Science Focus 8

Unit B

Teaching Notes

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Topic 1 – Living Organisms (pgs. 98 – 102)

Characteristics of Living things …

Functions		Structures
	Energy Living organisms need energy	
	Environment Living organisms respond and adapt to their environment	
	Reproduction Living organisms reproduce	
	Growth Living organisms grow	
	Wastes Living organisms produce wastes	

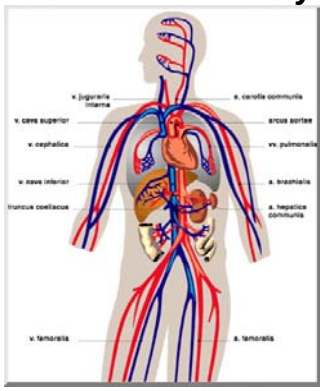
Do Find out Activity p.99 'Functions and Structures' to complete the table

Levels of Organization in Organisms

- organisms have **systems** which perform the functions that keep that organism alive
- systems are made up of **organs**
- organs are made from **tissue**
- tissues are composed of **cells**

Examples:

- figure 2.1A ***The Human Circulatory System***



- figure 2.1C ***A Plant's Shoot System***

Cells Work Together

The cells of an organism all work together to help perform the various functions that need to occur if the organism is to live. The specialized cells of the body perform task that enable the organism to survive despite the actions and or habits it is involved in on a daily basis.

The Pika eats only plants and bacteria in the Pika's stomach help it to digest the nutrients it needs to stay alive. The Seabird ingests salt every time it eats fish, but specialized cells concentrate the salt and allow the seabird to get rid of the excess salt out of a small tube in it's beak. Other animals get needed nutrients by the natural occurrence of high concentration in the environment in which these organisms live (salt licks for moose)

Topic 2 – Microscopes and Cells (pgs. 103 – 114)

A World Too Small To See …

- when an object is made to appear larger than it's actual size, it is said to be **magnified**..

Early Microscopes …

- micro-organisms were first discovered by **Anton van Leeuwenhoek**. His hobby of grinding lenses led him to eventually make the first simple microscope to study blood samples, pond water and plaque (which he scraped from his teeth) The organisms he found – that were single cells – he called '***animalcules***'
- **Robert Hooke** was also experimenting with microscopes he had built to look at different things, such as a tiny piece of cork. The small holes that were honeycombed were described as 'little rooms or boxes' and the word ***cellulae*** was used to name them (Latin form of 'cell').

Cells in All Living Things …

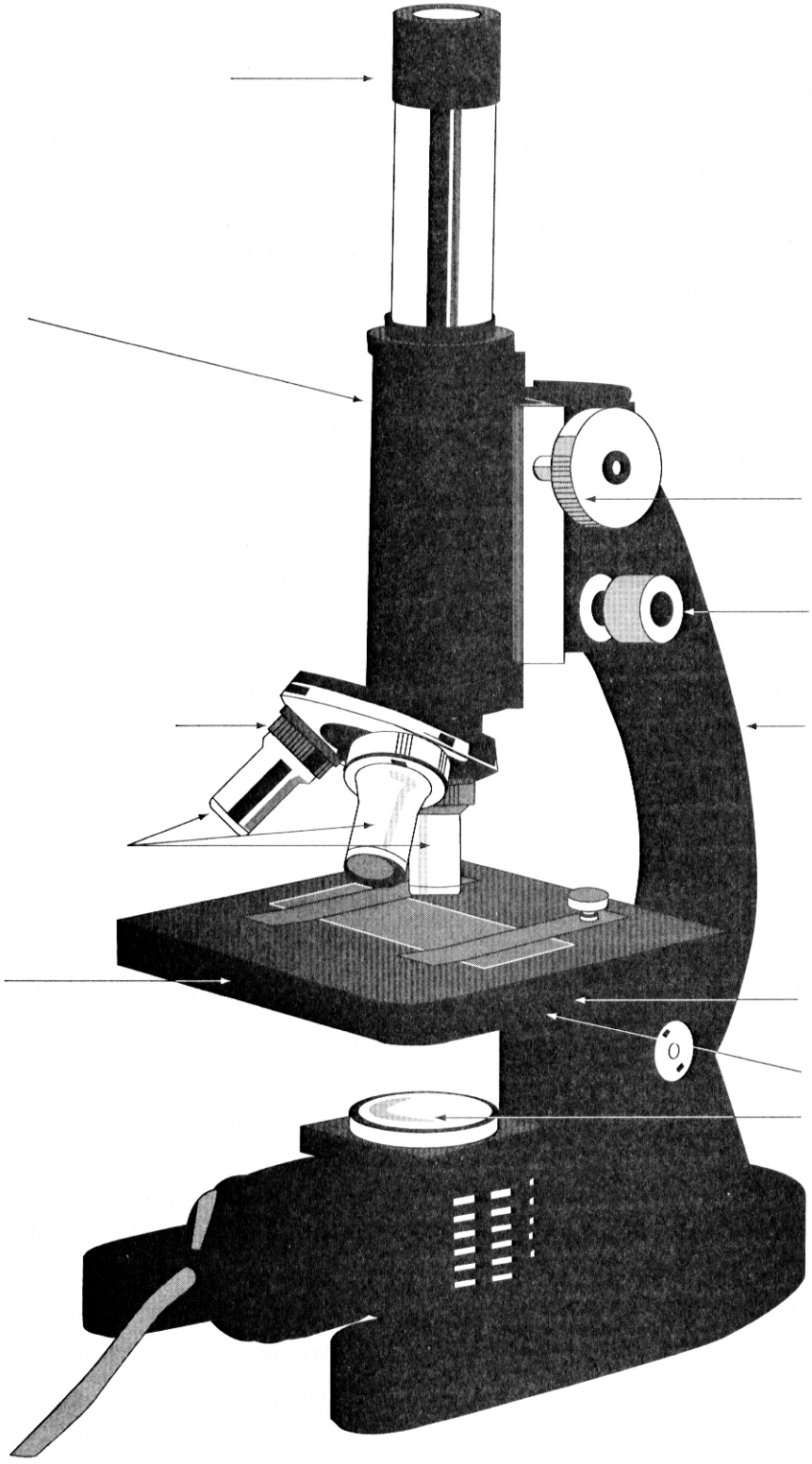
- Two scientists (Matthias Schleiden and Theodore Schwann) who studied cells combined their observations to make a hypothesis … ***all living things are made up of cells***.
- A cell is the basic unit of life, because all the functions carried out by living things are carried out by their individual cells
- Rudolf Virchow contributed his observation and together the **Cell Theory** was formulated:
    - all living things are composed of one or more cells
    - cells are the basic units of structure and function in all organisms (Web: http://library.thinkquest.org/3564/?tqskip=1)

Microscopes Today …

- Technology improvements have lead to the development of compound light microscopes (2000X magnification) and electron microscopes (2,000,000X magnification).
- there are two types of electron microscopes:
    TEM (transmission electron microscope) and
    SEM (scanning electron microscope)
- The microscope has become a valuable tool for the investigation of the microscopic world

See the electron microscopic images on page 114

Compound Microscope



Topic 3 – The Cell and Its Structures (pgs. 115 – 126)

The Cell (CELLS alive! - Student Resources)

- All cells, plant and animal, have structures and each structure performs a specific function in order for the cell to maintain life.
- When viewed with a compound light microscope these cell structures become visible to the naked eye.

Cell Structures

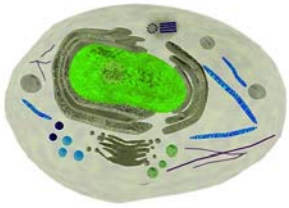
- the structures inside the cell are called **organelles**.

See pgs 122-123

*Check out the **Virtual Cell Tour***

Plant Cell

Animal Cell



Cell Membrane -surrounds and protects the contents of the cell

Cell Wall - are much thicker and more rigid than membranes, providing support for the plant or fungi

Cytoplasm - distributes materials to different parts of the cell

Nucleus - controls the cell's activities

Vacuoles - is a membrane-bound sac acting as a storage space for surplus food, wastes and other substances the cell is unable to use immediately

Chloroplasts - are the structures in which photosynthesis takes place (found in green plants)

Cell Size and Function

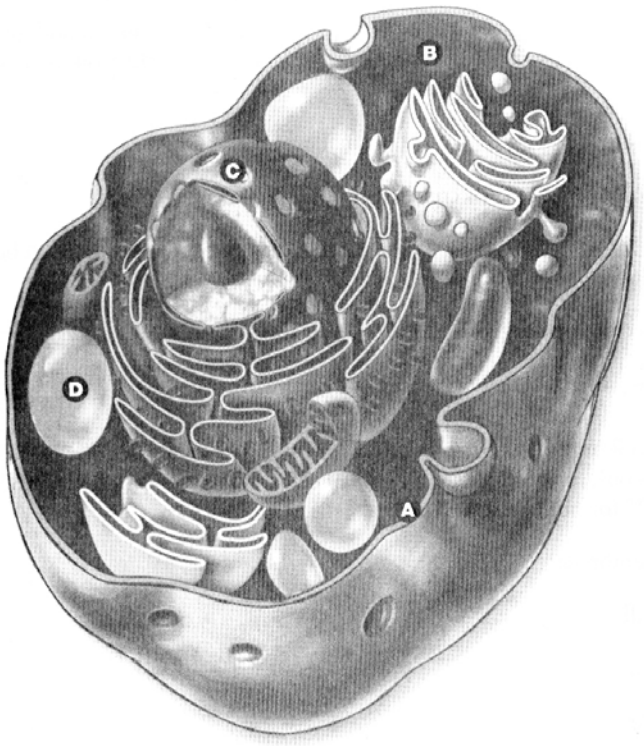
- to carry out their work, cells need a constant supply of materials, such as oxygen, water and food particles and they also need to get rid of waste products, all these materials must pass through the cell membrane, most cells fall into a very narrow range of size between 10 - 50 micrometers

(μm)

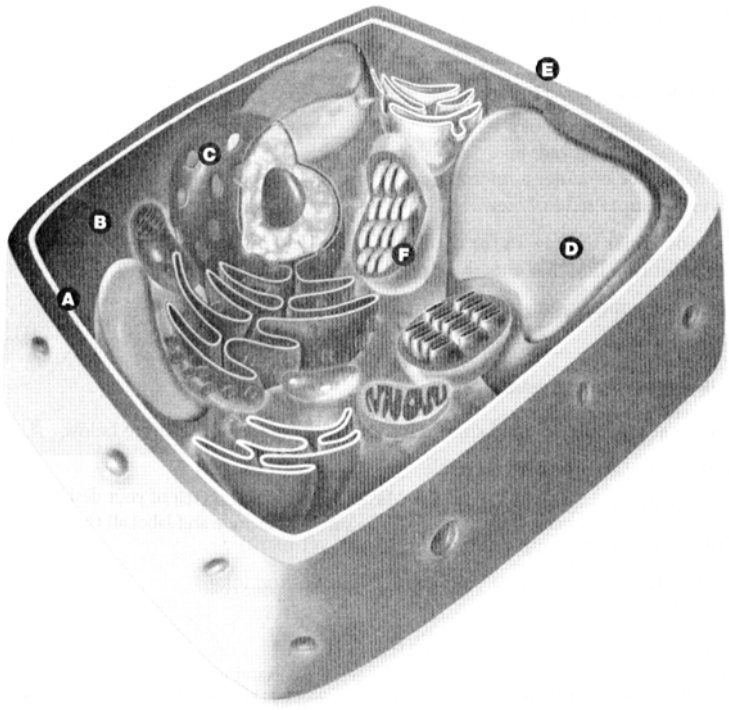
WRAP-UP p. 127

>>>> A good review of Topics 1 – 3 in this Unit <<<<

Animal Cell



Plant Cell



Topic 4 – Fluid Movement in Cells (pgs. 128 – 137)

The Cell Membrane

- A cell membrane allows some substances to enter or leave the cell, while stopping other substances. It is a **selectively permeable** membrane. (A **permeable** membrane allows all materials through, while an **impermeable** membrane does not allow anything through)

Diffusion

-The structure of the cell membrane controls what moves in or out of a cell. Particles - moving in all directions, bumping into each other, eventually spread out evenly throughout the cell (**diffusion**).
-Diffusion plays a part in moving substances into and out of a cell. **Concentration** determines the direction that a substance takes through the cell membrane – particles move from higher concentration areas to lower concentration areas (equal concentration allows the movement of particles in and out equally – whereas, a higher concentration of particles on the inside of the cell will move to an area of lower concentration on the outside (so movement will only occur from inside to outside) – until there is a balance.

Osmosis

- The diffusion of water through a selectively permeable membrane is called **Osmosis**.
- Water helps to dissolve many of the substances involved in cell processes. When water is lost (moves out of the cell) it leaves behind a high concentration of the dissolved substances – when water moves back into the cell, the substances become more diluted and can be used by the cell for it's life functions.

Fluid Movement in Plants

- Plants require a large supply of water to make sugars in the process of **photosynthesis**. A group of cells, that perform similar functions, are called **tissue**. The transportation of nutrients is the role of plant tissues.
- Vascular tissues connect the roots to the leaves.
- Phloem Tissue transports sugars manufactured in the leaves to the rest of the plant.
- **Xylem tissue** conducts water and minerals, absorbed by the root cells, to every cell in the plant.
    ***** Xylem and Phloem tissue usually occur together, along the length of plant stems and roots

From Root to Leaf

- The root system contains fine ' **root hairs** '. These hairs are extensions of epidermal cells (which protect the outside of the plant)
- When the concentration of water is greater on the outside of these ' root hairs ' then water can pass through the membrane by osmosis – which continues from cell to cell, until it reaches the xylem tissue.
- The tube-shaped xylem cells then move the water by a build up of water pressure in the root hairs (high pressure to low pressure) forcing the water up the xylem tissue, like water up a straw, into the stems and leaves.

Leaves are the plant's food-producing organs (this is where **photosynthesis** takes place). Photosynthesis takes place in the layer of cells that contain **chloroplasts** (these cells are called **palisade** cells). They are thin, allowing a large amount of light in (large surface area), and enabling the gases (in the air) to diffuse into the leaf cells. (see figure 2-19)

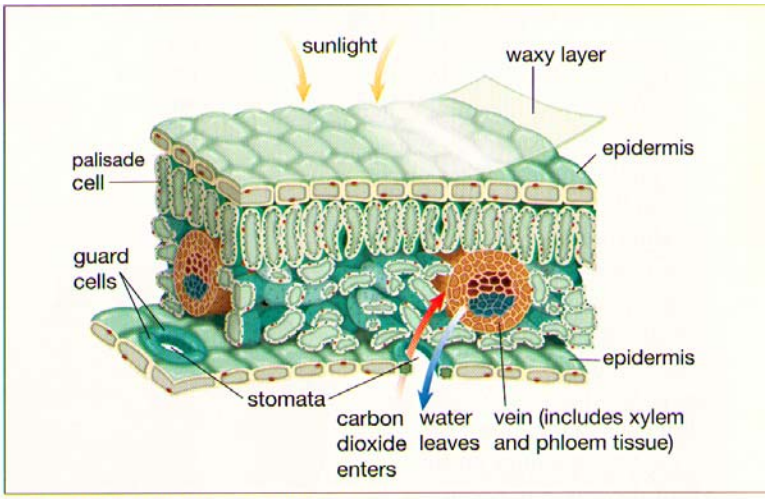


Figure 2.19 The structure of a typical leaf

- The tiny openings, called **stomata**, allow air to enter the leaf (supplying oxygen for respiration and carbon dioxide for photosynthesis). The spaces between leaf cells allow the air to flow and the **guard cells** open and close the stomata.

Transpiration

- The loss of water (in a plant) happens through evaporation and is called transpiration. It is not a problem, unless, the plant loses too much water and doesn't replace it by the roots.
- The movement of water throughout the plant happens because of the differences in pressure – high pressure in the root hairs to lower pressure in the leaves – (pushing and pulling water throughout the whole plant)

Topic 5 - Cell Specialization and Organization

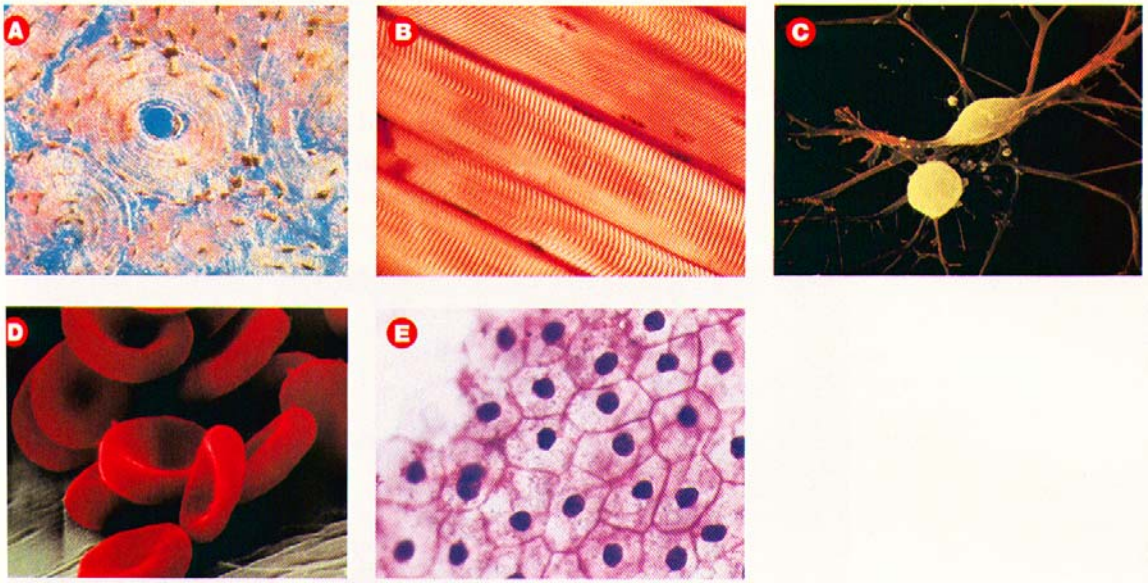
(**pgs. 138 – 144**)

Specialized Cells

Different cells have different structures and functions:

Type of Cell	Shape (Structure)	Function
Muscle	Elongated and tapered on either end	Move parts of the body
Skin	Flat and thin, brick-shaped or honeycomb	Fit closely together to form a continuous protective layer
Nerve	Long branched fibres running from the main part of the cell	To carry nerve signals from one part of the body to another
Blood	Thin, disc-like	Carry oxygen in the bloodstream (giving them a large surface area to collect oxygen)
Bone	Thick, mineral matrix	To provide support

Can you identify each?



The Advantages of Being Multi-cellular ….. Size ….. Versatility

Multi-cellular organisms can:

- live in a wide variety of environments
- grow very large
- obtain their energy from a wide variety of foods
- have complex bodies
- specialize functions and work in harmony with other cells

Cells with the same structure and function form tissue
Tissues form organs
Organs work together in organ systems
Systems work together to form an organism

Tissues

Tissues are groups of similar cells that work together, having similar structure and function. (Figure 2.22 and Figure 2.23 – page 141)

Organs

Each organ is made up of several tissues all working together. They are distinct structures in the body that perform particular functions. (Plants have organs as well – roots, stem and leaves)

Systems

Organs work together to perform activities that help the organism function as a whole. Plants typically have two systems (root system and shoot – stems and leaves – system). A reproductive system (flowers, fruits and seeds) is often produced at certain times as well.

WRAP-UP p. 145

>>>> A good review of Topics 4 – 5 in this Unit <<<<

Topic 6 – Body Systems in Humans (pgs. 146 – 153)

The Digestive System

Food enters your body through the mouth and then passes to the stomach and intestines. It is broken down along the way into usable, soluble particles that can be used by different cells. (Figure 2.26)

The Respiratory System

Breathing (the exchange of gases) moves air in (**inhalation**) and out (**expiration**) of our bodies. (Figure 2.27)

The Circulatory System

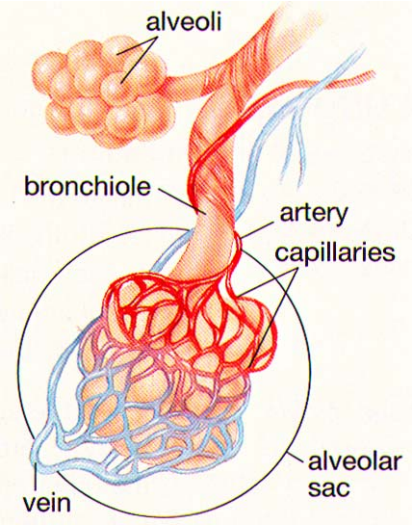
Transports food and gases throughout our body (Figures 2.28 and 2.29)

How the Respiratory and Circulatory Systems Connect

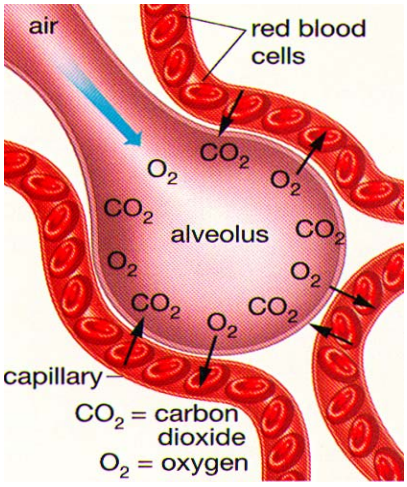
The respiratory system exchanges oxygen and carbon dioxide, while the circulatory system transports those gases throughout the body.

The interaction between these two systems happens in the tissues of the lungs

Diffusion occurs between the **alveoli** (tissues of the respiratory system) and the **capillaries** (tissues of the circulatory system)

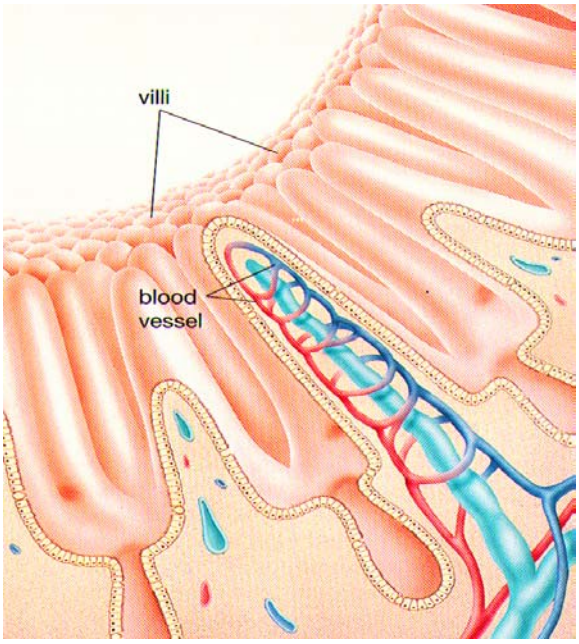


Oxygen goes from the alveoli to the capillaries and **carbon dioxide** goes from the capillaries to the alveoli



How the Digestive and Circulatory Systems Connect

The transfer of food particles, from the digestive system to the circulatory system, takes place at the inner lining of the small intestine, through millions of tiny, finger-like projections, called **villi**, which contain a network of capillaries. The transfer of food particles is possible because of **absorption** (the villi absorb the food particles from the capillaries and then transport the nutrients to the cells, to be used as fuel).



The Excretory System

Filters waste materials from the blood.

The Sensory Awareness System

Allows each of the systems of the body to respond to changing conditions and make adjustments in order to maintain a stable internal environment, allowing the cells to function properly.

- Quivering muscles generate heat
- 90% of heat loss is through the skin (most of the rest is through the lungs)
- Hairs on the skin stand on end when the tiny muscle cells near the surface contract, creating ' **gooseflesh** ' (goosebumps)
- Fluffing body hair (in animals with thick fur) reduces heat loss by improving insulation
- Feeling flushed (red and hot) happens because tiny blood vessels in the skin expand, which increases blood flow
- Sweating helps cool down your body as moisture evaporates from the skin surface

The nervous system helps to keep your body temperature stable by monitoring conditions outside, using temperature receptors in the skin. The information is then transmitted to the **hypothalamus** (section of the brain which regulates body functions) which then decides what action needs to be taken – increasing activity to raise the temperature or, reduce it to prevent heat loss.

Response to stimuli is co-ordinated by the **nervous system** (brain, spinal cord and nerves) and the **endocrine system** (glands that produce hormones).

Diet, exercise, drugs, injury and **disease** can affect body systems and how they perform their functions.

Summary Chart (Table 2.1 – Page 153)

Topic 7 – Body Systems and Your Health

(**pgs. 154 – 162**)

Muscles require more oxygen and nutrients as activity increases, making the heart work faster pumping blood (which supplies what is needed).

Blood – The Body's Transportation System

The blood vessels of the circulatory system form a complex network linking the outside environment with the internal environment of the body. The blood supplies all the living cells in the body with the nutrients they need to carry out their functions.

About 8% of an adult's body weight is blood, made up of:

(Table 2.2, page 155)

Component	**% of blood (by volume)**	**Main Function**
plasma	55%	carries nutrients, waste products, hormones, and blood cells
red blood cells	44%	carries oxygen (because they have **hemoglobin** – an iron-rich chemical, which attracts oxygen)
white blood cells	less than 1%	defends the body against infection and disease
platelets	less than 1%	causes the blood to clot (thicken) at site of wounds to prevent blood loss

The circulatory system must work closely with the respiratory system (which supplies the oxygen) and the digestive system (which supplies the nutrients)

Disorders, which can hospitalize Canadians include: circulatory system (15%), digestive system (11%) and respiratory system (10%).

A Healthy Circulatory System

The **heart** circulates the blood throughout the body by pumping it to where it can supply nutrients and remove wastes.

Disorders of the circulatory system include: high blood pressure (hypertension), heart attacks (damage to heart muscle) and strokes (brain damage).

Blood Pressure

The device used to measure blood pressure is called a **sphygmomanometer** (an inflatable cuff wrapped around the arm, with a pump attached – which is used to inflate it). The blood flow is slowed and then listened to by a doctor, with a **stethoscope**.
Blood pressure indicates:

- The volume of blood
- Heart rate
- Artery size
- Artery elasticity
- Blood viscosity

Disorders of the Circulatory System

Certain conditions place people at greater risk of contracting a circulatory system disorder:

- Smoking (**nicotine** causes blood vessels to constrict, increasing the heart rate and raising blood pressure – **carbon monoxide** competes with oxygen in the lungs, reducing the blood's ability to carry oxygen)
- Poor diet (may produce a high **cholesterol** level – building fat in the arteries and restricting blood flow)
- Little exercise (makes fatty deposits increase, because the nutrients are not used

A Healthy Digestive System

Food provides nutrients in the form of carbohydrates, fats, proteins, vitamins, minerals and water – which provide energy and materials used for growth, development and repair.
Some foods cause poor health and promote disease (like refined sugar and low fibre foods) if consumed in large quantities over long periods of time.

Nutrients in Food

Starch and **sugars** are carbohydrates and provide the body with its main source of energy. **Fats** are also essential in our diet, providing us with energy and cushioning the internal organs from shock. **Proteins** are essential for growth and repair of body tissues. **Minerals** and **vitamins** are also needed for good health.

Disorders of the Digestive System

High fibre diet is important because fibre is used by the colon to process waste materials (low-fibre can irritate the colon wall and lead to **colon cancer**).
Long-term stress, smoking, excessive use of alcohol or aspirin can lead to a **peptic ulcer**.

A Healthy Respiratory System

Smoking, air pollution and industrial by-products (coal dust) can lead to disorders of the respiratory system.

Disorders of the Respiratory System

Cilia (small hair-like projections in your lungs) beat continuously to remove airborne particles.
Poisons in cigarette smoke and pollutants irritate the lining of the lungs, causing certain cells to produce more mucus. If this lining becomes inflamed, it can lead to **bronchitis**, which can lead to **emphysema**.
Lung cancer is caused by the tar and smoke in cigarettes, which cause the lung cells to grow out of control and overcome healthy cells.

You and Your Body

Proper care means maintaining healthy organs and organ systems. This can be accomplished with clean air and water, nutritious foods, exercise and sleep. This is a healthy lifestyle, which makes you feels better and helps your body resist disease. Your **immune system** will work best when you are well fed and rested.

WRAP-UP p. 163

>>>> A good review of Topics 6 – 7 in this Unit <<<<

Unit Review p. 168-171

>>>> A review of all of the Topics in this Unit <<<<