration with inflammatory cells, and ulceration of the mucosa.

Inflammation can result from infectious agents such as bacteria, fungi, parasites, or even viruses. It can also arise from a chemical exposure, burn, trauma, or a number of other causes. The cause of IBD is undetermined but there is considerable research evidence to suggest that interactions between environmental factors, intestinal bacteria, immune dysregulation, and genetic predisposition are responsible. There is an increased risk for those who have a family member with the condition.

Although Crohn's disease is currently the proper name for the condition, sometimes you might hear older terms, such as regional enteritis, terminal ileitis, granulomatous colitis, or ileocolitis used interchangeably.

A diagnosis of inflammatory bowel disease can occur at any point throughout life, with a high occurrence in youth and then again around 40-50 years of age. Approximately 0.7% of the Canadian population has IBD. Canada has the highest prevalence and incidence yet reported in the world, at approximately 233,000 persons, with slightly more having Crohn's disease than ulcerative colitis.

## Symptoms/Complications

The most common symptom of IBD is diarrhea. Inflammation can affect transit time, usually causing food to pass more quickly and allowing less time for water absorption, resulting in watery stool. Crohn's disease can affect the small intestine and, in doing so, it may prevent the proper absorption of food, also resulting in diarrhea and the increased elimination of fat (steatorrhea) and other nutrients. In ulcerative colitis and Crohn's disease of the colon, the normal colon function of removing fluid from its contents is impaired, resulting in frequent, liquid stools. Since the lining of the colon may be ulcerated, the diarrhea often contains blood. In the later stages of the disease, the colon can narrow and shorten, impairing water absorption further, leading to urgency of bowel movements and poor control of elimination function. Constipation can also develop, as the body struggles to maintain normal bowel function.

Abdominal pain is another common symptom. Like muscles elsewhere in the body, the muscular coat of the intestine is subject to spasm; inflamed intestines are irritable and more likely to spasm, which in turn applies pressure upon the extensive nerve endings in the bowel wall. This explains some types of pain in IBD, particularly cramping. In Crohn's disease, pressure can build up behind a narrowed portion (stricture) of the intestine and produce pain. Occasionally, the narrowing is so severe that a blockage of the intestine occurs, requiring immediate medical and, less frequently, surgical intervention.

Fever frequently accompanies inflammation of any type and is present in IBD.

IBD patients can experience tenesmus, which is the feeling of incomplete defecation, as well as a sudden, short, severe type of pain at the opening of the rectum.

Weight loss is common in Crohn's disease, due to the small intestine's decreased ability to absorb sufficient nutrition. In children, a delay in growth and maturity might result. If possible, it is best to consult a pediatric gastroenterologist, who has specific training to manage the special needs of the growing child.

In Crohn's disease, the rectum and anus can become a focal point for inflammation, with the formation of painful inflamed slits in the skin and superficial tissues, called anal fissures. Large pus pockets or abscesses may accumulate, producing severe pain and fever. An abnormal, tunnel-like connection between the intestine and the skin, called a fistula, may occur. When this connection is near the opening of the rectum, it is called an anal fistula. Fistulae also may occur in Crohn's disease between loops of intestine within the abdomen or between the intestine and the abdominal wall. Abdominal surgery can increase the risk of fistulae.

Anemia, or low red blood cell count, commonly occurs from blood loss due to the ulcerations in the lining of the intestine. Occasionally, blood loss may be so severe that the patient requires a blood transfusion. Anemia may also be a consequence of general malnutrition due to nutrient malabsorption and the debilitating effects of the disease on a patient's body.

Other manifestations of inflammatory bowel disease include arthritis, skin problems, liver disease, kidney stones, and eye inflammation.

IBD patients who have ulcerative colitis or Crohn's disease of the colon are at a slightly increased risk for colorectal cancer after having the disease for about 10-15 years, so screening for colorectal cancer should be at an earlier and more vigilant schedule in this group than for that of the general population.

## Diagnosis

Malfunction of the intestinal tract may occur for a wide variety of reasons and some symptoms (diarrhea, pain, and weight loss) may be very similar to symptoms of other diseases or disorders.

The accurate diagnosis of IBD is essential, and a physician will take steps to exclude other conditions.

A careful evaluation of the history of the illness is the first step toward a correct diagnosis. The physician will review factors such as when and how the symptoms began, what subsequent problems occurred, the nature of the diarrhea, the type of abdominal pain, as well as the characteristics and quantity of rectal bleeding.

In ulcerative colitis, the most useful diagnostic tool is the sigmoidoscope, a short instrument that allows visualization of the inside of the lower bowel. If necessary, during this procedure a physician can biopsy any suspected areas for further investigation. Viewing the lining of the colon with this instrument at regular intervals throughout the healing process allows a physician to monitor the disease. If needed, a longer, flexible instrument called a colonoscope can help the physician see farther up into the colon, sometimes as far as the terminal ileum (where the small and large intestine meet), which is a likely location for the formation of Crohn's disease. In some cases, a gastroscop, entering the body via the mouth, is useful to confirm Crohn's disease in the upper part of the GI tract.

A physician might request a barium X-ray. When needed for the upper GI area, the patient drinks a liquid that coats the walls of the esophagus and stomach. This drink contains barium, which shows up as bright white on X-rays, providing a contrasting picture of the shape and function of the upper GI tract. When needed to provide details of the lower GI tract, the patient undergoes a barium-containing enema to allow the physician to view the contours of the bowel. The colonoscopy offers a diagnostic advantage over a barium enema X-ray in that a physician can take biopsies during this procedure.

Other diagnostic tools include blood tests and examination of a stool sample for infectious agents and hidden (occult) blood. Ultrasound, CT scans, and MRI are helpful in looking for complications of IBD but are not necessarily useful in making the primary diagnosis.

## Management

The treatment of inflammatory bowel disease is multifaceted; it includes managing the symptoms and consequences of the disease along with following a medicine regimen targeted at reducing the underlying inflammation.

### Dietary and Lifestyle Modifications

An important, overarching challenge is managing nutrition intake when disease has compromised the digestive system. Crohn's disease can interfere with nutrient absorption, putting those patients at high risk for deficiencies, but ulcerative colitis patients generally are at low risk, as colitis does not affect the

small intestine where most nutrients are absorbed. However, there are other factors and symptoms contributing to malnutrition in patients with either disease.

Depending on disease symptoms, a person with IBD may feel unwell, and the sensations of food passing through the digestive tract can be so uncomfortable that this might lead to food avoidance or food choices that might not provide a balanced diet. Better overall nutrition provides the body with the means to heal itself.

If bleeding is excessive, anemia may occur, and modifications to the diet will be necessary to compensate for this.

Depending on the extent and location of inflammation, patients may have to follow a special diet, including supplementation. It is important to follow *Canada's Food Guide*, but this is not easy for individuals with IBD. We encourage each patient to consult a registered dietitian, who can help set up an effective, personalized nutrition plan by addressing disease-specific deficiencies and the IBD patient's sensitive digestive tract. Some foods may irritate and increase symptoms even though they do not affect the disease course.

Particularly in Crohn's disease during symptom flare-up, and sometimes in ulcerative colitis, it might be necessary to allow the bowel time to rest and heal. Specialized diets, easy to digest meal substitutes (elemental formulations), and fasting with intravenous feeding (total parenteral nutrition) can achieve incremental degrees of bowel rest.

## Symptomatic Medication Therapy

The symptoms of IBD are the most distressing components of the disease, and direct treatment of these symptoms, particularly pain and diarrhea, will improve quality of life for the patient. A number of treatments exist to address diarrhea and pain. Dietary adjustment may be beneficial and anti-diarrheal medications have a major role to play. For painful symptoms not controlled by other drugs, analgesics can be helpful, with acetaminophen (Tylenol®) being the preferred choice.

There are two types of anti-diarrheal medications directed at preventing cramps and controlling defecation. One group alters the muscle activity of the intestine, slowing down content transit. These include: nonnarcotic loperamide (Imodium®); narcotic agents diphenoxylate (Lomotil®), codeine, opium tincture and paregoric (camphor/opium); and anti-spasmodic agents hyoscyamine sulfate (Levsin®), dicyclomine (Bentylol®), propantheline (Pro-Banthine®), and hyoscine butylbromide (Buscopan®).

The other group adjusts stool looseness and frequency by soaking up (binding to) water, regulating stool consistency so it is of a form and consistency that is easy to pass. These work in different ways; some, such as Metamucil® or Prodiem®, come from plant fibres, whereas cholestyramine resin (Questran®) is

a bile salt binder. Interestingly, plant fibres are also useful for constipation, due to their stool regulating effects.

If extra-intestinal signs of IBD occur, such as arthritis or inflamed eyes, the physician will address these conditions individually, as the patient may require referrals to other specialists. If anxiety and stress are major factors, a program of stress management may be valuable. (Ask for our pamphlet on *Stress Management*.)

Individuals with IBD may be anemic from a combination of factors, such as chronic blood loss or malabsorption of certain vitamins and minerals. Adding dietary supplements could help improve this condition, with heme iron polypeptide (Proferrin®) being the preferred choice, due to its quick-acting and low side-effect profile. Occasionally, a blood transfusion may be necessary.

In Crohn's disease, the most widely prescribed antibiotics are ciprofloxacin (Cipro®) and metronidazole (Flagyl®, Florazole ER®). Broad-spectrum antibiotics are important in treating secondary manifestations of the disease, such as peri-anal abscess and fistulae.

## Anti-inflammatory Medication Therapy

There are two goals of treatment for Crohn's disease and ulcerative colitis: 1) induction of remission, which is marked by the absence of symptoms and inflammation in the affected part of the gastrointestinal tract) followed by 2) maintenance of remission (prevention of flare-ups). To accomplish these goals treatment is aimed at controlling the ongoing inflammation in the intestinal tract. Through controlling inflammation, the symptoms of IBD will improve. This comes in many forms, using various body systems to effect relief. A physician may prescribe any of the following medications alone or in combination. It could take some time to find the right mix for any specific patient, as each case of IBD is unique. Depending on the location of your disease, a combination of drug delivery methods (oral and rectal) could help to ensure that all areas of the disease are covered.

### 5-Aminosalicylic Acid (5-ASA)

The medication used to reduce inflammation in mild to moderate IBD with the longest record of success worldwide is 5-ASA, including mesalamine (Asacol®, Asacol 800®, Mesasal®, Mezavant®, Pentasa®, Salofalk®) and olsalazine sodium (Dipentum®), all available orally in the forms of tablets and capsules. 5-ASA medication is safe and well tolerated for long-term use. Depending on the location of your disease, you may be required to administer mesalamine (Pentasa®, Salofalk®) rectally, in the forms of enemas or suppositories. Patients typically use rectal medications nightly at first and, as the disease improves, treatments can become less frequent.

5-ASA helps to settle acute inflammation and, when taken on a long-term basis (maintenance), it tends to keep the inflammation

inactive. It is important to keep up your medicine regimen even if your symptoms disappear and you feel well again. Maintenance therapy can be at the full initial dosage or at a reduced dosage and interval, depending on the disease response.

A combination of 5-ASA and sulfa antibiotic is available orally as sulfasalazine (Salazopyrin®).

### Corticosteroids

To reduce inflammation for the shorter-term in moderate to severe cases of IBD, corticosteroids might help. These are prednisone and budesonide (Entocort®) taken orally, although prednisone tends to have greater side-effects. For topical relief of ulcerative colitis or Crohn's disease in the colon, budesonide (Entocort®) and hydrocortisone (Betnesol®, Cortenema®, Cortifoam®, Proctofoam®) are available in rectal formulations (enemas, foams, and suppositories). Physicians can prescribe hydrocortisone (Solu-Cortef®) and methylprednisolone (Solu-Medrol®) for administration intravenously in-hospital. Corticosteroids should not be used for longer-term or maintenance therapy.

### Immunosuppressive Agents

These drugs are used to prevent flare-ups of ulcerative colitis and Crohn's disease, and to try to reduce dependence on steroids. They include azathioprine (Imuran®), cyclosporine, mercaptopurine/6-MP (Purinethol®), and methotrexate sodium (Rheumatrex®). It could take up to 12 weeks of therapy to see results.

### Biologics

Biologic medications are important treatment options for those who have moderate to severe IBD. These products are specially developed antibodies, which selectively block molecules that are involved in the inflammatory process. Gastroenterologists routinely prescribe biologics, which include infliximab (Remicade®), adalimumab (Humira®), golimumab (Simponi®), and most recently, vedolizumab (Entyvio®), to control the symptoms (induce clinical remission) of inflammatory bowel diseases.

**Crohn's disease:** Remicade® was approved in 2001 to induce clinical remission in Crohn's disease, for ongoing use to maintain clinical remission, for reducing or eliminating corticosteroid use, for healing and closing fistulae, and for healing the lining of the bowel wall (mucosal healing). Humira®, a fully human monoclonal antibody, was approved in 2006 to induce clinical remission in Crohn's disease and for ongoing use to maintain clinical remission.

**Ulcerative colitis:** Remicade® was approved in 2006 to induce and maintain clinical remission and mucosal healing, and for reducing or eliminating corticosteroid use. Simponi® was approved in 2013 to induce and maintain clinical remission and

mucosal healing. Humira® was approved in 2013 to induce and maintain clinical remission. Entyvio®, a humanized, anti-a4b7 integrin monoclonal antibody was approved in 2015 for the treatment of adult patients with moderate to severe ulcerative colitis who have had an inadequate response, loss of response to, or were intolerant to, either conventional therapy or infliximab.

Both Humira® and Simponi® are self-administered under the skin (subcutaneously), Humira® every 2 weeks, and Simponi® every 4 weeks. A health care professional administers Remicade® by intravenous (IV) infusion every 8 weeks, usually in a Janssen-provided BioAdvance® clinic. A health care professional administers Entyvio® by IV infusion, about every eight weeks, following a few initial doses. Some treatment intervals might change depending on response.

An emerging tool to help physicians be sure that patients are on the right medication at the right dose is Therapeutic Drug Monitoring (used primarily for Remicade® at this time). This involves laboratory testing to determine the level of the drug in the system and a gastroenterologist assesses this in the context of the patient's symptoms at specific periods during the treatment schedule. See our video explaining how this works at [www.badgut.org](http://www.badgut.org).

## Surgery

In patients with ongoing active disease that fails to respond to all forms of medical management, surgery might be necessary. Since inflammatory bowel diseases are systemic, not only the bowel is involved; therefore, removing diseased tissue, although sometimes necessary, does not remove the disease.

Ulcerative colitis only involves the large intestine, so removing this organ will remove the disease from the digestive tract, but it is not a cure. Removing the colon can lead to other symptoms and complications. Although there are many variations to possible surgical procedures, typically, after removing all or part of the colon (colectomy), a surgeon brings the end of the remaining intestine through a new surgical opening in the abdominal wall (ostomy) to which the patient can attach a removable appliance to collect stool. An ostomy may be either temporary or permanent, depending upon the particular situation.

Newer techniques have arisen whereby surgeons can preserve the anal muscle and create an internal pouch, or reservoir, from the remaining intestine. Emptying pouch contents via the anus more closely resembles the normal anatomical route. However, with the loss of colon function, bowel movements have very high water content and move very frequently. This means that even after surgery, patients could face troublesome gastrointestinal symptoms. One complication that can occur is pouchitis, which is inflammation within the surgically-created pouch.

Crohn's disease tends to recur, perhaps in as many as 75% of patients, even after surgical removal of all visible and

microscopic disease in the digestive tract. Inflammation can recur months or years later, and can be present elsewhere in the body. Physicians reserve surgery as only a last alternative, usually in cases when medical management fails, or for complications such as obstruction, fistulae, or abscess formation.

An emerging surgical therapy is intestinal transplantation, but there are barriers yet to overcome, such as tissue rejection and inflammation in the newly transplanted organ.

## Outlook

The future lies in education and research. Education of both the public and the medical profession is required to emphasize the importance of inflammatory bowel disease research. Many of the following areas need further investigation:

- the chemistry of the normal, as well as diseased intestine,
- further study of tissue changes that occur in inflammation,
- genetic factors,
- the role of nutrition,
- the relative incidence of the diseases, as determined by accurate population surveys,
- emotional and psychiatric implications,
- the role of infectious agents,
- the study of the nature of inflammatory response, and
- clinical trials of new forms of therapy.

A partnership between physicians and researchers interested in the study of these diseases, along with patients, their families, and their friends, is the best hope toward finding the cause or causes, and the cure, of inflammatory bowel disease. Please support the GI Society's educational and research initiatives.

Visit [www.badgut.org](http://www.badgut.org) for frequently asked questions about inflammatory bowel disease. If you do not have internet access, we would be happy to send them to you by mail. Just phone (toll-free) 1-866-600-4875.

### NOTES:

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## ABOUT US

As the Canadian leader in providing trusted, evidence-based information on all areas of the gastrointestinal (GI) tract, the Gastrointestinal Society is committed to improving the lives of people with GI and liver conditions, supporting research, advocating for appropriate patient access to healthcare, and promoting gastrointestinal and liver health.

The *Inside Tract*® newsletter provides the latest news on GI research, disease and disorder treatments (e.g., medications, nutrition), and a whole lot more. If you have any kind of digestive problem, then you'll want this timely, informative publication.

### Please subscribe today!

The GI Society, in partnership with the Canadian Society of Intestinal Research, produced this pamphlet under the guidance of affiliated healthcare professionals. This document is not intended to replace the knowledge, diagnosis, or care of your physician.

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