Vineyard Labourer Bible College

Health and Hygiene Module 4

"Beloved, I wish above all things that thou mayest prosper and be in health,
even as thy soul prospereth." 3 John 1:2

"Trust in the LORD with all thine heart; and lean not unto thine own understanding.
In all thy ways acknowledge him, and he shall direct thy paths.
Be not wise in thine own eyes: fear the LORD, and depart from evil.
It shall be health to thy navel, and marrow to thy bones."
Proverbs 3:5-8

"Since the mind and the soul find expression through the body, both mental and spiritual vigor are in great degree dependent upon physical strength and activity; whatever promotes physical health, promotes the development of a strong mind and a well-balanced character. Without health no one can as distinctly understand or as completely fulfill his obligations to himself, to his fellow beings, or to his Creator. Therefore the health should be as faithfully guarded as the character. A knowledge of physiology and hygiene should be the basis of all educational effort."
Education by E. White, page 195 para. 1.

"When properly conducted, the health work is an entering wedge, making a way for other truths to reach the heart. When the third angel's message is received in its fullness, health reform will be given its place in the councils of the conference, in the work of the church, in the home, at the table, and in all the household arrangements. Then the right arm will serve and protect the body."
Vol. 6 Testimonies For The Church by E. White, page 327 para. 2.

"Never should the Bible be studied without prayer. Before opening its pages we should ask for the enlightenment of the Holy Spirit, and it will be given."
Steps to Christ by E. White, page 91 para 1.

Vineyard Labourer Bible College Training for the Christian Walk

4a - Basic Anatomy Of The Human Body

7. DIGESTIVE SYSTEM

Digestion is the process of by which food is ingested, digested, absorbed and assimilated. Although the digestive system is usually divided into two parts, the main part is the alimentary canal. This canal or tube begins at the mouth, throat, esophagus, stomach, the small and large intestines, and ends with the anus. Over all it is about nine metres long. The other part of the digestive system include organs and glands that assist in digestion are teeth, tongue, salivary glands, pancreas, liver and gallbladder.

Most food as it is, cannot be digested by the body because the pieces are too big, their chemical complexity, and because some foods, like fats, are not water soluble. Consequently it cannot be absorbed into the bloodstream and pass into the body cells to feed them. So digestion is both a physical and chemical process. Physical because of the chewing action of the teeth so the food is broken into smaller particles and the churning action of the stomach wall, and chemical because the large molecules of food needs to be broken down in to simple ones so that absorption can take place. Digestive enzymes in the mouth, bile from the liver, and pancreatic juice from the pancreas bring about chemical changes. If digestion takes place too quickly the chemical changes that need to happen for absorption to happen, don't have time to take place. On the other hand if it is too slow then the food will become fermented and can cause other problems.

A balanced diet concentrating on a mixture of protein, carbohydrates and fats is important for our digestive system and the resulting conversion into energy. Vitamins, minerals, trace elements, water and fibre or roughage are also important. However, the energy needs of a human vary depending on age, sex, weight, and activity level.

The mouth includes the tongue, teeth, and the hard and soft palates. In the mouth food is chewed and broken into smaller pieces. It is also turned over, and tasted by the tongue a sensory organ, as well as mixed with saliva. Saliva is made up of water, mucus, and digestive enzymes. There are three sets of salivary glands called the parotid glands, sublingual glands and the submaxillary glands. In total the mouth excretes about 1.7 litres of saliva secretions a day. If dry food is eaten, then more saliva is produced than if liquid food is eaten Taste buds react to liquids, so when the food is mixed with the saliva it can be tasted. The saliva which starts to break down food, also keeps your mouth moist, and makes it easier to swallow food.

The act of swallowing food involves quite a few different parts of the mouth and throat. However, putting it simply the food is pushed to the back of the throat into the pharynx. The epiglottis blocks the tube leading down to the lungs, making the food enter the esophagus. Sometimes the epiglottis doesn't totally block off the tube and a small amount of food or liquid enters. When this happens we cough violently to expel it from the tube. The esophagus begins at the pharynx and ends at the stomach and is about twenty-five to thirty centimetres long. The muscle that joins the esophagus and stomach opens to allow food down into the stomach and then closes to prevent backflow. When this muscles is weak the acid called hydrochloric acid, from the stomach splashes up the esophagus and causes a lot of pain. We call this heartburn, although it has nothing to do with the heart.

The stomach continues the work of reducing the size of food and breaking it down, that the mouth and teeth started. The stomach wall is made up of three layers of muscles which when contracted cause a twisting, kneading action that helps to break up the food. The stomach is lined with a thick mucous layer which protects it from the digestive juices, so that the stomach does not digest itself. Sometimes this layer is perforated allowing the acids to attack the stomach. This is

called an ulcer and needs to be treated. Alcohol is absorbed in the stomach. The stomach is also lined with gastric glands which secrete enzymes that break down the food molecules. As the food moved through the stomach it becomes smaller and smaller particles until it reaches the pyloric antrum. The pressure builds up slightly here which helps push the food through the sphincter valve into the small intestine.

The small intestine is a small-coiled tube which linings are similar to that of the stomach. The small intestine has three very similar sections called the duodenum, jejunum and the ileum which is the longest part. The duodenum and jejunum walls are arranged in circular folds which increase their surface area. This greater surface area allows for more glands to secret digestive juices, and a larger area for absorption of soluble nutrients. These digestive juices along with enzyme secretions from the pancreas and liver completely break the food down in to the simplest molecules. It is here that carbohydrates are broken down to glucose, proteins are split in to amino acids, and fats are turned in to fatty acids. The glucose and amino acids are then ready for absorption by the blood and the fatty acids are absorbed by the lymph glands to be taken all around the body to feed hungry cells or stored.

Four or five million villi or microscopic finger-like projections line the small intestines. As the intestine pushes the food along by waves of contractions called peristalsis, the villi sway which helps mix the food. The villi also bring the blood and the lymphatic vessels close to the surface so that nutrients can be absorbed. Glycerol and fatty acids are carried away by the lymph, while sugars and amino acids are absorbed into the blood.

From the small intestine the watery mass of undigested food goes in to the large intestine. This occurs somewhere between two and five hours after eating. Although the small and large intestine walls are very similar, the large intestine does not have villi for absorbing nutrients. Its most important job is the reabsorption of water and essential salts or electrolytes and passing it onto the blood. It also absorbs small amounts of digested food still present. There is also a lot of bacteria in the large intestine which feed on partly digested food turning it into sugar. The large intestine also produces a lot of mucus to lubricate the passage of the dried out food remains or faeces. The opening between the small and large intestine is the ileocecal valve which is two projecting lips that stop material from flowing back into the small intestine. This opening is located in the lower right quadrant of the abdomen. Below this join is the caecum, which has a small finger-like protrusion called the vermiform appendix. Sometimes the vermiform appendix can become inflamed when particles become lodged there and putrefy, this very painful condition is called appendicitis. If the inflammation continues without treatment the appendix will rupture, which can cause peritonitis and the sufferer to die.

The large intestine is sometimes called the colon, but this term only properly describes the part of the large intestine from the caecum to the rectum. The colon is shaped like an upside down 'U' with an 'S' curve at its lower end. It is divided into four sections called the Ascending Colon which runs up the right side of the abdominal cavity, Transverse Colon which runs across the top of the cavity beneath the diaphragm, Descending colon which declines down the left side of the cavity, and the Sigmoid Colon which is the 'S' curve at the end. The colon stores the faces until there is a build up at which time defecation occurs through the rectum. There are two sphincter valves at each end of the rectum which terminates at the anus, which remain tightly shut, except during defecation.

There are also three more glands that play a major roll in the digestive process. They are the liver, pancreas, and the gallbladder.

The liver is the bodies largest internal organ or gland weighing in at about 1.2-1.8 kg. (3-4 lbs.) in an adult. The liver has many functions, but the most important three of these are: 1. Secretion of bile which helps with the digestion of fat in the small intestine. It is slightly alkaline and helps neutralise the acidity of the partially digested food from the stomach. Some of the bile is reabsorbed in the small intestine and excreted in the urine as bile salts. Some of the bile is also concentrated

and temporarily stored in the gall bladder. 2. Storage of vitamins A, B, D, iron and glycogen. and 3. The conversion and combining of separate elements involves fats, proteins. and carbohydrates, and also the detoxification processes. The spleen assists the liver by removing damaged blood cells. The spleen is an organ full of toxins and if damaged is life threatening. Emergency life-saving surgery is necessary to take it out.

The pancreas produces a digestive secretion which varies to the composition of food stuff. It contains three enzymes that breaks down all types of organic nutrients. The pancreatic duct usually joins the main bile duct which ends in the duodenum. Insulin, a hormone that allows cells to remove glucose from the bloodstream and to use it for energy, is also secreted from the pancreas cells called the islets of Langerhans. When the pancreas fails to produce enough insulin, the level of glucose in the bloodstream rises and a condition known as diabetes mellitus results. If the pancreas secretes too much insulin, blood sugar levels fall, resulting in a condition called hypoglycemia.

The gallbladder stores bile from the liver for when it is needed. As it is rather small the water is extracted from the gall or bile before being stored. Hormones cause the muscles of the gallbladder to contract when the gall is needed quickly when gastric juices and fatty foods enter the small intestine. The gall passes through the main bile duct which joins with the duct of the pancreas, to the duodenum. Should calculi form from minerals in the bile, thus blocking the bile duct, the painful condition of Cholecystitis results.

Questions of the lesson.

1. What are the two parts of the digestive system?
2. Give three reasons why most food cannot be digested as is?
3. What is saliva made up of and what does it do?
4. How does the stomach break food down?
5. What are the three parts of the small intestine?
6. How many and what is the job of the villi?
7. Name all seven parts of the large intestine.
8. What is the most important job of the large intestine?
9. What are the three most important functions of the liver?
10. What happens when the pancreas produces too much or too little insulin?

Further Study

- Draw a basic diagram of the digestive system naming all the parts mentioned in this study. Find information about which foods are broken down and digested where and make up a chart with the information.

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4b - Basic Anatomy Of The Human Body

8. URINARY SYSTEM

The human body has four organs for the removal of waste products. The skin removes excess heat that is not removed by breathing. This is helped by evaporation of sweat, which also includes nitrogenous waste, salts, and water. The lungs remove carbon dioxide and a variable amount of water and heat. The intestinal tract discharges the residues of the food, and a small amount of heat, water, some salts, and special water materials such as the bile pigments. The kidney, the excretory organ of the urinary system, is the structure specialized for the removal of the waste products that are carried out of the body in liquid form. This includes nitrogenous waste, and excess salts and water. Each of the body's cells excretes its wastes into the blood stream which carries the acids and salts to the kidneys for expulsion. Another important function of the kidney is the regulation of the make-up of the blood by retaining or expelling water, sugar, salts, and other substances. If this delicate balance varies beyond its narrow limits tissues or even the organism can die.

The urinary system consists of two kidneys, two ureters - one tube leading from each kidney, bladder, and urethra. The kidneys are located in the small of the back behind the liver and stomach, with the right kidney lower than the left. They are covered by peritoneum and embedded in fat. The bladder is located in the front of the pelvis and the ureters curve around the lower part of the abdomen to meet it. The urethra is different for males and females. In males it is about 20 cm long and is joined by the reproductive ducts and opens at the tip of the penis. Whereas in females it is only about 4 cm long and opens in front of the vagina.

Each kidney is about 11 cm long, 5 cm wide, and 3 cm thick, and weighs between 120 and 300 grams. They are in the shape of a bean with the vein, artery, and ureters all connected to the concave bend. They have a fibrous capsule covering the outside and lining the renal capsule. Each kidney consists of one to four million elongated tubules, arranged in orderly yet complicated patterns. At the commencement of each tubule is a renal corpuscle, and expanded end of the tubule with a cluster of blood capillaries. The capillaries of the renal corpuscles have high blood pressure which results in the filtration of water, wastes, glucose and salts. About 140 litres of water per day are filtered by the kidneys. Most of this water which contains compounds and minerals, is reabsorbed in the tubules and back into the blood stream. However, nitrogenous wastes, excess water, and salts which make up the urine pass into a basin-like structure called the renal pelvis. From here it pass through the ureters. The blood returning from the kidney has very little waste in it.

The kidneys are an extraordinary organ, in that if one is damaged or destroyed and has to be removed, the other will enlarge and do the work that both of them used to do. The kidneys also help to maintain the fine balance of our body's acid/alkaline content. They do this by identifying the salts and minerals that are to be excreted and those that are to be retained in the purified blood of the body.

The ureters are tubes which are about 5 mm in diameter, and 20 cm in length. They are made up of three layers. A mucous membrane lining, covered with a smooth muscle. The mucous membrane gives the ureters elasticity, while the smooth muscle contracts 1 - 4 times per minute in wave like movements which forces the urine down to the bladder. The outer layer is a casing of connective tissue which contains blood vessels and nerves.

The bladder is a smooth-muscle, very extensible, very elastic bag which functions as a reservoir and an expeller of the urine. Usually it can hold about 350 - 500 ml of fluid, but this can vary greatly between persons depending on training. However, the desire to urinate occurs at approx. 150 - 200 ml. When the bladder is empty it looks like a loose sack, but when full it appears spherical.

Just after the urethra leaves the bladder there are two sets of sphincter muscles in its walls. The sphincter nearest the bladder is not under the control of the will, while the second sphincter is. When the bladder accumulates about 150 - 200 ml of urine a reflex action relaxes the inner sphincter muscle. The act of expelling urine is called Micturition. This is a voluntary action commenced by relaxing the external sphincter. Only urine passes through the female urethra which exits the body in front of the vagina, while products of the genital system and urine pass through the male urethra which exits the body at the end of the penis.

Questions on the lesson.

1. What is the excretory organ of the urinary system?
2. What are the waste products expelled by the urinary system?
3. What does the urinary system consist of?
4. Where are each of these located?
5. What shape is the kidney?
6. What happens in the tubules?
7. What are the three layers of the ureter?
8. What is the function of the bladder?
9. Which sphincter muscle is consciously controlled?
10. What is the differences between the male and female urethra?

Further study.

- Copy a diagram of the urinary system.
- Find out what the consequences would be to a kidney if you don't drink enough water.

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4c - Basic Anatomy Of The Human Body

9. REPRODUCTIVE SYSTEM

The reproductive system consists of those structures concerned with producing offspring by combining genes from the male and female. The main function of the male reproductive system is to produce, store, and deliver the sperm cells to the female. The main function of the female reproductive system is to produce the ova or egg, to supply the pathway for fertilization, and to provide a suitable place called the uterus, for a fertilized egg to grow and receive nourishment during the early part of its life.

Male Reproductive System

Testes or male gonads are the male's reproductive glands. They are in the shape of an egg, but are about the size of a plum. The testes develop in the abdomen, but just before birth they descend to the groin and are suspended in a pouch outside of the body called the scrotum. This is essential for the normal development of the sperm which require a slightly lower temperature then what the abdomen usually is. Following the onset of puberty the testes produce about 200 million immature and non-mobile sperm cells a day which are stored in the epididymis. Here the sperm cells mature and are stored until required. The second function of the testes is the production of testosterone, the male sex hormone.

The penis is the male copulative organ which allows sperm to pass from the male to the female during sexual union. It is short and soft when not in use, but contains special strands of cavernous tissue which can swell with blood causing stiffness. During the sexual act the veins which normally allow the blood to flow away, close causing the cavernous tissue to swell causing stiffness or erection. The sperm which has been stored in the epididymis, now travels through ducts which pass through the prostate gland and join the urethra. The prostate gland is a series of glands completely surrounding the ejaculatory ducts and the urethra at a point just beyond the urinary bladder. The prostate gland secretes an alkaline, runny, milky fluid that enhances the sperm's movement, and the Cowper's gland secretes a protective lubricating mucus. Ejaculation or the expulsion of the semen which is made up of sperm and the secretions from the prostate and Cowper's glands, occurs as a result of the sudden contraction of muscles under nervous stimulation. The sperm is ejaculated into the urethra and penis and from there into the female's vagina. Although only one sperm cell is needed to fertilize the egg, ejaculation contains about two to three hundred million sperm greatly increasing the possibility that fertilization will occur. With a sperm count of less than fifty million per ejaculation, a male is usually incapable of fertilizing the egg.

Female Reproductive System

Ovaries, fallopian tubes, a uterus, a vagina, external genitalia or vulva, and two breast or mammary glands are the organs of the female reproductive system.

The ovaries are located in the pelvic region. In a young girl they have approximately 1 million potential eggs in each ovary. However, only a small number of these ever reach maturity. In the ovary of a sexually mature female are found a number of maturing follicle. During each menstrual cycle a primary follicle matures in one of the ovaries to become an egg. Approximately half way through the menstrual cycle the mature egg or ovum is extruded or ovulated from the ovary into the fallopian tube. It is at this time that a female may become pregnant. During this process the

hormones estrogen and progesterone are produced. These hormones prepare the uterus for the implantation of the egg and nourishment of the fertilized egg cell. The fallopian tubes are 10 - 20 cm long tubes which are lined with a mucus membrane containing various glands and ciliated membrane tissue. This mucus lining and especially the ciliated membrane with its hair-like projections which are capable of a lashing movement help the egg to move along the tubes to the uterus. This transportation is helped by a contraction of the fallopian muscles towards the uterus. The cilia also helps the sperm swim up the tubes toward the egg.

The uterus is a hollow pear shaped organ the neck of which is called the cervix. The top end of the uterus is connected to the two fallopian tubes. The uterus has three layers. The outer layer of connective tissue, and layer of smooth muscle, and the inner layer of connective tissue which is lined with a thick mucus and a mucus membrane that varies in thickness from 2 - 8 cm depending on the time of the menstrual cycle. This mucus membrane is called the endometrium. After menstruation the endometrium is thin. As the egg matures in the ovary, the endometrium becomes thicker; its uterine glands elongate and its blood vessels increase in number. After the egg has ovulated the endometrium continues to grow in thickness in preparation for a fertilized egg. If the egg is not fertilized the endometrium finally breaks down and menstruation takes place. The menstrual flow which includes the unfertilized egg passes out of the body through the vagina. The cycle of menstruation then commences again and continues until menopause, when production of ova ceases. Sometimes the endometrium grows on the outside of the uterus which is called endometriosis. This is a very painful condition especially during menstruation which requires medical treatment.

If fertilization of the egg occurs, the egg implants in the endometrium about a week after fertilization. The day before implanting in the endometrium the embryo develops a specific defence known as IDO, which prevents the mother's immune system from detecting it as 'foreign' tissue and expelling it. When this defence mechanism fails miscarriage results. A number of structures are formed by the development of the egg and two of these are the embryo and the placenta. The placenta is the organ that exchanges foods, gasses and wastes between the developing child and the mother. At two months the embryo is called a foetus. At nine months of gestation the foetus has fully developed and is ready for birth. This is when the muscle layers come in. They push the foetus followed by the placenta out of the uterus, through the cervix and vagina, and out the vulva.

The cervix is about 1 inch long and connects the vagina to the uterus. Part of the cervix protrudes directly in the vagina. Its opening is called the external mouth of the uterus. The vagina is a tube-like space of about seven to ten centimetres long composed of connective tissue and muscle. The vagina is very flexible because it is lined with fold of mucus membrane. The flexibility is essential for child birth and sexual intercourse. The primary task of the vagina is to accommodate the penis during sexual intercourse and enabling the sperm to enter the female body. From the vagina the sperm passes through the cervix and uterus, and into the fallopian tubes. If a sperm enters the egg, a membrane that keeps out other sperm forms around the fertilized egg. The fertilized egg is called a zygote.

The group of external organs surrounding the vagina are called the vulva. These include the labium majora and minora which are flaps of skin, the clitoris which is at the very front part of the labium but is covered by them, the urethra comes next, followed by the entrance to the vagina.

The mother's two mammary glands begin to enlarge as the foetus is developing. These glands are composed of fatty tissue as well and glandular tissue. However they do not become functional until after childbirth. The initial secretion is called colostrum and is a yellowish fluid. This is replaced with milk with 2 - 3 days. Milk is the perfect food for the young infant and its composition varies with the age of the baby. It becomes gradually more concentrated as the child's digestion improves. At the height of lactation or secretion of milk, up to 1.5 litres of milk may be formed each day. To supply the nutrients for this it is important for the mother to have adequate supplies in her own diet and drink plenty of water.

Questions on the lesson.

1. What is the main function of the male reproductive system?
2. What is the main function of the female reproductive system?
3. Why is it essential that the testes be suspended in a pouch outside of the body called the scrotum?
4. Where is the prostate gland and what does it do?
5. How many sperm does an ejaculation contain? Why so many?
6. What does a primary follicle mature into?
7. How and why does the endometrium change in thickness?
8. What is a placenta?
9. Why is it necessary for the vagina to be flexible?
10. At the height of lactation how many litres of milk if formed each day?

Further study.

1. Read Te. pages 170 - 173; and 1 M.C.P. pages 131 - 141 about prenatal influences.

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4d - Basic Anatomy Of The Human Body

10. ENDOCRINE SYSTEM

The endocrine system is one of the systems that help to perfectly coordinate the activities of cells and organs in the body. The glands and tissues that make up this system secrete certain chemical compounds. These compounds are called hormones. These hormones are released straight into the blood system, not into tubules, ducts, or specific organs. As these hormones are released in the blood stream they are carried throughout the arterial circulation of the whole body. If one part malfunctions it may bring about the malfunction of others, as well as the normal body functions.

The endocrine glands and tissues are thyroid, parathyroid, pituitary, adrenal, thymus, pineal, testes, ovaries, pancreas, and the villa which line the stomach, intestines and kidneys. There is some dispute over whether the thymus gland is part of the inner brain, and the pineal gland whose function is uncertain, should be included in the endocrine glands.

Thyroid

The two oval shaped thyroid glands are located on either side of the windpipe below the pharynx. They secrete thyroxin which is an iodine containing hormone. This controls the metabolic rate of the body, physical and mental growth, oxidation, rate of heart beat, blood pressure, fertility, temperature, glucose absorption, and the utilization of glucose. The glands require iodine for proper functioning and enlarge when sufficient amounts are not included in the diet or there is overactivity of the secretory vesicles. This enlargement is called a thyrotoxicosis, and produces a goitre or a swelling in the neck. Underactivity of the gland in children causes dwarfed stature called dwarfism and mental retardation, while in adults it causes marked dry skin, loss of hair which is dry, swelling of tissues with resulting weight gain, and decline of mental and physical vigor. This underactivity is called myxoedema.

Parathyroid

There are four parathyroid glands which are located on the back of the thyroid. Their secretion regulates the calcium balance of the body. Calcium is a mineral that plays a role in the nerve and muscle cell function, in blood clotting, and growth of bones. Overactivity of the parathyroid results in bone destruction, calcium deposits in the blood vessels, and kidney stones. A deficiency causes low calcium level in the blood resulting in abnormal calcifications of the skeleton and teeth, contractions and cramps of the skeletal muscles, slows clotting should an injury occur, and nervous irritability.

Pituitary

The pituitary gland is located at the base of the brain. The hormones it secretes influence other glands. The pituitary gland regulates skeletal growth, the development of the reproductive organs, secretions from the ovaries and testes, the stimulation of the mammary glands to provide milk after child birth, blood pressure, raises blood sugar, the performance of smooth muscles, the reabsorption of water in the kidneys, and the functioning of the adrenal cortex, which becomes more active during times of stress. Overactivity during youth may produce a giant, while underactivity may cause dwarfism. Overactivity in adults results in heavy, massive bones which is called Acromegaly.

Adrenal

The adrenal gland sits on the top of the kidneys and consists of two parts - and outer cortex and an inner medulla. The cortex is essential to life and helps in regulating the salt and water balance in the body. The medulla is not essential to life and is actually part of the nervous system. In situations of danger, fright, or stress the adrenal gland secretes adrenaline. This causes blood pressure to rise, the activity of the heart is accelerated, blood vessels contract usually causing facial paleness, and blood sugar rises. The body is now ready for "fight" or "flight". The secretion of adrenaline ceases when the state of excitement has receded.

Thymus

The thymus is located behind the sternum, and over the roots of the great blood vessels. It is large in infants but does not grow as fast as the rest of the body, and from puberty onwards it gradually degenerates. It is important in creating and maintaining immunity or antibodies. The hormones it secretes stimulates the growth of lymphoid tissue and general growth. In adulthood the job of maintaining immunity is taken over by the auto immune system which produces antibodies to protect us.

Pineal

The pineal body is located at the base of the brain is about the size of a pea. Not much research has been conducted into what this gland does. We do know that it is sensitive to light and works in conjunction with the pituitary gland in order the maintain diverse vital processes.

Testes

Only human males have testes. Testosterone is secreted by these testes. This hormone controls the growth of body hair and beards, body size, and the deepening of the voice. Both male and female hormones biologically function according to a specific sex but they are essential in both genders. However the quantities in the different genders varies.

Ovaries

Only women have ovaries. They secrete the two female hormones estrogen and progesterone. Estrogen is responsible for female characteristics and initiates female bodily functions. Progesterone is responsible for the thickening of the mucous membrane of the uterus in preparation for the egg and the development of the placenta. In the case of pregnancy a continuous secretion of progesterone is necessary.

Pancreas

The pancreas is located across the upper abdomen behind the stomach. Dispersed throughout the pancreas are small groups of cells called the islets of Langerhans which are named after the man who discovered them. These cells secrete the hormone called insulin which controls the level of sugar in the blood. When the level of insulin in the blood is relatively low sugar Diabetes Mellitus which is commonly called diabetes results. There are two types of diabetes called state or type 1 and 2. Type 2 diabetes frequently starts later in life and causes obesity. This type of diabetes can be controlled by and in most cases reversed by a vegan diet. Type 1 diabetes is sometimes called Juvenile Diabetes and is much more serious and is most often the result of a hereditary deficiency, so that in the young patient they have to have replacement insulin by subcutaneous injection for life. This insulin is usually made from pig's insulin. As a first aid measure all diabetics are advised to carry glucose sweets if they feel the onset of a coma i.e. dizziness, a feeling of distance, and being befuddled. Some of the side effects are reduced efficiently in circulation resulting in gangrene and the loss of lower limbs necessitating amputation, and degenerative eye sight resulting in blindness.

Questions on the lesson.

1. List the glands and tissues of the endocrine system.
2. What do all these glands and tissues do?
3. What does insufficient iodine or overactivity of the thyroid cause?
4. How many and where are the parathyroid glands?
5. Where is the pituitary gland and what does it do?
6. What does the adrenal gland produce in situations of danger, and what does this hormone do?
7. Where is the thymus located and what does it do?
8. How big is the pineal body and what does it work in conjunction with?
9. Name the three sex hormones?
10. What does the pancreas secrete which affects what?

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4e - Basic Anatomy Of The Human Body

11. LYMPHATIC SYSTEM

The lymphatic system allows the return to the blood system of tissue fluids that are unable to diffuse into the capillaries. If these tissue fluids do not drain properly, oedema results. This tissue fluid is called lymph when it is collected by the lymph vessels. The composition of lymph is very similar to plasma, but with less protein, food materials, and more waste materials. It contains white but no red corpuscles.

The lymph vessels or veins start as fine, blind-ended lymph capillaries. These join to form lymphatics which are similar to veins in structure and general course. However, they are more numerous and fine and have many more semilunar valves to prevent lymph flowing backwards. The lymph system flows only towards the heart. As it does so it passes through at least one of the lymph glands or nodes before reaching one of the main lymph vessels. These glands or nodes are most concentrated in the neck, armpit, elbow, and groin. There are also masses of lymph tissue which form the tonsils and adenoids, and solitary glands and Peyer's patches in the intestinal wall, and the lymph nodules in the spleen. The nodes filter out and destroy bacteria, germs and their poisons, and other foreign bodies and produce lymphocytes in the blood. In doing so they may become inflamed, swollen and painful. This can also occur during some infections. Some forms of malignant cancer spread to other parts of the body by the lymphatic system.

The right lymphatic duct receives lymph from the right side of the head and thorax and from the right arm, while the thoracic duct receives lymph from the rest of the body. The fluid from the right lymphatic duct flow into the right subclavian vein, while those from the thoracic duct flow into the left subclavian vein.

The spleen found to the left of the stomach is associated with the lymphatic system. The spleen destroys worn out red blood corpuscles, stores large quantities of all kinds of blood cells for release in emergencies, produces lymphocytes in the lymph nodules, and it produces red corpuscles and granulocytes during foetal life and on certain occasions in adult life, e.g. after severe haemorrhage. It also removes bacteria and debris from the blood.

Questions on the lesson.

1. What does the lymphatic system return to the blood system?
2. What is this fluid called when collected by the lymph vessels?
3. What are the lymphatics similar to?
4. Which way does the lymph system flow - towards or away from the heart?
5. Where are most of the lymph nodes?
6. What do the lymph nodes do?
7. What can happen to the lymph nodes as they do their work?
8. The right lymphatic duct receives lymph from where?
9. What organ is associated with the lymphatic system?
10. What does the spleen destroy and produce?

4f - Basic Anatomy Of The Human Body

12. SKIN

The skin is the body's largest organ. This waterproof and airtight covering encases the other organs and tissues of the body and is a protective layer between the body and the environment. The skin consists of two main layers: a superficial layer called the epidermis, and a deep layer called the dermis.

The epidermis is a multi-layered tissue with the outermost layer of cells being dead and cornified. These are continually shed in the form of tiny scales. New cells are grown at the innermost layer which slowly come to the top as the old ones are shed. As they move upward they undergo chemical changes until they dry and die and flake off. This transformation from moist to dry allows the innermost layer to be encompassed by fluid even though our bodies exist in relatively dry air. Friction stimulates this growth so that the epidermis becomes thicker where it has to withstand wear such as the palms of the hands and the soles of the feet. These two areas have five layers to the epidermis, whereas the rest of the body has only four.

The epidermis protects the surface of the body against friction, water loss, and entry of germs. The eye lids protect the cornea of the eye. The epidermis also contains pigment called melanin. This pigment varies in individuals and is closely related to our genealogical heritage. The epidermis offers some protection from the sun's ultraviolet rays by increasing the amount of melanin which tans the skin. Accumulation of melanin causes freckles and liver spots.

The dermis consists of dense connective tissue with nerves and blood vessels. Below the dermis there is a subcutaneous layer of looser connective tissue with large fat deposits. Fibres from the dermis reach into the subcutaneous layer and securely fasten the skin. The nerve endings of the dermis sense touch and temperature changes. In the case of a blister the dermis is separated from the epidermis. The blister is the epidermis and the reddish layer below is the dermis or true skin. After a large wound normal skin tissue does not grow back, instead scar tissue forms. Blood rushes in to clean and seal a wound when it occurs. The blood clots forming a scab. This area then commences to fill with granular tissue made of blood vessels and newly formed, hard connective tissue. The epidermis bridges the top, forming a scab which eventually falls from the wound. After the wound tissue is replaced, the vessels wither, stopping supply of blood. The absence of blood makes the scar tissue whitish and over large areas, wrinkled.

The oil glands, and sweat glands are in the dermis, and this is where the hair follicles form and the hair erupt through the epidermis.

Hair follicles produce hair which not only grows, but is regularly replaced. Hair can grow for as short a time as a couple of months or a long as 5 years. When the old hair loses the ability to divide cells and grow, it dies. A new hair is formed and as it grows it pushes the old hair out of the follicle. When it reaches the outer part of the hair follicle the old hair falls out. As with most mammals, humans have hair that covers nearly the whole body with some people having more and longer hair than others. There are two main types of hair: fine and downy, and course. Fine and downy hair is found all over the body. The course hair is usually darker and stronger, and can be found in the nostrils, outer ear canal, and armpit. Public hair and beards are also course hair. Eyelashes, eyebrows which prevent foreign bodies from reaching the cornea, and the hair of the head are a special type of course hair. Pigment is found in the dermis and this determines the colour of the hair. Pigment loses its potency with age, and consequently the hair appears white or grey. Later still, the follicles die and result in hair loss.

Oil or sebaceous glands are found all over the body except on the soles and palms. They usually appear in combination with a hair follicle and a short duct connects them. It secretes an oily substance that prevents the outer layer of the skin and the hair from drying and becoming brittle. When the body gets chilled or encounters fear or anger, muscles near the hair root contract and make the hairs stand erect. This same process causes oil to eject onto the skin to impede evaporation and heat loss, and causes goose pimples or bumps to appear on the skin. If the oil gland gets blocked off due to specific infection, it enlarges and will cause a blackhead. Clogged oil glands frequently occur at the onset of puberty when pimples and acne occur in the adolescent.

Sweat glands are located all over the skin, but are more numerous in the armpits, palms, forehead, and soles. Each sweat gland is a single curly tube that begins in the subcutaneous tissue, passed through the dermis, and opens as a pore in the epidermis. They produce a watery secretion containing salts and waste nitrogenous materials making them excretory organs, but their main function is to help regulate body temperature. If the temperature rises due to muscular activity, hormones, or external conditions, the blood capillaries of the skin enlarge so that more blood circulates near the surface of the skin to be cooled. At the same time sweat glands are actively increasing the cooling effect. The evaporation of sweat cools the body because as water turns into water vapour, the vapour evaporates thereby drawing off excess heat. Alternatively, if the body temperature falls the blood vessels contract and the sweat glands cease to function.

Finger and toe nails consist of special horny layer of certain skin sections which protect the ends of the fingers and toes. The root of the nail is hidden beneath a skin fold known as the nail bed. The nail usually grows about 0.1 mil per day. As it grows it slides over the nail bed towards the tip of the finger or toe. The nail bed looks pink because of all the blood capillaries just under it. There is a whitish half-moon shape at the base of the nail because the capillaries in this section are not as close to the surface. The visible part of the nail is called the nail body.

Questions on the lesson.

1. What sort of covering is the skin?
2. What is the superficial layer called?
3. What is the deep layer called?
4. Where do skin cells begin growing?
5. Where is the epidermis the thickest?
6. How is old hair replaced?
7. What are the two main types of hair and where are they found?
8. What do the secretion of the oil gland prevent?
9. How does the body cool itself when the temperature rises?
10. Why does the nail bed look pink?

For further study:

- Read 'Restoring The Temple' by Sheryle Beaudry, RN, C., in 'Landmarks' at www.stepstolife.org/php/landmark.php in part from issue July, 2002 to July, 2003, or the entire series which went for several years.

Disclaimer:- This basic anatomy study is only to help people understand how their bodies work so that they can know how to look after themselves. The information for this study is our understanding of the information gathered from the following resources:- *Collier's Encyclopedia*; *Cromption's Interactive Encyclopedia* CD; *Human 3D* CD by Glasklar; *Basic Anatomy and Physiology* by R.G.O. Rowett; and *Human Anatomy Coloring Book* by Margaret Matt.