

AT A GLANCE

Life Systems: Grade 5 – Human Organ Systems

In Grade 5, study of the human body focuses on five major organ systems – the respiratory, circulatory, digestive, excretory, and nervous systems. Using models and simulations, students will learn where the major internal organs are located and will explore the functions and interactions of organs within specific systems. In studying the structures of organs, students will learn that all living tissues are composed of different kinds of cells. Students will also develop an understanding of proper nutrition and exercise to the healthy functioning of organ systems.

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Morals and Ethical Connections

Since humans are created in the image and likeness of God, our personhood is endowed with an essential dignity. We are literally a reflection of the divine. In scientific terms, the human body is a marvel in its biological complexity and integration. In religious terms, the human body is the temple of the human soul. Our scientific discoveries lead us to a deeper realization and appreciation of a masterpiece of God's creation, the human person.

LIST OF SUB TASKS

Sub Tasks	Title	Descriptor
1	The Things I Can Do!	Through an activity-based investigation of their own abilities and needs, students will learn to identify the major organ systems and their basic functions.
2	Celebrate Cells	Students will use a microscope to observe onion cells and human cheek cells, in order to understand that the cell is the basic unit of life.
3	Model Lung	Students will make a simple model of a lung in order to better understand the way our lungs function.
4	Exciting Exhalation	Students will determine their lung capacity.
5	Muscle Mania	Students will design and make a simple model of an arm.
6	Brain Games	Students will participate in a number of activities to familiarize themselves with the nervous system.
7	Digestive System Demo	Students will make a simple working model of the stomach and intestinal tract in order to better understand the function of the digestive system.
8	My Terrific Tongue	Students will identify taste areas on their tongue and understand that their tongue is both part of their nervous system and their digestive system.
9	You Are What You Eat	Students will keep a food journal for 3 days, and then prepare a chart demonstrating their eating habits.
10	The Menu	Students will design a menu in keeping with Canada's Food Guide.
Culminating Task	Medical Researcher	Students, alone or with a partner, will research a disease or medical condition. They will find out how this disease or condition affects the human organ systems, and how diet and medical technology have made life easier for those people affected by it. They will make a visual and oral presentation of their findings to a "medical board" comprised of their classmates.

ONTARIO MINISTRY OF EDUCATION AND TRAINING
 SCIENCE AND TECHNOLOGY EXPECTATIONS

Sub Tasks

OVERALL EXPECTATIONS		1	2	3	4	5	6	7	8	9	10	Task
LS1	Demonstrate an understanding of the structure and function of the respiratory, circulatory, digestive, excretory, and nervous systems, and the interactions of organs within each system	•	•	•	•	•	•	•	•			•
LS2	Investigate the structure and function of the major organs of the respiratory, circulatory, digestive, excretory, and nervous systems		•	•	•	•	•	•	•			•
LS3	Demonstrate understanding of factors that contribute to good health				•	•				•	•	•
SPECIFIC EXPECTATIONS												
Understanding Basic Concepts (<i>know</i>)												
LS4	Identify the cell as the basic unit of life		•									
LS5	Describe the basic structure and function of the major organs in the respiratory, circulatory, digestive, excretory, and nervous systems			•	•		•	•	•			
LS6	Describe, using models and simulations, ways in which the skeletal, muscular, and nervous systems work together to produce movement (e.g., make a model of the structure of the bones and muscles in an arm, using cardboard rolls and elastic bands)			•		•						
LS7	Identify the skin as an organ and explain its purpose					•						
LS8	Explain what happens to excess nutrients not immediately used by the body											
LS9	Describe the components of the body's system of defence against infections (e.g., tears skin, white blood cells)											
Developing Skills of Inquiry, Design and Communication (<i>do</i>)												
LS10	Formulate questions about and identify the needs of humans, and explore possible answers to these questions and ways of meeting these needs (e.g., in studying the nervous system, investigate response times by having someone catch a ruler between the thumb and index finger after it is dropped by another person; investigate ways in which orthopaedic devices, such as back rests, have improved the quality of life)	•			•		•	•	•	•	•	
LS11	Plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions				•			•	•	•		

LS24	Explain how the health of human beings is affected by environmental factors (e.g., smoking, smog, and pollen affect the respiratory system)					•											
LS25	Explain the benefits and disadvantages of using some technological innovations (e.g., headsets designed to protect ears from excessive noise are helpful, but headphones used to listen to music can cause hearing impairment)					•											
LS26	Describe some types of medical technology (e.g., exercise machines, hearing aids, prosthetics)					•											

SCIENCE AND TECHNOLOGY REFERENCES

Glossary of Terms

cell - the basic structural and functional unit of all life

nutrients - the useful parts of food used by the body for energy, metabolism growth and repair. Include carbohydrates, protein, fats (lipids) water, minerals and vitamins

organ - a group of tissues that works together to perform a specific function, e.g., the stomach is made of three layers of muscle and a layer of epithelial tissue (skin) that secretes gastric juices and mucous, all together they churn and chemically digest food

organ system - a group of organs that work together to perform a specific function. e.g., the digestive system digests food, absorbs nutrients and gets rid of waste from food

pathogen - a disease-causing agent such as a virus or bacteria

peristalsis - muscular contractions that push food through the digestive tract similar to the way a snake eats and digests its prey

tissue - a group of cells that have the same structure and function e.g., muscle cells group together to form muscles which cause movement

Background Information

Cells are the basic structural and functional units of life. They are composed of smaller parts called organelles. The *nucleus* is a dark body, usually centrally located, that controls all cell activities. Surrounding the nucleus is a gelatinous substance, called the *cytoplasm*, that supports organelles and assists in cellular metabolism. Surrounding the cell is a *cell membrane* composed of lipids and proteins; this membrane regulates the flow of materials into and out of the cell. In plant cells only, a *cell wall*, composed of cellulose, surrounds the membrane to help give the cell structure.

Cells in multicellular organisms, such as animals and plants are specialized as to whose functions (e.g., nerves for sending and receiving messages, skin for covering and protecting and muscle for causing movement) and arranged into *tissues*. Groups of tissues with similar functions work together in an *organ*, and groups of organs work together to perform a specific function in *organ systems*. A series of organ systems are found in an *organism*, allowing it to function and to complete all metabolic processes.

The six nutrients and their functions in the body:

Carbohydrates - a group of nutrients composed mainly of sugars and starches whose function is to provide the body with energy, and to aid in growth and repair. Carbohydrate can be stored as glycogen in liver and muscle tissue

Proteins - a group of nutrients composed of amino acids that provide the body with structural materials and assist in metabolism (enzymes)

Fats (lipids) - a group of nutrients composed of animal fats and plant oils that provide the body with energy, assist in growth and repair and help protect organs

Vitamins - found in various foods in differing quantities (especially in fruits and vegetables) whose function is to assist enzymes in metabolism

Minerals – inorganic (don't contain carbon) compounds needed in small amounts for building bones, maintaining osmotic balance (balance of water and solutes) across cell membranes and forming larger molecules such as haemoglobin, thyroid hormone and enzymes

Water - important in many cell processes including acting as a solvent for nutrients, assisting in metabolism, lubricating joints, protecting organs from injury, preventing dehydration and maintaining body temperature

Food and Nutrients:

Carbohydrates are found mostly in grain products (breads, rice, pasta) and in fruit and vegetables. Vegetables such as potatoes, carrots and sweet potatoes have higher amounts of starch than ones such as lettuce, broccoli, spinach and tomatoes. Fruits are generally higher in sugar content.

Proteins are found mostly in meats, poultry, fish, eggs, beans and tofu. While peanut butter is a reasonable source of protein for children it is very high in fat content. Children can eat more fatty protein food as they require concentrated energy for growth. Adults should limit fatty protein foods.

Fats are found on and in meats, in butter, margarine, plant oils such as corn oil, olive oil and in eggs, cheese and other dairy products.

Vitamins and Minerals are found in varying degrees in all foods which is why a balanced diet is vital to good health. Meat and alternatives are good sources of the B vitamins, iron, zinc and magnesium. Grains provide the same nutrients in lower concentration. Fruits and vegetables additionally supply vitamins A and C, along with orange coloured vegetables providing beta carotene a precursor to vitamin A. Milk and dairy products are good sources of calcium, vitamin D and A along with zinc, magnesium and riboflavin (vitamin B2).

Water is found in all food especially fruit and vegetables, along with milk and other beverages. It should be noted that soft drinks are not good sources of water as many contain extra sugar and several contain caffeine, which acts as a diuretic, causing water to be lost from the body. Several soft drinks also contain phosphoric acid, which prevents uptake of calcium from dairy products.

Fibre is not considered a nutrient but is considered part of a healthy diet since it helps carry food through the digestive tract more rapidly, adds bulk to waste and assists in regularity of elimination. It is found readily in whole grains, fruits and vegetables. Certain types of fibre that are soluble such as oat bran, have been linked to reducing the bad (LDL) cholesterol in blood and thus contributing to heart health.

Balanced Healthy Diets should contain the following number of servings from each food group per day, with emphasis on natural unprocessed foods such as whole grains and enriched products, non-processed meats and cheeses, leaner meat and meat alternates, dark green and orange fruits and vegetables and a limit to fat and salt.

Grain products 5-12

Milk Products 2-4

Vegetables and fruit 5-10

Meat and Alternatives 2-3

See *Canada's Food Guide* and using *Food Labels* for more detail.

The Digestive System is composed of the following organs which all work together to break down food, absorb nutrients and eliminate any waste from food digestion.

Mouth - contains the teeth which bite and grind food into smaller parts, the tongue which pushes food from side to side and finally back to the throat for swallowing and also tastes the food eaten. Three pairs of salivary glands drain into the mouth that secrete saliva, which moistens food and breaks down starches into sugars using enzymes.

Esophagus - a muscular tube, which carries food from the mouth to the stomach by a process, called peristalsis

Stomach - churns food by contracting muscle layers in several directions and secretes gastric juices containing enzymes that break down food and leave it in the form of a thick soupy substance called chyme

Small Intestine - the top portion receives bile from the *liver* and *gall bladder* and pancreatic juices from the *pancreas*. These enzyme filled juices along with some digestive juice from the intestinal wall complete digestion of food. The remainder of the small intestine acts to absorb the nutrients from food. Food is moved by peristalsis

Large Intestine - reabsorbs water from waste, compacts waste (undigested food and fibre along with intestinal bacteria), and adds mucous to waste for ease in disposal

Rectum - stores waste until ready for excretion

Anus - a circular muscle that controls flow of waste out of the lower digestive tract

Health conditions that can be affected by diet:

Diabetes can be affected by too great an input of sugars and by being overweight. Careful control of weight and a diet low in refined sugars can help control the disease.

Heart disease has been shown to be linked with high blood cholesterol levels, triglycerides from fat metabolism, lack of exercise and obesity. While diets low in cholesterol may help, there is also a link to use of polyunsaturated fats and refined sugars; thus a low fat, low sugar diet and aerobic exercise is the best preventive.

Obesity is caused by consumption of more food than the body needs and the storage of that food, whether it be carbohydrate, protein or fat, as fat on the body. Obesity can increase the risks of heart disease, stroke and diabetes as well as causing strain on joints. Reduction in calorie consumption and regular exercise normally helps to control this problem.

Anorexia and **bulimia** are food-related psychological disorders related to a person's body image. Both disorders become life threatening when a person loses too much weight and is malnourished.

The Respiratory System is composed of the following organs that function together to bring oxygen into the body and to release carbon dioxide from the breakdown of sugars for energy by cells.

Nasal Cavity - warms, moistens and filters air

Trachea - a tube held open by cartilage similar to a vacuum cleaner hose that carries air from the back of the mouth to the branches in the tube called *bronchi* (bronchus singular). The bronchi branch into *bronchioles* (forming the respiratory tree) and end in tiny sacs called alveoli.

Alveoli - tiny thin membrane air sacs surrounded by blood vessels and internally (in the lung) kept moist. Exchange of oxygen and carbon dioxide occurs here between the blood and the lungs.

Lungs - two cone-shaped organs of muscular, epithelial (skin), vascular (blood) and connective tissue, containing the alveoli.

Diaphragm - a muscle located below the lungs separating the abdominal cavity from the chest cavity. It raises and lowers to help the lungs exhale and inhale air.

Aerobic exercise is important for respiratory health, as is refraining from smoking, avoidance of smog and pollution. Asthma is a condition where the respiratory system reacts to a non-pathogenic substance and the airways secrete mucous and start to narrow causing difficulty in breathing and wheezing.

The Circulatory System acts to transport blood around the body carrying oxygen, carbon dioxide, nutrients and waste, as well as playing a role in defense against disease, immunity and blood clotting. It is composed of:

Heart - a muscular pump that moves blood around the body

Arteries - hollow muscular vessels that carry blood away from the heart

Veins - hollow muscular vessels, a little thinner than arteries and containing valves that carry blood to the heart.

Blood - made mostly of plasma, composed of water, minerals, vitamins and nutrients, gases, clotting agents, hormones and also containing red blood cells that carry oxygen and carbon dioxide, white blood cells that help fight disease and platelets that assist in blood clotting.

Heart health is linked to regular aerobic exercise, a balanced diet low in fat and refined sugars, or avoidance of large amounts of caffeine and alcohol, and avoidance of smoking.

The Excretory System is responsible for filtering blood to remove wastes. Every activity in the body uses energy and generates waste. If these were not removed, they would accumulate to harmful proportions. It is composed of:

Kidney - found on the posterior wall of the body cavity on either side of the spine, just below the ribs. The kidneys filter blood to remove the products of metabolism such as urea, poisons, mineral salts and some water.

Ureters - tubes which carry urine from the kidneys to the bladder

Bladder - a thin, muscular hollow organ that stores urine until it is ready to be excreted. The bladder can hold between 200 ml and 400 ml

Urethra - a muscular tube that controls the exit of urine from the body

The *skin* and *lungs* can also be considered excretory organs as they release salts, some urea and water, and carbon dioxide, some poisons and water respectively.

Excretion also occurs from the anus releasing food wastes containing fibre, undigested food, intestinal bacteria and other digestive products.

Excretory system health is closely linked to good nutrition; exercise also plays a role.

Waste from the body, particularly feces and urine, is deposited in a sanitary sewage system. This system of pipes carries waste to a sewage treatment plant where it is filtered to remove solid and dissolved waste with the help of waste eating bacteria. The resulting water is treated with chlorine or ozone to kill bacteria and placed back into rivers and lakes.

The Nervous System is responsible for sensing the environment, receiving information, transmission of messages, interpretation of messages and transmission of messages that cause response to stimuli. It is composed of:

The central nervous system made up of the *brain* and *spinal chord* that coordinates and directs bodily activity.

The peripheral nervous system is made up of *nerves*, which extend beyond the brain and spinal chord and brings information from sensory and internal organs to the central system and carries impulses to cause reaction by muscles in all bodily areas.

The autonomic nervous system controls the reflex parts of our body and parts that react without thinking. It helps prepare the body for emergencies and helps return it to normal after an emergency has passed.

The basic component of all parts of the nervous system is the *neuron*, a specialized cell that carries messages by electrochemical impulse.

Sensory organs include the eye, ear, nose, tongue and skin, (several areas are more sensitive to touch than others are).

The nervous system works in conjunction with the muscular system to affect movement toward and away from stimuli and to create movement. Since the nervous system affects muscular movement it also can be considered to affect the skeletal system.

The Nervous System is kept healthy through a balanced diet, exercise and limitation of exposure to loud music (hearing), strong chemicals (smell and touch), exposure to sunlight without sunglasses (the eyes).

Technology has been able to assist in deterioration of sight and hearing by the production of eyeglasses, contact lenses, corrective surgery and hearing aids.

The Immune System is responsible for defending the body from disease. It is composed of the blood and lymphatic systems (produces white blood cells, helps fight disease and helps rid the body of dead pathogens) and functions as follows.

First line of Defense - The body prevents the entry of disease causing agents using barriers and traps such as skin, mucous, tears, ear wax and cilia (hairs).

Second line of Defense - White blood cells known as phagocytes engulf and digest pathogens. (Similar to eating them)

Third line of Defense - White blood cells produce antibodies, which destroy pathogens. There is one antibody made for each pathogen. Thus the presence of antibodies to a specific disease creates immunity to that disease.

Immunity can be acquired naturally as the body recovers from a disease or as a baby feeds from its mother's breast milk, or acquired artificially by injection of pathogens to induce the body to make antibodies (vaccines) or by injection of antibodies. Immune system health is dependent on a healthy body and a diet particularly balanced in vitamins.

Skin is an organ and plays a role in protection of inner cells, excretion of waste, defense against disease, sensing the environment, healing of wounds, insulation against cold, release of heat, production of hair and nails, production of vitamin D in sunlight, production of oils, prevention of water loss and prevention of water logging (keeps out water).

FOR ADDITIONAL INFORMATION

The resources listed below are a compilation of lists submitted by teachers, boards and publishers. Therefore, they are not necessarily recommended or endorsed by OECTA, but constitute a survey of existing materials.

Print Resources

- Andrews, William A., Ed., **Discovering Biological Science**, Prentice Hall, 1983
- Berry, Gordon S., **Biology of Ourselves a study of Human Biology**, Wiley, 1987
- Berry, Gordon S., **Teacher Resource Package in Human Biology**, Wiley, 1987
(a good source of diagrams)
- Health and Welfare Canada, **Using the Food Guide**, Ministry of Supply and Services Canada, 1992. Available from Health and Welfare Canada, Ottawa Ontario, K1A 0K9 (613-954-5995)
- Health and Welfare Canada, **Using Food Labels to Choose Food for Healthy Eating**, Ministry of Supply and Services Canada, 1992. Available from Health and Welfare Canada, Ottawa, Ontario, K1A 0K9 (613-954-5995)
- McLaren, James E. and Lissa Rotundo, **Heath Biology**, D.C. Heath and Co., 1985
A teacher's manual with diagrams exists for this one as well.
- Poole, M.C., G. Pilkey and , E.C. Johnson, **Biology in Action**, Harcourt Brace Jovoanovich, 1992. (An excellent source of activity ideas)
- Avila, Victoria, **Invisible World: How Our Muscles Work**, New York: Chelsea House Publishers, 1995.
- Bailey, Donna, **All About Digestion**, Austin, Texas: Steck-Vaughan, 1991
- Bailey, Donna, **All About Your Brain**, Austin, Texas: Steck-Vaughan, 1991
- Bailey, Donna, **All About Your Heart and Blood**, Austin, Texas: Steck-Vaughan, 1991
- Bailey, Donna, **All About Your Lungs**, Austin, Texas: Steck-Vaughan, 1991
- Bailey, Donna, **All About Your Skeleton**, Austin, Texas: Steck-Vaughan, 1991
- Bailey, Donna, **All About Your Skin, Hair, and Teeth**, Austin, Texas: Steck-Vaughan, 1991
- Cole, Joanna, **The Magic School Bus Inside the Human Body**, Toronto: Scholastic, 1989
- DiYore, Larry, et al, **Sciences en Marche, Sieme Annee**, Toronto: Maxwell MacMillan Canada, 1991
- Fodor, John T., et al, **Rester en Sante**, Toronto: Doubleday Canada, 1982
- Funston, Sylvia, and Jay Ingram, **A Kid's Guide to the Brain**, Toronto: Greey de Pencier Books (Owl), 1994
- Hassard, Jack, **Science Experiences Cooperative Learning and the Teaching of Science**, Addison-Wesley, 1990 (an excellent source of integrated and cooperative activities for classroom use)
- Kenda, Margaret, and Phyllis S. Williams, **Science Wizardry for Kids**, New York: Barrons, 1992
- Paradis, Raymond, **Sciences de la Nature**, Montreal: Editions Marie-France, 1980

Penrose, Gordon, **Dr. Zed's Science Surprises**, Toronto: Greey de Pencier Books (Owl), 1989

Penrose, Gordon, **Magic Mud and Other Great Experiments**, Toronto: Greey de Pencier Books (Owl), 1987

Peterson, Rod, and Neil McAllister, **Innovations Sciences: Niveau 6**, Montreal: Les Editions de al Cheneliere, 1997

Eyewitness Visual Dictionaries: The Visual Dictionary of the Human Body. Toronto: Stoddart, 1991

Eyewitness Visual Dictionaries: The Visual Dictionary of the Skeleton, Toronto: Stoddart, 1991

Kits and Media

Bill Nye Science Guy Video Series

Address: Magic Lantern Communications (Disney Educational Media)
38-775 Pacific Road
Oakville, Ontario
L6L 6M4 Tel: 1-800-263-1717

Internet Sites

Like all Internet sites, these addresses may change at any time. However, the new addresses can often be found again very easily. This can be done by searching for the full name of the site, as it appears here, on a web browser that allows the user to "Search by Phrase."

Visible Human

http://www.nlm.nih.gov/extramural_research.dir/visible_human.html

Virtual Heart

<http://sln.fi.edu/TOC.biosci.html>

Science worksheets

<http://www.lookup.com/Homepages/37409/worksheets.html>