The word diarrhea originates from the Greek term _dia_ (through) and _rhein_ (to flow). Diarrhea is considered by most when there is increased liquidity of stool with or without increased frequency of stool. Stool consistency is somewhat an objective parameter, hence, stool frequency or stool weight is used to define diarrhea. Three or more bowel movements per day or stool weight greater than 200 g per day are considered as diarrhea. There may be some exceptions to this definition. For e.g. Indian diet has a high fiber content, and hence they have increased stool weight (> 200 g/day) but do not have diarrhea because they have normal stool consistency and frequency (< 3/day). Conversely, other patients have normal stool weights but complain of diarrhea because their stools are loose or watery (but frequency < 3/day). Two common conditions, usually associated with the passage of stool totaling < 200 g/d, must be distinguished from true diarrhea. Pseudodiarrhea, or the frequent passage of small volumes of stool with rectal urgency and accompanying the irritable bowel syndrome or anorectal disorders like proctitis. _Fecal incontinence_ is the involuntary discharge of rectal contents and is most often caused by neuromuscular disorders or structural anorectal problems. Diarrhea and urgency, especially if severe, may aggravate or cause incontinence. A careful history and physical examination generally allow these conditions to be discriminated from true diarrhea.

**PATHOPHYSIOLOGY AND MECHANISMS OF DIARRHEA**

Normally, absorption is quantitatively greater than secretion in the intestines. Therefore, either a decrease in absorption or an increase in secretion can lead to diarrhea. When infectious agents, toxins, or other noxious substances are present within the gut, fluid secretion and motility are stimulated to expel the unwanted material, producing diarrhea. There are four major mechanisms of diarrhea: (1) the presence in the gut lumen of unusual amounts of poorly absorbable, osmotically active solutes (osmotic diarrhea); (2) intestinal ion secretion or inhibition of normal active ion absorption (secretory diarrhea); (3) deranged intestinal motility; and (4) exudation of mucus, blood, and protein from sites of inflammation.

**OSMOTIC DIARRHEA**

Ingestion of poorly absorbed sugars or alcohols (e.g., mannitol, sorbitol) or ions (as found in laxatives - magnesium, sulfate, and phosphate) leads to diarrhea of the osmotic type. Since the intestines cannot maintain an osmotic gradient, these unabsorbed ions in the intestinal lumen cause retention of water to maintain an intraluminal osmolality equal to that of body fluids (about 290 mOsm/kg). Disaccharide (sucrose and lactose) requires disaccharidase for their breakdown before absorption. Lactose intolerance, results due to deficiency of lactase and cannot be hydrolyzed by the human intestine and cannot be absorbed intact in greater than trace amounts. It thereby causes an osmotic diarrhea when given in sufficient quantity to overwhelm the metabolic capacity of colonic bacteria (about 80 g/day). The essential characteristic of osmotic diarrhea is that it disappears with fasting or cessation of
ingestion of the offending substance. In contrast, secretory diarrhea typically continues with fasting (though may be slightly reduced).

SECRETORY DIARRHEA

In this form, either net secretion of chloride or bicarbonate or inhibition of net sodium absorption is the mechanism for diarrhea. The most common cause for secretory diarrhea is infection. Infectious agents (bacteria, parasites and viruses) produce enterotoxins that interact with receptors and lead to increased anion secretion or these enterotoxins may block specific absorptive pathways (e.g. Na-H exchange). Peptides produced by endocrine tumors such as vasoactive intestinal peptide or calcitonin cause secretory diarrhea by stimulating secretion by epithelial cells. Even though there is a large reserve absorptive capacity in both the small intestine and the colon, significant loss of surface area of intestines (e.g. after resective surgery, inflammatory bowel disease), may compromise water absorption and cause diarrhea. In some cases the problem is temporary because over time the intestine may improve its capacity for absorption by the process of adaptation.

Deranged Motility Because rapid transit prevents adequate time for absorption, diarrhea results despite intact mucosal absorptive capacity. In disorders such as diabetes mellitus, postvagotomy diarrhea, postprandial diarrhea and irritable bowel syndrome, intestinal hurry has been linked to abnormal enteric nervous system function. Many endocrine diarrheas, such as those due to peptide-secreting tumors or hyperthyroidism, may lead to diarrhea not only by effects on intestinal electrolyte transport but also by accelerating intestinal motility. Conversely, slow intestinal transit may lead to a secretory diarrhea by promoting bacterial overgrowth in the small intestine. Excess bacteria in the small intestine disrupt digestion and may alter electrolyte transport (e.g. diabetes mellitus and scleroderma).

Exudation Disruption of the integrity of the intestinal mucosa due to inflammation and ulceration (bacillary dysentery, ulcerative colitis) results in discharge of mucus, proteins, and blood into the bowel lumen. In such conditions the colonic absorption of water and electrolytes is severely impaired.

COMPLEX DIARRHEA

Rather than being produced by a single pathophysiologic mechanism (osmotic or secretory), most diarrheas are complex; and are produced by a combination of mechanisms. For example, a patient with malabsorption syndromes might have diarrhea because of the osmotic effects of unabsorbed carbohydrates and secretory diarrhea because of inhibition of colonic absorption by the unabsorbed long-chain fatty acids.

CLINICAL CLASSIFICATION

Clinically, it may be useful to classify diarrhea: by time course (acute vs. chronic), by volume (large vs. small), by pathophysiology (secretory vs. osmotic), by epidemiology, and by stool characteristics (watery vs. fatty vs. inflammatory).

ACUTE VERSUS CHRONIC

Acute diarrheas (<4 weeks) usually are due to infections, most of which are self-limited or are easily treatable by antibiotics. Although there are a few infectious agents that cause prolonged diarrhea in immunocompetent individuals (such as Giardia lamblia or Yersinia spp.), chronic diarrhea is usually due to some other cause.

LARGE-VOLUME VERSUS SMALL-VOLUME STOOLS

Normally rectum and sigmoid colon functions as a storage reservoir. When this reservoir capacity is compromised by inflammatory or motility disorders involving the left colon, frequent small-volume bowel movements ensue. If the source of the diarrhea is upstream in the right colon or small bowel and if the rectosigmoid reservoir is intact, bowel movements are fewer, but larger. Thus, frequent, small, painful stools may point to a distal site of pathology, whereas painless large-volume stools suggest a right colon or small bowel source. The daily total stool output may also provide etiologic hints. Irritable bowel syndrome often results in normal or only slightly elevated 24-hour stool weights, whereas diarrheas due to etiologies like VIPomas or medullary thyroid carcinoma may produce fecal output of greater than 1L/day.

OSMOTIC VERSUS SECRETORY

Because osmotic diarrhea is due to ingestion of some poorly absorbed substance, it abates with fasting. Secretory diarrheas typically continue during fasting, although stool output may decrease somewhat due to reduced endogenous secretions. Measurement of stool electrolyte concentration, osmolality and osmotic gap will also help differentiate between secretory and osmotic diarrhea.

WATERY VERSUS FATTY VERSUS INFLAMMATORY

Watery diarrhea implies a defect primarily in water absorption due to increased electrolyte secretion or reduced electrolyte absorption (secretory diarrhea) or ingestion of a poorly absorbed substance (osmotic diarrhea). Fatty diarrhea implies defective absorption of fat in the small intestine. Inflammatory diarrhea implies the presence of one of a limited number of inflammatory or neoplastic diseases involving the gut.

(Part II will include clinical evaluation and management of diarrhea).