



### Section 4.0

#### Scientific investigation leads to new knowledge about body systems and new medical applications

##### 4.1 – Developing A Theory For Disease

If you lived in before the 17<sup>th</sup> Century, chances are that a simple cut or broken bone would have killed you. This is because of infection and the lack of knowledge about cleanliness.

##### The First Vaccine

In the late 1700's **Edward Jenner**, an English country doctor, developed the first vaccine. He noticed that milkmaids who had cowpox (a mild form of smallpox) did not get smallpox. He began infecting people with cowpox so that they would become immune to smallpox, and it worked – the first **vaccine** was created. The last case of smallpox reported was in 1979.

##### Watch Out Germs!

**Louis Pasteur** was the first person to identify living micro-organisms as “germs”. He suggested, and later proved his theory that these germs were the cause of most infectious diseases. The process of heating food, to kill the micro-organisms, worked. The process was called pasteurization and is still used today.

##### Cleaning Up The Germs

Once doctors knew that ‘germs’ caused disease, other discoveries followed. **Joseph Lister** determined that these germs were entering his patients wounds, so he introduced the practice of cleanliness and sterilization to surgery.

##### Nutritional Research

During the time of discovery, explorers would travel on ships for very long periods of time. The only foods they could take along were ones that wouldn't spoil. Many sailors developed **scurvy** as a result – with open sores, bleeding gums, loose teeth, and an unsteady gait. James Lind treated these sailors by feeding them oranges and lemons. It was later discovered that scurvy was caused by a lack of Vitamin C. Researchers have discovered that various diseases can be treated by proper dietary choices. [Canada's Food Guide](#) was developed to show people how much of certain types of foods are necessary to stay healthy.

##### 4.2 – Factors That Affect The Healthy Function of Body Systems

Diet, exercise, drugs, injury and disease can affect body systems and how they perform their functions. Scientific Research has also determined that there are many factors, which can affect your cells, and consequently, your body systems.

These factors include:

- Diseases or conditions that are inherited from family
- Sensitivity (allergies) to environmental conditions; such as smog, pollen, dust, dairy products, or peanuts. Asthma is a condition, which reflects this kind of sensitivity.
- How you respond to physical, emotional and psychological stresses.
- How you treat your body in general – making healthy choices, instead of unhealthy choices

Disorders, which can hospitalize Canadians include:

- circulatory system (15%)
- digestive system (11%)
- respiratory system (10%).



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

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

### **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).

## **Factors Affecting the Respiratory System - SMOKING -**

### **The Contents of Cigarettes**

There are over 400 different chemicals in a cigarette. Tar, carbon monoxide, and nicotine are the most destructive. **Tar** is a sticky substance formed when the cigarette is burned. As it is inhaled, the tar settles on the surface of organs (lungs) and interferes with the function of the cilia (to move mucus out of the respiratory tract). **Carbon monoxide** is also released when the cigarette is burned and gets absorbed by the red blood cells, during gas exchange. Less oxygen is absorbed by the red blood cells, causing the heart to work harder and faster. **Nicotine** is an addictive drug that causes the heart to speed up, and raises the blood pressure. Besides smoking, air pollution and industrial by-products (coal dust) can lead to disorders of the respiratory system.

### **Disorders of the Respiratory System** (Smoking-Related diseases)

If the lining of the lungs becomes inflamed, it can lead to **bronchitis** (which makes breathing more difficult), which can further lead to damage of the lung tissue, causing **emphysema** (shortness of breath), which is a permanent condition. **Lung cancer** is caused by the tar and smoke in cigarettes, which cause the lung cells to grow out of control (tumours are formed) and overcome healthy cells.

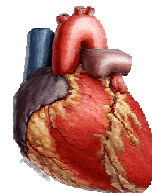
## **Factors Affecting the Circulatory System**

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 (a lipid – 'fat') level**. Too much of a type of food that has a high content of fat will cause a build-up of cholesterol in the walls of the arteries. This build-up, called **arteriosclerosis**, makes it more difficult for blood to flow and can lead to a **heart attack**.)
- **Little exercise** (makes fatty deposits increase, because the nutrients are not used up completely.)

### **A Healthy Circulatory System**

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



### **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:

<u>Component</u>	<u>% of blood (by volume)</u>	<u>Main Function</u>
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

**Disorders of the Circulatory System** include: **high blood pressure** (hypertension), heart attacks (damage to heart muscle) and High blood pressure, or **hypertension** (*'the silent killer'*) can lead to **strokes** (brain damage).

### Measuring 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

### Factors Affecting the 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. 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

Painful **ULCERS**; sores on the lining of the stomach, originally thought to be caused by stress, are caused by H. pylori (*Helicobacter pylori*), a bacteria present in the stomach..

High fibre diet is important, the 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**.

### Healthy Life Style

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 feel better and helps your body resist disease. Your immune system will work best when you are well fed and rested.