PATHOLOGY: THE STUDY OF DISEASES

Pathogens:

Pathogens may include viruses, bacteria, fungi, protozoa, or multicellular parasites. Viruses are made up of genetic material (DNA or RNA but not both), surrounded by a coat made up of proteins, lipids, etc. Because they are not complete cells, lack organelles, and many essential enzymes, they cannot reproduce by themselves. They require another organism (a host) and use its components for reproduction. When a virus invades a cell or an organism, it inserts its genetic material into the chromosomes of the host, and causes the cell to produce more viruses. The viruses containing RNA are called retroviruses since they have to undergo reverse transcription (to make DNA from RNA) before inserting their genetic material into the host. Examples of viruses are the ones causing cold, flu, AIDS, rabies, herpes, chicken pox, and measles.

Bacteria are actually complete cells with varying degrees of sophistication depending on their degree of evolution. Diseases caused by bacteria are strep throat, gonorrhea, tetanus, anthrax and cholera. They multiply under the right conditions.

Fungi (plural of fungus) are advanced cells causing ailments such as toenail fungus, athlete’s foot, yeast infections, and ringworm.

Protozoa are from the protista kingdom and, unlike bacteria, they are advance cells. They cause diseases such as malaria, amoebic dysentery, sleeping sickness, and trichomonas (vaginitis).

Multicellular parasites are frequently worms or flukes that take residence in certain parts of the body such as the gut or under the skin. The examples of multicellular organisms are tapeworms, and hookworms.
**Immune System:**

The system in human beings that protects against pathogens is called the Immune System. The Immune System operates in three ways:

1. **Protective surface phenomena:**
   
   A. Skin blocks the entrance of pathogens into the body. When the surface continuity of the skin is lost, as with cuts or burns, the probability of infection goes up because the torn surface can no longer prevent pathogens from entering the underlying tissue.

   B. Mucous membranes, such as the ones lining the nasal or oral cavity, produce many substances that destroy pathogens.

   C. Other immune mechanisms include the elimination of foreign particles from the lungs by cilia (cell extensions beating towards the nose) and creation of acidic environments in the stomach, vagina and even skin that inhibits the survival of pathogens.

2. **Nonspecific cellular responses:**

   When pathogens enter the living system (called antigens due to reactions they initiate), the body tries to destroy them before they can increase sufficiently to cause disease. Protective processes, such as inflammation, are activated which increase both blood flow and production of white blood cells in the affected area that engulfs and digests the pathogens. Certain other chemicals secreted by immune cells travel via blood to inhibit the growth of pathogens such as interferon acting against viruses.

3. **Specific immune response:**
The invasion and growth of a pathogen activates the Immune System to produce specific molecules called antibodies against specific pathogens to defeat the disease process. This is why, after a disease has progressed for a short time, the patient starts to recover. The antibodies found against the specific antigen produced by a pathogen facilitate its destruction and terminates the disease caused by it.

**Study of diseases (Pathology):**

Disease or “absence of ease” is when a disturbance of bodily structures or function occurs that is beyond normal. The body or cells tries to adapt to this disturbance. If the harm exceeds the normal range of adaptation, disease occurs. Beyond that, the organism or cell could die.

Small variation $\rightarrow$ further disturbance $\rightarrow$ still further disturbance

(adaptation) (disease or injury) (death)

The causes of disease is classified in the following way:

1. **Genetic abnormalities:** Abnormal chromosomes or genes (e.g., Sickle Cell Anemia) or susceptibility to disease(s) due to a particular genetic type.

2. **Diseases that are acquired:**

   A. From physical agents such as trauma, radiation, extreme heat or cold, etc.

   B. By chemical poisons such as lead.

   C. From nutritional deficiencies due to lack of specific vitamins or from malnutrition.

   D. From infections caused by pathogens such as pneumococcus.
E. From abnormal immune reactions (e.g., pollen allergies).

F. Psychological diseases such as schizophrenia or depression.

Diseases are also classified according to their manifestations:

A. Inflammatory diseases caused by a variety of agents such as bacteria (pneumonia, salmonella poisoning) or viruses (cold, herpes or AIDS).

B. Degenerative diseases caused by malnutrition, coronary heart diseases, stroke, lung disease, and diabetes.

C. Neoplastic diseases, either malignant (i.e. cancer) or non-malignant (benign tumors).

**AIDS and other infectious diseases:**

When pathogens find a suitable environment in an appropriate host, they start to grow. The host generally shows certain symptoms resulting from the growth of pathogen. Together, invasion by pathogen and symptoms it causes are called infection, and the disease that results is referred to as an infectious disease. The infection brings about damage or death to the affected cells just as may be caused by a physical agent (trauma or burn), a chemical poison, or an immune reaction. In all these processes, which cause an injury, the first reaction the body shows is acute inflammation. It involves redness; heat, swelling, pain, and loss of function.

The process of inflammation begins with vascular changes in which dilation of blood vessels causes both redness of the affected tissue and helps to move protein-rich fluid and blood cells through the vessel wall into the area. This fluid-cell mixture causes swelling and serves to dilute any possible toxins and distribute protective antibodies to the area. In addition, it helps to form a fibrin mesh in the area made from certain proteins delivered there. This mesh limits the movement of pathogens and helps in wound healing. Moreover, the surge of
blood helps white blood cells to enter the area so they can engulf and kill pathogens.

Sometimes the infected host can infect other individuals either directly or indirectly. Such diseases are called contagious or communicable diseases.

There are several features of infectious diseases one should know:

1. Incubation period: The period from entrance of pathogens to the appearance of clinical symptoms.

2. Infectious period of the disease: The period in which the host carries the pathogen in such a form that may infect others directly or indirectly. This infectious period has an onset, duration, and mode of transmission, all of which should be known for a disease.

3. For many infectious diseases, it is possible to introduce antigens from a specific pathogen into the body (vaccinations), which by immunizing the person, protects against becoming infected when next exposed to the pathogen. During immunization, the person generally is exposed to a non-virulent form of the pathogen. Non-virulent means the pathogen is weakened or killed so that it cannot cause the disease but rather endures an immune reaction.

Colds and Flu (Influenza):

Cold and flu are two contagious respiratory diseases of viral origin that have always plagued mankind and for which there are only symptomatic treatments. The symptoms of cold may be nasal congestion, inflammation of the voice box, malaise,
burning and watery eyes, and a low-grade fever. There is generally a contagious period of two or three days. Flu may exhibit the same symptoms, but they are usually more intense, and, in addition, chills, muscle pain, and cough may be present. The flu generally has an abrupt onset.

The medications available for these viral diseases are symptomatic, including mild painkillers and anti-fever drugs, drinking lots of fluids, decongestants, and rest. There is always the danger of a secondary infection after a cold or flu. That is why sometimes antibiotics are prescribed even though they are usually ineffective against viral agents. There is a vaccination for flu, but since flu virus mutates continuously, vaccination does not guarantee immunity. To prevent developing the disease or contaminating others, one should wash their hands frequently and when coughing, cover the mouth or use a handkerchief.

**Acquired Immunodeficiency Syndrome (AIDS):**
AIDS is caused by human immunodeficiency virus (HIV) for which there are three modes of transmission:

1. By blood, meaning that the virus can enter the bloodstream from transfusions or tainted blood or through a cut exposed to fluids containing HIV. The IV drug users are at high risk, especially when they share needles.
2. **By sex:** After heterosexual or homosexual intercourse, there is a good chance that HIV can penetrate from the infected person to the other. In anal sex, the chances of becoming infected are greater (due to rupture of many capillaries in the rectum) whereas in oral sex or casual contact, the chances are very low.

3. **By birth:** During fetal growth or during childbirth, there is a good chance that the offspring can become infected by an HIV positive mother.

The development of the disease may begin with flu-like symptoms or no symptoms at all. They symptoms, if any, will disappear spontaneously. Eight to ten week’s later the individual becomes HIV positive and contagious. However, there are still no symptoms to warn that the individual may be infecting others without knowing it. For adults, symptoms generally occur eight to ten years later. Children will show symptoms much earlier, after seventeen months.

When symptoms do occur, they involve fatigue, loss of appetite, weight loss, vomiting, diarrhea, fever, neurological symptoms (such as memory loss, headaches, depression, etc.), breathing problems, coughing, chest pain, chronic illness, enlarged lymph organs (lymphadenopathy), and occurrence of many opportunistic infections and malignancies, some of which may eventually kill the patient.

When the virus enters a victim's body, certain white blood cells (lymphocytes) try to destroy the viral particles by engulfing them. Inside the lymphocytes, the virus injects its genetic material into the chromosomes of the host cell and converts the cell into a virus factory. It is ironic that they very cells supposed to destroy the virus become their producer. As more virus is formed, more cells become infected and the disease progresses.

In this age when AIDS is becoming an epidemic, one has to use all precaution to avoid becoming infected with AIDS. There are certain steps to follow that can help avoid the disease:

1. Always use precautions, including condoms, for safe sex.

2. Keep away from hypodermic needles, infections, and use precautions when handling blood and body fluids.

3. Eliminate drug abuse and malnutrition.
During blood transfusions, make sure the blood has been screened for safety.

There are several drugs in the market that will help AIDS patients to cope better, though as yet, no cure is in sight. These drugs are two classes. First reverse transcriptase inhibitors that are AZT, ddI, ddC, d4T, 3TC, and Nevirapine. Second class of drugs is protease inhibitors, which are Saquinavir, Indinavir and Ritonavir. Sometimes the patients take a mixture of these drugs.

**Cancer:**

Cancer is the second highest killer in the U.S. after cardiovascular diseases. A lump or swelling in the body may be an abscess (which is an accumulation of pus or dead body cells and fluids), or may be neoplasm. The term neoplasm means simply a new growth and in no way serves a purpose. There are two kinds of neoplasm, a benign or non-cancerous tumor, and a malignant or cancerous one. Benign tumors grow slowly and their cells resemble normal body cells. Malignant tumors are invasive, grow rather rapidly, and can spread via the blood system or lymphatics to other parts of the body (called metastasis).

Normally contact inhibition exists between healthy cells and this is why cell growth and division is controlled. Sometimes this control is disrupted and cancer develops for reasons not fully understood.

Our genes are made up of DNA, which copies itself, or make usable copies called RNA’s. These processes are very precise with few errors. Even when errors do occur, they usually are corrected quickly.

Occasionally, gene errors in chromosomes remain and such cells divide and bring about accumulations of abnormal cells. By the middle of adulthood, millions of these abnormal cells may be on the way to becoming cancerous. However, cancer hardly materializes. First of all, damage should be on several specific genes in order for a cancer to be possible. Second, since there are two strand of each chromosome, the damage most likely would have to occur in both strands.
Certain factors increase the chance of a cancer developing. These are either an inherited genetic disposition to develop cancer, or an environmental factor (or carcinogens) that can bring about abnormal gene mutations. Environmental carcinogens may be tobacco, toxic fumes, high fat, low fiber diets and too much sun or radiation.

One of the questions frequently asked about cancer is why exposure to certain carcinogens causes cancer in some people but not others. The answer is that most chemicals entering our system are changed through certain metabolic pathways caused by enzyme. These changes may make a chemical not likely to cause cancer become carcinogenic or vice versa. Because of genetic differences, people have variable amounts of these enzymes in their system. Depending on how much enzyme is available to activate or deactivate the carcinogenic activity of a chemical, individuals are more or less prone to develop cancer.

The following should be followed in order to lower the chance of cancer:

1. Eat breakfast.
2. Avoid cigarette smoking.
3. Limit alcohol.
4. Avoid needless x rays.
5. Limit exposure to chemicals, solvents, dyes, pesticides, herbicides and follow instructions for their use carefully.
6. Limit hormone therapy.
7. Avoid polluted air.
8. Monitor calorie intake and consume more fiber, less fat, more fruits and vegetables and less red meat.
10. Do regular screenings, mammograms, pap smears and breast or prostate exams.

If cancer develops, there are several treatment procedures:

2. Chemotherapy, using certain poisons or chemicals, which inhibit the growth of cancer. There are many side effects
to this treatment: nausea, vomiting, anorexia, anemia (low red blood cells), and loss of hair.

3. Radiation therapy with X rays, radioscopescopes, or neutron therapy, all of which serve to kill cancer cells more than they do normal cells. The side effects are hair loss, nausea, vomiting, damage to mucous membranes, all of which tend to subside after therapy.

4. Immune therapy can stimulate the body’s own immune system to fight the disease through use of certain bioagents or vaccinations.

CARDIOVASCULAR DISEASES (CVD)

CVD are diseases of the heart or blood vessels. These diseases cause more death in the U.S. then any other single cause. These diseases include the following:

Aneurism: A part of a vessel, whose wall has been weakened, may balloon out and eventually burst.

Heart attack (Myocardial Infarction):

Sudden necrosis (death) of a part of the heart tissue or the whole heart due to blockage of coronary vessels (the vessels which feed the heart).

Stroke:

Condition resulting from sudden cessation or reduction of the blood flow to the brain by a clot in a vessel or from hemorrhage (loss of blood from a ruptured vessel in the brain).

Angina Pectoris:

Chest pain resulting from shortage of blood to a part of the heart.

Congestive Heart Failure (CHF):
Condition arising from a gradually failing heart that is unable to pump enough blood to the different parts of the body resulting in the blood vessels becoming abnormally distended by increased amount of slowly moving blood.

**Cardiac Arrest:**

Sudden unexpected interruption of the heart function due to heart attack, shock, or physical trauma.

**Atherosclerosis:**

Disease resulting from hardening of the walls of certain large arteries by the formation of plaques within them. To understand such a disease, one first should consider lipoproteins and their metabolism. When lipids enter the bloodstream, they are assembled into complexes in combination with proteins to render them water-soluble. These complexes are called lipoproteins from their composition of lipids and proteins. The major lipoproteins are HDL (high-density lipoproteins) and LDL (low-density lipoproteins). Both of them carry cholesterol but due to their different structure and composition, their functions are different. HDL’s function is to vacuum up excess cholesterol wherever it is found and are, therefore, called good cholesterol. LDL’s, on the other hand, deposit cholesterol anywhere so are referred to as bad cholesterol.

Many tissues in the body produce steroid hormones, some of which are essential for life, others are sex hormones. These tissues use cholesterol to manufacture hormones. However, when the concentration of LDL’s in the body goes up, some of the cholesterol seeps out of the blood and becomes deposited in the vessel walls which result in plaque formation. This process is exacerbated by the superimposed blood clot formation, and this, eventually can build up to a structural plug that may lock the entire channel of the vessel. As long as the blood clot is stationary, it is called thrombus. However, sometimes a clot is released from its site of formation. Then it is referred to as an embolus (a moving clot). When the blood-borne embolus becomes stuck in a vessel too small
for it to pass through, it deprives the surrounding tissue environment of blood. The effect of an embolus varies greatly, depending on where the blood flow is restricted or blocked. If it is to the heart, it will result in damage to that part of the heart deprived of blood and possibly death. The blockage of blood to parts of the brain causes stroke. Arteriosclerosis is a general term for thickening and hardening of the walls of arteries usually from plaque formation that lessens their elasticity. The form of arteriosclerosis, which is due to the accumulation of cholesterol, lipids, etc., in the walls of large muscular arteries as mentioned above, is termed atherosclerosis.

**Hypertension:**

Hypertension is another term for high blood pressure, the result of increased resistance to blood flowing from the heart. In order to understand the mechanism of hypertension, one has to understand how the cardiovascular system functions, especially the heart.

The Cardiovascular System encompasses the heart, blood vessels and blood which, working together, are responsible for the blood flow throughout the body, the distribution of nutrients and other chemicals to body cells, and the removal of waste and toxins from these cells.

The heart is a muscular organ, which, by its contractions and relaxations, serves to pump blood into blood vessels. Full contraction of the heart, called systole, causes maximum pressure (called systolic pressure), which is normally about 120 mm Hg. This pressure is responsible for delivering blood to furthest parts of the body. It is also related to cardiac stroke volume, the total volume of blood the heart pumps during each beat.

In contrast to contraction, the heart relaxes in order to receive blood (called diastole) and the pressure is minimal, approximately 80 mmHg in normal individuals (called diastolic pressure). This pressure measures peripheral resistance. It cannot be much lower than 80 mm since the entire system is always under a certain pressure. The difference between systolic and diastolic
pressures is referred to as the pulse pressure and is normally around 40 mm Hg.

Hypertension is identified by a systolic pressure of 140 mm Hg or above and a diastolic pressure of 90 mmHg or above. It can be mild or severe depending on how high the systolic and diastolic pressure rises. Of all people suffering from hypertension, 68% have a mild one. However, the total people suffering from primary or essential hypertension, the causes of which are unknown, include 20% of Americans. Secondary hypertension occurs less frequently and is the result of many functional disorders associated with the diseases of the Endocrine System, the renal (kidney and urinary tract system), and Nervous System among others.

Hypertension is caused by:

1. High amounts of sodium (Na+) in the blood stream, which, in turn, brings about the absorption of water from the tissues and increases the volume of fluid in the vascular system.

2. Renal diseases affecting either the kidney’s ability to eliminate excess water and sodium from the system, or those cells of the kidney that secrete hormones controlling blood pressure.

3. Constriction of blood vessels (arterioles).

4. Stimulation of the Sympathetic Nervous System that prepares the individual for fight/flight emergency situations in which one needs less blood from the internal organs and more blood for skeletal (voluntary) muscles.

From hypertension, the following may occur in patients:

1. A greater chance of congestive heart failure (generally 3-4 times more likely chance of coronary heart disease).

2. Kidney disease.
3. Atherosclerosis (due to plaque formation in blood vessels from deposits of lipids and cholesterol).

Risk factors for developing hypertension are:

1. Males, blacks, and elderly affected severely.

2. Heredity: runs in families.

3. Obesity: Overweight people because of their more extensive vascular system.

4. Stress: Stress increases the risk.

   b. Low calcium intake.
   c. Low potassium intake.
   d. Low magnesium intake.
   e. High alcohol consumption.

Treatment for hypertension involves the following factors:

a. Restricted sodium intake
b. Mineral supplementation
c. Weight reduction
d. Cessation of smoking
e. Moderate exercise
f. Restriction of alcohol
g. Reduction of stress
h. Use of anti-hypertensive drugs
i. Evaluations of medications that might increase blood pressure or interfere with anti-hypertensive drugs.

DISEASES OF THE DIGESTIVE SYSTEM

Diarrhea, Constipation, Flatulence, & Vomiting:

After food leaves the stomach, it passes through the small intestine; large intestine and finally, any remnants are eliminated (excreted)
through the rectum. Most digestion of nutrients takes place in the first third of the small intestine (duodenum) with the aid of digestive enzymes. Absorption of most of the digested nutrients also takes place there except for fats and bile acids, which are absorbed in the last third of the small intestine (ileum). What remains of the nutrients has watery consistency but when this material passes through the large intestine (colon), the water and gas are removed. The results, generally solid, are excreted from the rectum.

Obviously, a dysfunction in any of the above processes is the usual cause of digestive problems including diarrhea, constipation, gas (flatulence), and/or vomiting. The speed at which nutrients pass through the intestinal tract determines how much digestion and absorption will have taken place in the small intestine, how much water and gas will be absorbed while in the large intestine, and what consistency the stool will likely have.

Generally, from the time of ingestion to the time if defecation takes place is from 25 – 72 hours. However, slower passage of seven days or faster of half-a-day has also been observed. Because of this time range, the number of evacuations can range from three times a day to one a week.

Although it might seem that once-a-week defecation is more convenient, individuals who defecate more often remain healthier. The reason for this is that the material ingested may contain toxins, some of which are produced by bacterial action on food as it passes through the gut. The faster these toxins are eliminated, the less damage they can have on the system (such as cancers).

The movement of chyme (food and its breakdown products) and stool, through the esophagus, stomach, and intestines is the result of muscular contraction and relaxation. This process is called peristaltic motion. Peristalsis can be affected by a variety of factors, such as:

1. Psychological disturbances.
2. Any irritation to the mucous membrane.
3. Disturbance in the muscular action of the colon (dyskinesia).
4. Distention of the colon.
5. Too rapid movements of chime through the small intestine without proper digestion taking place (malabsorption).

6. Prolonged use of cathartics (purgative agents or laxatives), which stimulate evacuation of the bowels.

Also problems with defecation affect the health of the digestive system, such as resulting from:

1. Fecal impactation.
2. Inflammation of the rectum.
3. Sphincter (circular muscle around the anal opening which controls evacuations) damage.
4. Nerve damage.

One of the factors of the passing food mass which affects intestinal motility (so-called peristaltic motion) is its bulkiness. The more fiber or roughage consumed, the bulkier the stool and the higher the motility. The way fiber exerts its effect is through its ability to absorb water. Anyone using soluble fiber psyllium, such as in Metamucil, may have observed that a tablespoon can absorb a full glass of water. Also, bacteria in the colon ferment fiber into volatile fatty acids, which, in turn, stimulates intestinal motility. Another positive effect of fibers is that it slows down the absorption of glucose and cholesterol.

One of the major dysfunctions of the digestive system is impairment of absorption of nutrients or fluids through intestinal tissue into the blood stream. Such disorders are called “malabsorption syndromes” and are caused by:

1. Deficiency of one or more digestive enzymes. The most common malabsorption syndrome results from a deficiency of the enzyme lactose (lactose intolerance). When the sugar lactose (a disaccharide or double sugar) cannot be digested into two monosaccharides (single sugars), it cannot be absorbed.

As a result, a high load of lactose reaches the colon. Its presence causes:
A. Elevations of the osmotic pressure of stool, which limits water absorption. Too much water remains in the large intestine and may cause diarrhea.

B. The bacteria within the colon (which normally contains many nonpathogenic organisms) utilize and ferment nutrients, such as lactose, producing much gas or flatulence in the process.

C. If the loss of water and minerals becomes excessive, the individual will become dehydrated.

Deficiencies of other enzymes, such as sucrase (sucrose intolerance) are possible. Although these are not as common as lactose intolerance, they can cause similar symptoms.

2. Reduced secretion of bile, a produce of the liver that emulsifies lipids (emulsification permits water and oil to mix rather than remaining as separate phases): The bile is stored in the gallbladder and when lipids enter the small intestine, the gall bladder releases the content of bile. Bile helps to disperse lipids, giving their molecules larger surface area for digestion by certain enzymes so they can be absorbed. Bile insufficiencies can result from liver disease, bile duct obstruction, bacterial reduction of bile acids, drug reactions, or surgical removal of gall bladder. When any of these occurs, lipids will not be absorbed and end up in the large intestine (a disease called steatorrhea). As the result, the stools are bulky, pale, frothy, foul smelling, and greasy because of their fat content.

3. An inadequate absorptive surface for nutrients has many causes including surgery, inflammation, or damage to the gut surface, etc. The nutrients end up in the large intestine causing symptoms similar to those mentioned for lactose intolerance.

4. Diabetes or other endocrine diseases.

5. Lymphatic and/or cardiovascular disorders.
6. Rapid movement of stool through small intestine due to outpouring of water and electrolytes (minerals); or outpouring of mucous, blood, and plasma proteins, and, in turn, accumulation of water and electrolytes. The cause of these problems may be bacterial toxins, viruses, etc. When the contents of the small intestine are not given enough chance to get discarded, presence of nutrients in the large intestine causes symptoms as explained above. If the speed of passage of the contents is too high through the large intestine, water cannot be absorbed and stool will be watery.
As noted, many of the above dysfunctions cause diarrhea. **Diarrhea** is defined as “frequent evacuations of liquid stools accompanied by excessive loss of fluids and electrolytes, especially sodium and potassium ions”.

The following treatments are recommended for diarrhea:

1. **Removal of the cause.**
2. **Fast until the acute phase is over.**
3. **Rehydrate, if dehydration has taken place, especially by administering sodium and potassium ions.**
4. **Eat sparingly. Initially, proper foods should be liquids such as bouillon and fruit juices. Applesauce would be helpful because of its pectin content.**
5. **Avoid dairy products because they contain lactose (the activity of the enzyme, lactase, may be diminished during diarrhea).**
6. **When diarrhea stops, begin administering solid food, starting with low fiber foods and followed by protein-rich ones.**

In infants and children, diarrhea can be quite dangerous when extreme dehydration occurs. Rehydration should be immediate and aggressive.

**Constipation** is defined as “infrequent and difficult passage of stools”. The many causes of constipation include:

1. **Low fiber diet:** This, a major cause, occurs from diets poor in fiber. The stool has low bulkiness so that it takes much time to pass through the large intestine, and as a result of losing too much water there, takes on the hardened consistency or constipation.
2. **Side effects of certain medications.**
3. **Lack of exercise.**
4. **Delaying the urge to defecate.**
5. Any factor that slows the motility of the large intestine including nerves, muscular or vascular disorders.


7. Anal fissures or hemorrhoids.

8. Laxative abuse.

The following are helpful in treating constipation:

1. A fiber, fluid-rich diet is the best way. Most people suffering from constipation follow diets with inadequate bulk. Also, regular eating times can help.

2. Regularity of elimination.

3. Other good health habits such as adequate sleep, rest, and relaxation.

4. Exercise is very important.

5. Massaging the colon from its beginning towards the rectum is helpful too.

6. If all above fail and laxatives are needed, it is wisest to use a mild laxative. The best ones contain soluble fiber such as psyllium. Also, prunes and prune juice contain the chemical hydroxypehnylisatin, which stimulates intestinal motility. Sometimes mineral oil will be helpful too.

7. If one suffers from hemorrhoids or anal fissures, treatment of those diseases will help ease the elimination process.

One chronic disease, the “Irritable Bowel Syndrome” or IBS, has no known cause. Its symptoms are either diarrhea, diarrhea and constipation together, or alternating constipation and diarrhea. This affliction generally begins in early adulthood and lasts for years.
There is no cure except to remove irritating foods and to undertake symptomatic treatment for the constipation and/or diarrhea.

**Flatulence or gas** is a condition resulting from gas accumulation in the intestines. If the gas is concentrated close to the rectum, it can be expelled. However, sometimes the gas is higher up along the intestinal tract and causes bloating, especially if for some reason, it cannot move toward the rectum (possibly due to narrowing of the passageway from bends or flexure along the tract).

Most of the gas results from inhaling or swallowing air (aerophagia), which contains nitrogen and oxygen. This gas can be gotten rid of by belching (eructation) and generally does not cause bloating. To avoid aerophagia, one should chew with mouth closed, avoid eating rapidly, and drink fluids with straws. A certain amount of gas (7-10 liters per day) can be absorbed in the colon and whatever remains will be lost via the rectum without being aware of it. However, excessive amounts of gas will cause discomfort and bloating.

Most of the gas that causes bloating is formed by bacterial fermentation of food in the intestines, especially the large intestine. These gases contain mostly hydrogen and oxygen, and small amounts of nitrogen, carbon dioxide, and methane. The material fermented can be certain fibers, lactose (in lactose intolerance), and dried beans that contain both very branched polysaccharides, which cannot be digested easily, and other indigestible carbohydrates such as stachyase and/or raffinose.

Gas producing vegetables are kidney beans, lima beans, navy beans, broccoli, Brussels sprouts, cabbage, cauliflower, corn, cucumbers, leeks, lentils, onion, peas, green peppers, radishes, sauerkraut, scallions, shallots, soybeans, and turnips, and gas-producing fruits are apples, avocados, cantaloupe, honeydew melon, and watermelon.

**Vomiting** is a reflex by the diaphragm (muscular membrane separating abdominal and thoracic cavities) pressing against the stomach, causing it to empty its contents into the outside world via the esophagus, pharynx and mouth. This reflex is caused by excitation of nerves due to:
1. Fear, anxiety or disgust.

2. Motion sickness.

3. Local irritation of the auditory nerve by drugs, poisons, or certain diseases of the digestive, cardiovascular or reproductive systems.

4. Certain emetic drugs (drugs causing vomiting).

5. Certain infections.

6. Overeating.

Eating disorders:

Although eating or feeding disorders have been observed throughout the history of mankind, never before have so many young people, especially women, been afflicted by eating disorders in the Western World.

The apparent reason is that many people in these societies adore the slick figures of models and some of the celebrities who starve themselves to be thin, and these thin figures serve as models for the young. As a result, eating disorders such as anorexia nervosa and bulimia are not uncommon.

If the appetite is lost from a medical problem, the person is suffering from simple anorexia. However, in anorexia nervosa, the individual has an intense desire to remain thin even though the appetite is not lost. These people who may lose up to 25% of their body weight and undergo malnutrition, suffer from a psychiatric disorder whose cause is unknown. These patients are in a state of semi-starvation and induce vomiting, exercise excessively, and exhibit metabolic and hormonal disturbances, hypothermia, cardiac problems, and in women, failure to menstruate (amenorrhea).

Since there is a high incidence of suicide among these individuals, they should be treated as soon as possible so as to reverse the effects of malnutrition. They require individual and/or family group psychotherapy, and may even have to be hospitalized. However, such patients usually fail to cooperate and often end up committing suicide.
or die from malnutrition or starvation. Even if treated, there is a high incident of relapse.

Another common eating disorder is bulimia. Like anorexia nervosa, it is a psychiatric eating disorder of unknown cause found mostly in young women. However, these individuals are of normal weight or even may be slightly overweight, but that have a morbid fear of getting fat. As a result, they go through repetitive bouts of first gorging foods such as ice cream, cadies, or doughnuts, then self-induce vomiting and laxative abuse. They have a history of depression and struggle for self-identity. They usually suffer from malnutrition, dental caries, and chronic sore throat (from frequent vomiting of stomach acid) but show no sign of menstrual irregularity. They also try to hide their abnormal behavior.

As with anorexia nervosa, there is also a high suicide rate and these individuals need immediate supervision through long-term psychotherapy even though there is generally little cooperation.

There is no known prevention for either disease yet.

**Food Allergies:**

Food allergies should not be confused with food intolerance. The former involves immune reaction, but the latter does not.

The process of initiating an immune reaction is as follows:

1. The food contains a macromolecule (generally a protein referred to as an allergen), which is absorbed through the gut and enters the circulation. Since, as mentioned before, only small molecules (monomers such as amino acids) can be absorbed, macromolecule cannot get into the circulation. However, sometimes absorptive barrier fails for one of the following reasons:
   a. Intestinal permeability is greatest in infancy and declines with increasing age.
   b. Gastrointestinal diseases or malnutrition can damage the gut wall thereby increasing permeability.
2. When a foreign protein (allergen) enters the circulation it may produce an allergic reaction in some people (just as a
foreign tissue is rejected after transplantation). The presence of an allergen stimulates production of certain protein molecules, known as antibodies that can bind to the allergen.

3. Binding of the antibody with the allergen activates the production of compounds such as histamine. Histamine may cause such adverse reaction, as hay fever, edema (swelling of tissues), nausea and vomiting, diarrhea, eczema, or even more severe reactions that may lead to death. (To recognize the effect of histamine, think of taking an antihistamine during a cold or flu to counteract histamine. It is the histamine that is responsible for the runny nose and congestion.

The chance of developing an allergy depends on the following factors:

b. Exposure to allergenic food.
c. Gastrointestinal permeability.
d. The amount the suspected food consumes. Sometimes a small intake of the allergen can be tolerated but a large amount causes an immune reaction.
e. Environmental factors: Some people react to a number of environmental influences that can intensify immune responses. These generally include house dust, mites, mold, feathers, animal dander, pollens, and tobacco smoke; even cold weather, stress or excessive exercise may do this.

Common food allergens are usually those foods with a high protein content. In children, these include cow’s milk, soy products, peanuts, eggs, wheat, and fish. In adults, such foods as corn, rice, rye, nuts, shrimp, chicken, turkey, pork, beer, bananas, squash, and potatoes may be allergenic.

Food intolerance can induce adverse reactions that originate from the toxic effect of a chemical in food, or from an agent that cannot be metabolized, or whose metabolic products are irritating. Examples are lactose intolerance (lactase deficiency), previously described, or similarly sucrose intolerance, etc. Foods containing additives such as preservatives, flavor enhancers (monosodium glutamate or MSG), and
coloring agents can cause food intolerance in certain people. Intake of MSG may produce headache, nausea, flushing, abdominal pain and asthma. Also, adverse reactions from sulfites in food have been observed (sulfites are food additives used to control microbial growth).

**Inflammation of the gut:**

Depending on the part of the digestive system involved or the cause of the inflammation, the gut is subject to many diseases of this nature.

Gastritis is an inflammatory disease of the stomach that may cause bleeding, belching, pain, and vomiting. The inflammation can arise from a variety of factors such as irritating foods, alcoholic beverages, aspirin (salicylates), ingested poisons, and even flu.

Gastroenteritis, an inflammatory disease of the stomach and small intestine, may also be referred to as Traveler’s Diarrhea or food poisoning. It may be caused by bacteria, parasitic protozoa, such as amoeba, or by viruses. Ingestions of poisons or toxins may also be responsible. Many pathogens, especially certain bacteria, metabolically produce a poison or toxin used in their life cycle to immobilize or kill other small organisms to provide food or living space. Penicillin, for example, is a kind of mold that kills many bacteria. And pathogenic bacteria such as E. Coli may produce toxins. When food contaminated with these agents is ingested, the subject will become sick or may even die if untreated. It is the poison that does the job.

The infection may also be caused by direct contact with an infected person. Depending on which pathogenic organism is involved, different symptoms may arise such as diarrhea, cramping, nausea, vomiting, malaise, fever, and rumbling stomach sounds.

Appendicitis or inflammation of appendix (vermiform appendix which has an immune function). Appendix is a small extension or colon (large intestine) which may get infected initially due to obstruction by a piece of feces, neoplasm, foreign body, or worms. Whatever the initial reason would be, the agent causes inflammation, infection, and eventually necrosis (death of tissue) of appendix will result and may be life threatening. The symptoms of acute appendicitis are pain around
appendix (right side of belly), nausea, vomiting, fever, malaise, diarrhea or constipation, or even anorexia.

Colitis is inflammation of colon especially the part close to the rectum. Colitis should not be confused with colic which is abdominal pain in infants due to excess gas by rapid feeding, over eating, swallowing air, etc. Colitis sometimes involves ulceration (many lesions) on the colon (called ulcerative colitis). The cause is unknown but may be due to stress and irritating foods. The symptoms are bloody diarrhea, accompanied by abdominal pain, and urgency to evacuate.

**Gastric and Duodenal Ulcers:**

The gastric juice contains a strong acid (HCl) that can destroy any tissue, but its presence is necessary to act on undigested food arriving in the stomach from the esophagus and also to kill most of the pathogens ingested. The entire inner lining of the stomach, from its junctions with the lower end of the esophagus, and upper, initial portion of the small intestine (the duodenum), is covered by a layer of mucus secreted by the stomach. Mucus is a viscous, slippery fluid containing mucin and acid neutralizing bicarbonate that serves to protect the stomach's tissue from the destructive action of acidic gastric juice. Additional bicarbonate is secreted into duodenum to neutralize the semi fluid mass of partly digested food entering from the stomach (chyme). It sometimes happens that gastric juice makes contact with the living tissue of the stomach or upper duodenum. When this occurs, the acid erodes the surface locally causing a crater-like lesion known as an ulcer. Ulcers may result from over secretion of, or deficient neutralization of gastric juice (peptic ulcer), or may be associated with certain malignancies or infectious diseases (gastric ulcers).

Peptic ulcers occur far more frequently in the upper duodenum (duodenal ulcers) than in the stomach. Likely contributory factors associated with over secretion or under neutralization are smoking, reaction to certain drugs, such as aspirin, or NSAID (nonsteroid anti-inflammatory drugs), excessive stress, or hereditary factors.

Symptoms of peptic ulcers are heartburn, indigestion, nausea and vomiting, weight loss, or even sometimes bleeding. The treatment of peptic ulcers involve:
Neutralization of gastric acid by antacids.
2. Reduction of acid secretion by the stomach using drugs such as Tagamet (Cimetidire), which helps to prevent recurrences.
3. Prevention of further erosion of gut lining by acids using agents that either help form a viscous coating over the ulcer center or promote healing (milk can have such an effect).
4. Use of antibiotics or, even, sometimes surgery (if complications occur).

Peptic ulcer sufferers should follow certain nutritional habits:

1. Eat regularly three meals a day avoiding hunger states.
2. Avoid eating too much in order to decrease stomach distention.
3. Avoid drinking coffee (regular or decaffeinated) and/or alcohol.
4. Avoid smoking.
5. Avoid aspirin and similar drugs (NSAID) as much as possible.
6. Avoid any food or drink that causes discomfort.
7. Remove stressing factors as much as possible, especially while dining.
8. Take antacids after meals and at bedtime.

**Hepatitis, Jaundice, and Cirrhosis of the Liver:**

The liver is one of the most essential organs of the body due to numerous complex functions it performs (so-called LIVER). The functions of the liver include:

1. Secretion of bile into the gall bladder.
2. Detoxification of poison and drugs.
3. Many major metabolic processes such as converting amino acids into certain blood and tissue proteins, as well as into sugar or
fat; formation and storage of glycogen (sugar reserve); glucose production from glycogen and distribution of ingested glucose throughout the body after a meal; changing glycerol (from ingested fats) into glycogen; utilization of dietary fatty acids for energy production; and ketone body formation (ketosis which is formation of ketone bodies such as acetone when lipid and thereby acetic acid concentration goes up).

Hepatitis is inflammation of the liver (hepat- liver; itis = inflammation). It may result from the death of liver cells (hepatocellular necrosis), and its symptoms and signs are malaise, anorexia, nausea, enlargement and tenderness of the liver, and usually jaundice (explained later). The usual cause of hepatitis is viruses, so-called viral hepatitis. There are five different causative agents for viral hepatitis resulting in hepatitis A (HAV), Hepatitis B, Hepatitis C, Hepatitis D, and Hepatitis E.

The initial symptoms of viral hepatitis are similar to flu (vague), which are malaise, fatigue, anorexia, muscle pain and tenderness, exhaustion, fever, dark-colored urine, clay-colored stools, rashes, abdominal pain, and severe itching. Sometimes the patient has a tendency to smoke excessively or devour certain foods. After the incubation period, the patient experiences fever, malaise, and anorexia. However, the disease is generally self-limiting and results in complete recovery. In a few cases, it may turn into chronic hepatitis, or even kill the patient.

Another indication of these diseases is jaundice, a clinical sign characterized by yellowish coloration of the skin, whites of the eyes, and body fluids. Normally, blood hemoglobin is transformed into bilirubin (a yellowish to orange compound) before being disposed of by mixing with bile and collecting in the gall bladder. When the liver does not function properly, the bilirubin is distributed by blood throughout the body giving it a yellow discoloration. This is one of the signs seen in viral hepatitis.

The cause of death from viral hepatitis is generally late complication, known as cirrhosis of the liver. Cirrhosis is a chronic, progressive liver disease characterized by failure of the liver cell function and hypertension. The causes of cirrhosis are:

1. Viral hepatitis.
2. Infections of the liver due to bacteria (e.g., staphylococci, streptococci, etc.) or parasites.
3. Chronic hepatitis.
4. Excessive alcohol consumption.
5. Certain chemicals, medications, or poisons.

Gallstones:

Gallstones are solids formed in the gall bladder, an organ located under the liver that receives and collects bile. Bile is formed in the liver and functions to emulsify lipids in the intestine. Although lipids are insoluble in water, bile is able to get them into a single-phase mixture with water so that they can be digested. Once lipids enter the intestine, the gall bladder releases bile into the intestine. Individuals who have lost their gall bladder through surgery cannot digest lipids well because the bile seeps slowly into the intestine from the liver, rather than in larger amounts from the gall bladder after meals.

Gallstones may contain one or more of the following:

1. Cholesterol.
2. Pigments formed from breakdown of hemoglobin (called bile pigments such as bilirubin).
3. Calcium carbonate (a salt).

These stones measure from a few millimeters to a few centimeters in size and may be present in the gall bladder as a single or multiple stones.

The stones may arise from a variety of factors including:

1. Diets rich in cholesterol (the highest incidence is in North American Indians).
4. Infection and inflammation of the gall bladder (cholecystitis).
5. Diabetes.

Clinical manifestation:
1. There may be no symptoms except for mild indigestion (dyspepsia).

2. The gallstone may lodge in the neck of the organ. As a result, an incomplete or complete blockage may arise so that normal bile flow to the small intestine is affected. The process of stone formation may give rise to infections of the gall bladder.

Hemorrhoids:

Hemorrhoids occur when veins in the anal canal become engorged and cannot drain adequately. They are similar to varicose veins except that varicose veins occur in the legs. Hemorrhoids can be internal or external depending how deep in the canal they are located.

The symptoms of hemorrhoids are pain, especially during bowel movements, bleeding, protrusions, and itching. Sometimes anal fissures complicate the situation.

For mild hemorrhoids, hydrocortisone creams are prescribed. However, there may be a need for surgery if the symptoms become too severe.