

3

Physical Well-being – Healthy Body

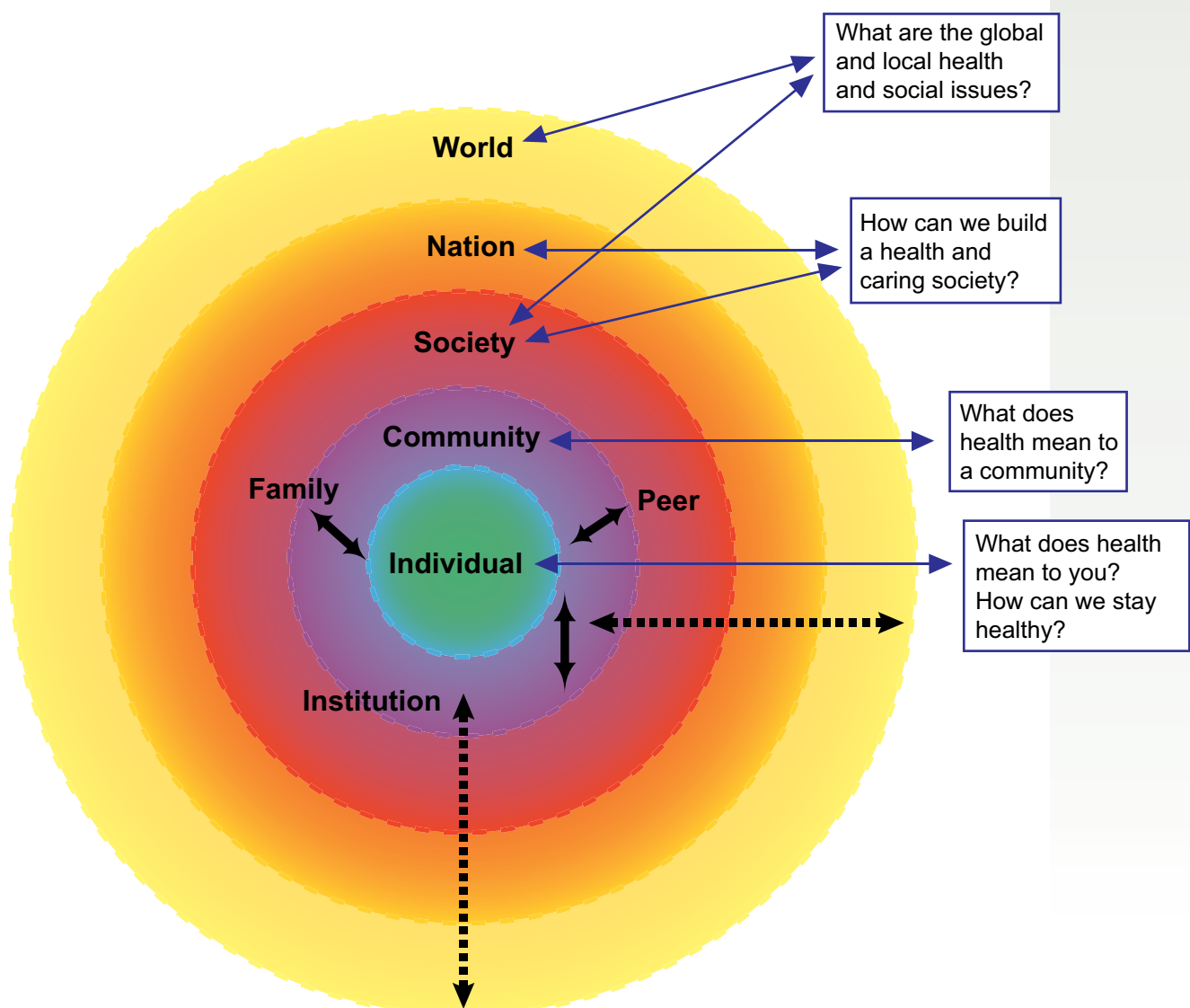
Health Management
and Social Care
(Secondary 4-6)



Health Management and Social Care Booklets

The design of the HMSC curriculum rests on the notion of the interconnectedness of the various levels at which phenomena related to health and sickness, well-being and ill-being, and personal and community care are to be understood. The curriculum aims to enable students to explore all of these levels as well as the relationships between them. The different levels can be interpreted as the individual, the family, the peer group, the community, the institutional setting, society, the nation and the world (Figure 1).

Figure 1 The Various Levels and Essential Questions of HMSC



This part includes 19 booklets of learning and teaching reference materials for teachers. The topics and information in these booklets are selected and organized based on the five essential questions from various levels mentioned in the curriculum design in Chapter 2 of the Health Management and Social Care Curriculum and Assessment Guide (Secondary 4-6)(2007). The booklets facilitate teachers to develop an overall framework of HMSC and identify the key concepts of the curriculum so that their students will be more able to critically assess the relevant issues. Details of these booklets are as follows:

Levels	Essential Questions	Booklets	
Individual, Family and Peer	What does health mean to you?	1	Personal Needs and Development across Lifespan
		2	Health and Well-being
	How can we stay healthy?	3	Physical Well-being - Healthy Body
		4	Mental Well-being - Healthy Mind
		5	Social Well-being - Inter-personal Relationship
Community	What does health mean to a community?	6	Healthy Community
		7	Caring Community
		8	Ecology and Health
		9	Building a Healthy City
Society	How can we build a healthy and caring society?	10	Health Care System
		11	Social Welfare System
		12	Medical and Social Care Professions
		13	Health and Social Care policies
		14	Social Care in Action
Local and Global Societies	What are the local and global health and social issues?	15A	Health and Social Care Issue - Ageing Population
		15B	Health and Social Care Issue - Discrimination
		15C	Health and Social Care Issue - Domestic Violence
		15D	Health and Social Care Issue - Addiction
		15E	Health and Social Care Issue - Poverty

Each booklet will start with some essential questions. The expected learning outcomes in terms of knowledge, skills, value and attitude as well as the content outline will be listed as an overview. Teachers are advised to adapt and flexibly use the materials based on the school or community situation, background of students, interest, learning skills and the prior concepts and knowledge that students have acquired before, to add or delete contents. Teachers can also use social issues as examples and graphic organizers illustrated in Booklet 3.1.5 to help student organize and analyze complex and abstract concepts, helping them to construct their knowledge effectively and build a good foundation with thorough understanding.

How can we keep healthy?

Health begins with individuals. To learn how to promote community, social and global health, one should begin with himself/herself by establishing a healthy life style. According to the World Health Organization (WHO), the definition of health introduced in 1947 is that health is a state of complete physical, mental and social well-being, and more than simply being free from diseases or physically fit. That is, one should maintain their physical, mental and social well-being in order to stay healthy. How can an individual maintain health along these three dimensions?

This section is divided into three booklets. Booklet (3) - Physical Well-being - Healthy Body starts with an overview of different body systems and is followed by sections on how we measure physical health and ways to maintain our physical fitness such as weight management, balanced diet and physical exercises etc. Booklet (4): Mental Well-being – Healthy Mind explores the factors that influence the mental health of individuals and the ways to maintain mental health. Booklet (5): Social Well-being – Interpersonal Relationship: explores how interpersonal relationships influence personal growth and how to develop and maintain good interpersonal relationship.

The topics of Health Management and Social Care to be included in Booklet 3, 4 and 5 are listed in the following table:

Booklet		Health Management and Social Care Curriculum and assessment topics
3	Physical Well-being - Healthy Body	<u>Compulsory part</u> 3A The notion and practice of health promotion, health maintenance, ill-health prevention, social care, welfare and community services 4C Aspects of risk assessment and health management
4	Mental Well-being - Healthy Mind	<u>Compulsory part</u> 5C Mental health as a personal predicament and as linked to the social context
5	Social Well-being - interpersonal Relationship	<u>Compulsory part</u> 1C Transitions and changes in the course of lifespan 4D Social care, healthy relationships, social responsibility and commitment in the family, community and groups

3 The Healthy Body

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Learning Targets

Through the study of the topic on physical well-being - healthy body, students are expected to:

Values and attitudes

- ❖ Demonstrate a commitment to the promotion of personal health and a healthy lifestyle
- ❖ Encourage and support others in making health decisions for healthier lifestyles

Knowledge

- ❖ Understand the basic functioning of body systems
- ❖ Understand the protective factors and risk factors to physical health

Skills

- ❖ Use health indicators to keep track of general health conditions

Key Questions

To achieve the above learning targets, teachers may use the following questions to enhance understanding:

- ❖ What does a healthy body mean?
- ❖ How can an individual's physical health be measured?
- ❖ How can we maintain a healthy body?

3.1 Indicators of Physical Health

In Booklet (2), physical health refers to a good condition of physical functioning. How do we know our body systems are working properly? The following are the common indicators of physical health:

(A) Height and Weight

Growth charts are commonly used to measure physical growth at different stages of life. The charts are valuable in helping to determine the degree to which physiological needs for growth and development are met and provide a record that visualizes the child's achieved size and his or her growth pattern over time.

If an abnormal pattern of growth is detected, a health care professional can take action, together with the family, to further assess and address the situation. This can mean improving nutritional support, addressing environmental impediments to growth, administering appropriate medical therapy, or conducting an investigation that can lead to a more timely diagnosis of an underlying disease.

Many government agencies rely on growth charts to measure the general well-being of populations, formulate health and related policies, and plan interventions and monitor their effectiveness.

The World Health Organization (WHO) launched the New Global Child Growth Standards for Infants and Children on 27 April 2006, providing the growth rate and reference for child development for the whole world. (Please see part 1.1 of Booklet (1) for further details)

The new Child Growth Standards for infants and children provided by the WHO indicate that: given a good start, a child will eventually develop and grow to the same height and weight irrespective of the place they were born. Although there are individual differences, people have similar growth patterns in different territories and across different nationalities. For example, by providing good conditions for growing, children will have similar growth pattern irrespective of whether they come from India, Norway or Brazil. The new standard has proved that the development of children before 5 years old is affected by nutrients, feeding methods, environment, and hygiene and medical care rather than heredity and nationality.

With these new standards, parents, doctors, decision makers and child rights advocates will be able to understand when their children's nutrition and hygiene needs are not met. Hence they can discover and treat malnutrition, obesity, cases of overweight children, and other growth problems in the early stages.

The WHO carried out research in 1997, assessing the physical growth, nutrition status and physical development of children from infancy to 5 years-old, in order to release a new international standard. From 1997 to 2003, the WHO collected the growth and other related data of 8,440 healthy children from different countries such as Brazil, Ghana, India, Norway, Oman and the United States. Children in this research were advised and provided the best living environments and appropriate conditions for growth and development. This included advice on feeding methods, good conditions of hygiene and care, non-smoking mothers, and other factors that promote healthy conditions. The growth and development standard suggested that the differences in growth and development among children are mainly influenced by nutrition, feeding methods, environment and health care rather than genetic factors and their respective nationalities. Hence, this standard is suitable for all children in the world.

At present, the most criticized thing about the standard of child growth is the feeding of formula milk. Feeding of formula milk is different from breast-feeding. Children who are fed formula milk usually put on weight faster. Hence, there may be a misunderstanding that children who are fed by breast-feeding are underweight. The new standard that provides the growth and development charts of children is based on the breast-feeding of children.

The new growth standard has the following features:

- ❖ It provides a standard to outline the growth of babies and infants. The care is based on the important healthy practices in health promotion, such as breast-feeding, appropriate child care and a non-smoking family
- ❖ Breast feeding and the breast fed babies become the norm
- ❖ It is a world standard, with data having been collected from six countries
- ❖ It not only includes the standard of height and weight, but skinfold thickness
- ❖ It is a longitudinal study, providing the standard of growth rate

For further information, please visit the WHO website-
<http://www.who.int/childgrowth>



Related Booklet

- ❖ The growth charts of the new global Child Growth Standards is included in Booklet (1) - Personal Needs and Development across Lifespan

(B) Body Composition and Fat Ratio

Body composition and the problem of obesity can be measured by using the BMI, Callipers and waist-hip ratio.

1. Body Mass Index (BMI)

BMI is usually used to assess body composition. It is a simple index of height and weight to determine whether an adult is underweight, overweight or obese. BMI is the sum of the ratio of body mass expressed in kilograms to the square of height in meters.

$$\text{BMI} = \text{body mass in kg} / (\text{height in m})^2$$

According to the standard for Asian adults from the WHO west pacific region (2000):

BMI	Classifications
< 18.5	Underweight
18.5 - 22.9	Healthy / desirable weight
23 - 24.9	Overweight
25 +	Obese

There are health risks associated with increasing BMI, but the interpretation of BMI grading in relation to risk may differ across populations. BMI may not correspond to the same degree of fatness in different populations, due to the fact that different populations may have different body proportions. Moreover, BMI may not be applicable to some target groups, such as the elderly and the practitioners of physical fitness programmes.

Asian populations have different associations between BMI, percentage of body fat and health risks from European populations. For example, the BMI of Asians with a high risk of type-2 diabetes and cardiovascular disease is lower than the existing WHO cut-off point for being overweight. Recently there is a growing debate about the interpretation of BMI cut-off points for determining who is overweight and obese in Asian populations. The WHO has collected data

from ten countries in Asia, stating that when the BMI of an Asian reaches 23, eventually the risk of obesity and related disorders and cardiovascular diseases increases. In 2007, the WHO revised the standard for Asians, ranging from 18.5 to 22.9.

2. Callipers and body fat scale

The shortfall of BMI is that it does not distinguish between fat and fat-free mass. Moreover, weight increases may be due to the accumulation of fat content under skin, excess accumulation of water content in the body or muscle mass. Hence, weight is not an accurate measurement to determine the degree of fatness. We can get a more accurate reading by measuring the thickness of fat under the skin.

Callipers are used to measure the thickness of skin-folds at various sites, with the biceps, triceps, sub scapula and super iliac crest being the most common anatomical sites of measurement. Pinch the skin with your thumb and index finger when you do your measurements and use the callipers to measure the thickness.

Moreover, the body fat scale also shows one's fat ratio (please see figure 3.1)

Figure 3.1 Body fat scale



Generally, the proportion of fat to weight among males is 10% to 20% while 15% to 25 % among females. People are said to be obese if males exceed 25% and females exceed 30%.

3. Waist circumference and waist-hip ratio

Most of the major organs are in the abdominal region. High percentages of fat in the abdominal region are associated with health problems. Also, the waist circumference is proportional to the percentage of fat in the abdominal region. Hence, waist circumference is another measurement of fatness. On the whole, a waist circumference of more than 102 cm (40 inches) in men and 88 cm (34.5 inches) in women puts them at risk. In 2000, the WHO suggested an average waist circumference of 90cm (35.5 inches) in men while 80cm (31.5 inches) in women.

The waist-hip ratio is a measurement of central obesity, which is the quantity of fat accumulated around the waist.

 Calculation: $\text{Waist Circumference (cm)} / \text{Hip Circumference (cm)}$

Researches show that the desirable waist-hip ratio should be less than 1.0 for men and less than 0.85 for women.

Generally speaking, the waist-hip ratio is related to the risk of cardiovascular diseases. A high ratio suggests that most of the body fat is accumulated around the waist, that is called central obesity, which means there is an increased risk of cardiovascular diseases.

4. Body image: the product of media

The human body is the physical manifestation of oneself. How a person pictures and feels about his/her body represents his/her own body image. Body image includes the values towards one's size, sex, sexuality, appearance, body functions and status. The value of self-image is greatly influenced by the media. The values of media on beauty and health together with peer pressure have great influences on one's body image.

Social pressure may force an individual to conform to certain body shape standards. Hence, there may be a link between eating disorders and the image of skinny models that are created by the media.

Eating disorders refer to a disruption in the eating habits or appetite of an individual. The inappropriate amount and the type of food that an individual eats or chooses not to eat. Eating disorders influence one's emotion, mental and physical health. Eating disorders are associated with emotional, interpersonal relationship and psychiatric problems.

Bulimia nervosa is a compulsive eating disorder. Very often patients consume huge quantities of food in an uncontrolled manner, followed by self-induced vomiting. It is most common among females. Recently however, it is becoming more common among males. This disorder can be caused by many factors. Most people suffering from this disorder are extremely afraid of gaining weight. They secretly indulge in binge eating and self-induced vomiting. Psychological treatments should be provided to patients and they should participate in eating classes that are under the supervision of a health professional.

Anorexia nervosa is an eating disorder that is regarded as an imbalance between physical and psychological health. That is, a physical as well as a psychological disorder. This is more than a loss of appetite. In the beginning, patients have normal appetite. Yet, they have a distorted perception of their body image which causes them to start controlling their eating habits. They may indulge in using medication or vigorous exercise in order to control their weight. In time, their eating behaviors are disrupted and eventually develop into anorexia nervosa.

The ideological messages created by the media place much emphasis on gender identity and body size, which may lead to eating disorders. Some people believe that regular readers of women's magazine are easily influenced by the articles about body shape and weight management and are more likely to diet to reduce weight. People also follow the instructions of the magazines and participate in fitness courses to achieve skinny body shapes illustrated in the magazine. Some young ladies are dissatisfied with their body weight and shape after reading fashion magazines. Some research found that people believe the ideal body shape of girls who reach puberty is 153 cm in height and 45 kg in weight, with long blond hair and blue eyes. Yet, the Body Mass Index (BMI) of this ideal body shape does not reach the normal standard: it is underweight.

Appropriate weight management is important for a person to maintain proper height and body shape. Ideal weight is believed to be the optimal weight that allows proper physical functioning.



Useful Websites

Reading (1) Slim is beautiful?! -
Normal body weight
http://www.cheu.gov.hk/b5/info/exercise_17.htm

Reading (2) Slim is beautiful?! -
“Slimming treatments” at a glance
http://www.cheu.gov.hk/b5/info/exercise_16.htm

Reading (3) Slim is beautiful?! -
a safe and effective weight loss programme / treatment
http://www.cheu.gov.hk/b5/info/exercise_15.htm

(C) Cardiovascular Functioning

Having good body shape does not mean having good physical health. Physical health also means the working ability and activity of the body are at their best. Cardiovascular functioning affects different body systems. Cardiovascular functioning will be negatively affected due to cardiovascular diseases caused by being overweight or obese. The followings are the different ways we can measure cardiovascular functioning:

1. Pulse rate

Figure 3.2 Measuring pulse rate



Pulse is the blood flow in an artery that is palpable. The circulation system is composed of the heart, bloodstream and blood. They are responsible for transporting oxygen, carbon dioxide, nutrients and waste. The pulse is caused by the stroke volume ejection and distension of the walls of the aorta, which creates a pulse wave as it travels rapidly towards the distal ends of the arteries. As the volume of blood increases, the arteries are expanded. The pulse can be felt by applying gentle pressure over a pulse point.

Normal age - related variation in resting pulse rate :

Age	Normal range / Minute	Average rate / Minute
Newborn	100-170	140
1 year	80-170	120
3 years	80-130	110
6 years	75-120	100
10 years	70-110	90
14 years	60-110	90
Adult	60-100	80

✧ Pulse rate may be different when it is measured at different times or in different physical conditions (such as after exercise). Therefore, the judgment can not be made on the data from one or two measurements.

2. Blood pressure

Blood pressure is the measurement of pressure exerted on the blood vessel walls during systole and diastole. It is measured in terms of millimeters of mercury (mmHg). Blood pressure is a result of the cardiac output and peripheral vascular resistance. Normal arteries expand during systole and contract during diastole, creating two distinct pressure phases:

Figure 3.3 Mercury Sphygmomanometer



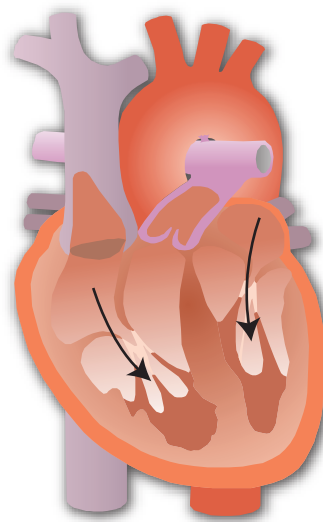
- ✎ Systolic blood pressure - a measurement of the maximum pressure exerted against arterial walls during systole (when myocardial fibers contract and tighten to eject blood from the ventricles), which is primarily a reflection of cardiac output.

Figure 3.4 Heart contracts to eject blood



- ✎ Diastolic blood pressure - a measurement of pressure remaining in the arterial system during diastole (period of relaxation that reflects the pressure remaining in the blood vessels after the heart has pumped), which is primarily a reflection of peripheral vascular resistance.

Figure 3.5 Heart relaxes for blood returning



Normal blood pressure at different ages:

Age	Systolic (mmHg)	Diastolic (mmHg)	Average (mmHg)
Newborn	65-95	30-60	80/60
Infant	65-115	42-80	90/61
3 years	76-122	46-84	100/56
6 years	85-115	48-64	100/56
10 years	93-125	46-68	109/58
14 years	99-137	51-71	118/61
Adult	100-140	60-90	120/80
Elderly	100-160	60-90	130/80

✧ Blood pressure may be different when it is measured at different times or in different physical conditions (such as after exercise). Therefore, the judgment can not be made on the data from one or two measurements.

Pulse and blood pressure reflect one's physiological functioning as well as physical functioning. They are sensitive to any changes of the body; thus, they are the best indicator for clinical use. Any changes in blood pressure indicate manifestations related to cardiovascular function, renal function, metabolic function, as well as neurological function. Besides, rises in pulse rate or blood pressure may also reflect the emotional status of an individual. Therefore, people with persistent abnormalities in pulse rate and blood pressure should seek medical advice and pay attention to personal health management.

(D) Physical Fitness

Apart from the above-mentioned indicators, a good state of physical fitness is also another component that represent healthiness. Physical fitness refers to the ability that an individual is able to carry out daily activities with energy and alertness without feeling exhausted, and enjoys the leisure time, coping with unexpected incidents.

Physical fitness can be measured in several aspects:

1. Muscular strength and muscular endurance

Muscular strength is the ability of the muscles to exert force using one single muscle contraction to overcome resistance, e.g. the amount of force needed to move a heavy object. Muscular endurance is the ability to perform repeated muscle contractions over a period of time, e.g. walking and running.

2. Cardio-respiratory endurance

Cardio-respiratory endurance refers to the ability of the circulatory system and the respiratory system (i.e. heart and lungs) to supply oxygen to the working muscles and remove metabolic waste (e.g. carbon dioxide) at the same time. Cardio-respiratory endurance is the basis for sports. This function is important to everyone's health because it increases the blood and oxygen supply to major organs and eventually increases body efficiency and improves health.

Figure 3.6 Cardio-respiratory endurance



3. Flexibility

Flexibility refers to the ability of the joints to reach their full range of movement. The ageing process will reduce flexibility, as the normal joint lubrication mechanisms become less efficient. This, together with the 'wear and tear' on the joints can result in stiffness and is associated with loss of muscle tone that affects balance.

3.2 Maintaining Physical Health and Well-being at Different Levels

We can maintain a good condition of physical functioning at individual and social levels.

(A) Individual Level

1. Healthy diet

Food is the source of energy, satisfying the needs of daily activities as well as metabolic function. Food also provides nutrients to humans and is essential for life. Human activities are supported by energy that is generated from food. Nutrients are important for growth, repair, and health maintenance as well as disease prevention.

Nutrients are biochemical substances that come from both liquid and solid food we eat. Nutrients can be subdivided into macronutrients and micronutrients.

Macronutrients

Macronutrients refer to nutrients that we need a large amount of everyday. They are the main ingredients of food that are needed for body processes and health maintenance. Macronutrients are important for growth, metabolic function and bodybuilding. Macronutrients can be classified into three groups, namely, carbohydrates, protein and fat. Macronutrients are responsible for producing and maintaining body tissue and providing energy to the body.

- Protein - Protein is the basis for making body cells. It is important to muscles, internal organs, the cerebrum, the nervous system and the skin. It is also a regulatory material inside the body. The major function of protein is to promote growth and repair body tissue. When the amount of energy stored in the body is inadequate, protein will be decomposed and release energy to support the body.
- Carbohydrate - Carbohydrates are the source of energy in our daily diet. Carbohydrates can be divided into 3 groups, namely, monosaccharide, disaccharide and polysaccharide (starch and dietary fibre). Dietary fibre is a kind of carbohydrate, which cannot be neglected in our diet. Soluble fibre is able to lower the level of blood sugar for diabetics, and helps clean the colon, reducing contact with possible carcinogens, preventing colon cancer.

- Fat - Fat belongs to the group of lipids. It can prevent heat loss in cold environments, as well as protecting the internal organs from shock. Fats are classified according to the amount of elements they contain. The two main groups of fats are saturated fats and unsaturated fats. Too much consumption of saturated fats (e.g. animal fats and oil) tends to increase low-density lipoproteins and lower high-density lipoproteins, which will elevate cholesterol levels and therefore increase the chance of cardiovascular diseases. Unsaturated fats (e.g. plant food) help lower the cholesterol level. However, recent research suggests that trans fatty acid in the unsaturated fat will increase low-density lipoprotein and reduce high-density lipoprotein.



Trans fatty acid

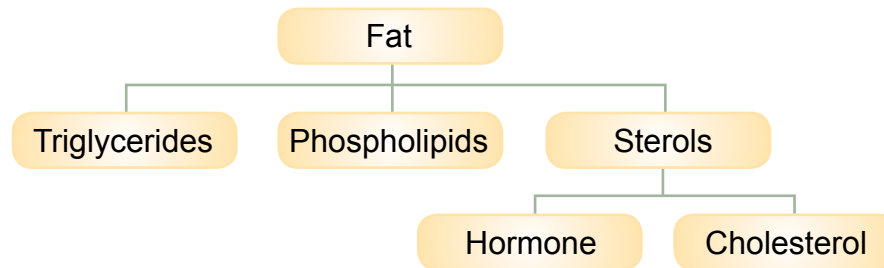
Unsaturated fats can be classified into:

- ✧ Monounsaturated fats
- ✧ Polyunsaturated fats
- ✧ Trans fatty acid

Trans fatty acid in meat and natural source of milk product is relatively small. If natural fat is being fried, trans fatty acid will be released. Most trans fatty acid comes from hydrogenated vegetable oils. Trans fatty acid creates a crispy texture and is good for preserving food. This kind of fat is commonly used among packed foods and fried food in restaurants. Consumption of trans fatty acid increases the risk of Coronary Heart Disease because trans fatty acid raises low-density lipoprotein cholesterol (so-called bad cholesterol) level.



What does a high level of cholesterol mean?



Fat

There are three types of fat, which have different functions:

1. Triglycerides - account for 95% of dietary fat and is the main source of energy
2. Phospholipids - elements of membranes; help absorb fat and soluble vitamins
3. Sterols - responsible for producing hormones and cholesterol

Cholesterol

Cholesterol is a kind of fat. It comes from meat, fish, poultry, shellfish, egg and dairy product. 20% to 30 % of the cholesterol in the blood is directly absorbed from the food we eat, while most of the cholesterol is produced by the liver.

Cholesterol produces sex hormones, bile and vitamin D. Cholesterol in the blood is attached to lipoproteins and cannot be transported alone.

Cholesterol in the blood can be divided into:

- ❖ Low Density Lipoprotein (LDL)
 - ◆ It is like a truck, circulating the cholesterol in the blood. Yet, it deposits cholesterol in the cells, quickening the rate of hardening of the arteries.
 - ◆ It is also known as bad cholesterol.
- ❖ High Density Lipoprotein (HDL)
 - ◆ It is like a garbage truck, removing cholesterol from the artery walls and returning it to the liver where it is excreted from the body.
 - ◆ It is also known as good cholesterol.

Figure 3.7 The work of the HDL and LDL

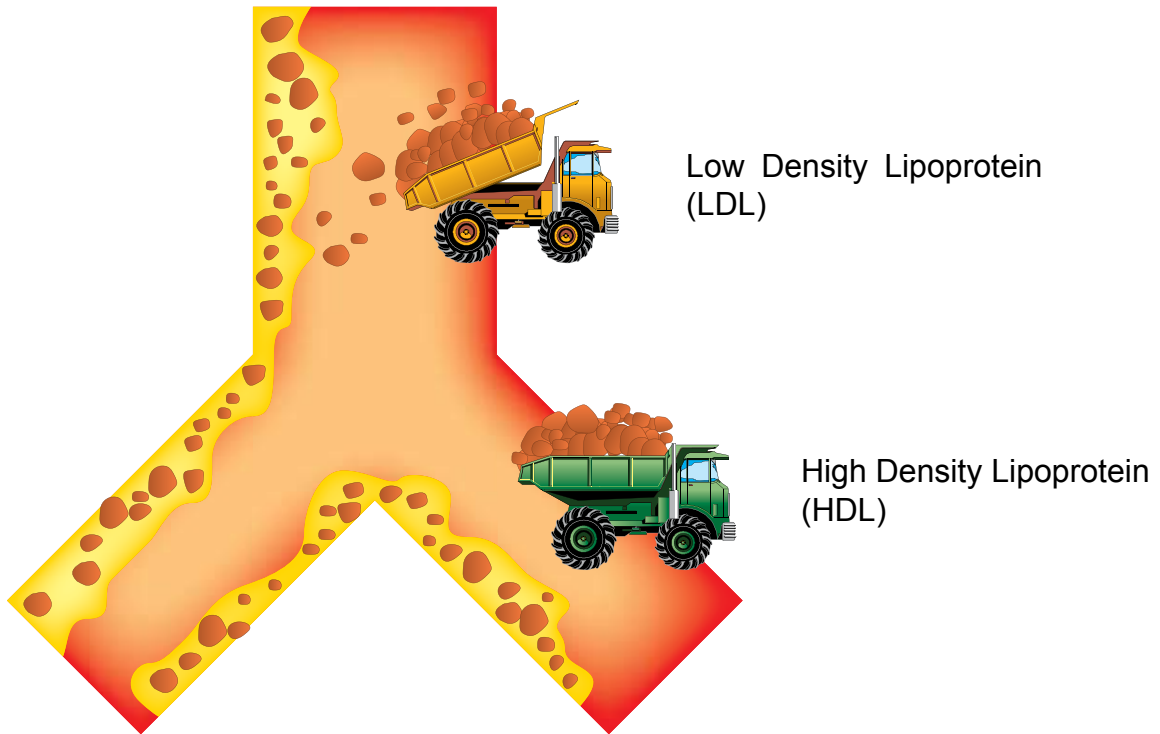
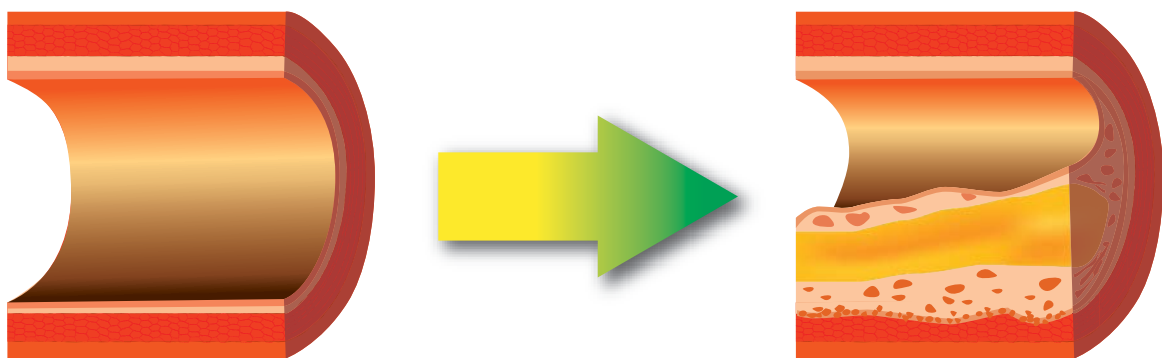


Figure 3.8 Fat Deposition in Arteries



Micronutrients

Micronutrients are responsible for regulating cell function. People do not need too much of these nutrients to maintain their health. There are two major types of micronutrients, namely, vitamins and minerals.

➤ Vitamins

Vitamins are an organic compound. They can be divided into fat-soluble (vitamins A, D, E and K) and water-soluble (vitamins B and C). Different solubility affects their absorption and persistence in the body. Vitamins are essential in maintaining one's health. Excessive intake of fat-soluble vitamins is undesirable. Fat-soluble vitamins will be dissolved in the blood and circulated around the body after absorption. Excess amounts will be stored in the human body – the liver. Hence, excess amounts stored in the liver may cause poisoning. Unlike the fat-soluble vitamins, water-soluble vitamins cannot be stored in the body. They will be excreted through the kidney, and they are relatively safe. Yet, an excess amount will create biochemical reactions in the body.

An adequate amount of vitamins is essential to our health. For example, vitamin B12 is necessary for the production of red blood cells. Vitamin B12 deficiency will lead to anemia. Vitamin C helps wound healing, absorption of iron supports the action of the oxidase system and enhances resistance to infection. Deficiency in Vitamin C will lead to scurvy. Vitamin D helps the development of strong bones. It also protects older elderly from deterioration of ossicles and osteoporosis; thus, reducing chances of bone fracture.

➤ Minerals

Minerals refer to other elements which living things require other than the four major elements, namely, carbon, hydrogen, nitrogen and oxygen. Minerals that we can find in our daily diet include calcium, iron, phosphorus, sodium, potassium, magnesium and sulphur. Minerals are essential in assisting in blood clotting, carrying oxygen around the body, heart beating, transmission of nerve impulses and functioning of the metabolic system. For example, sodium plays a role in maintaining water balance within the body and regulates acid-base balance; thus, muscular and nervous system can function properly. Iron is responsible for the formation of haemoglobin, which is essential for red blood cells. Calcium is responsible for forming the hard structure of bones and teeth. Potassium plays a role in maintaining water balance within the body and regulates acid-base balance, helping to maintain the function of the heart beating and the nervous system. Minerals in the body are competitive in nature. Hence, an excess of one mineral may directly or indirectly lead to disorders. For example, excessive intake of zinc may not be harmful, but it will interfere with copper absorption.

Balanced diet

A balanced diet is essential for growth, development and prevention of diseases. A balanced diet is a diet which contains all the essential nutrients in the appropriate quantities for the body to grow, repair and function efficiently. A balanced diet should include a variety of foods that provide different types of nutrients and an appropriate amount of calories. Most important, the energy intake varies according to different age, height, body weight and level of physical activity. It is widely accepted that carbohydrates, proteins, fats, minerals, vitamins and dietary fibre are essential nutrients.

An imbalance in our diet does not only lead to specific nutrient deficiency. Diets with high fat, high salt and high sugar but low fibre and low calcium also increase the risk of various health problems, such as heart disease, cerebrovascular disease, diabetes mellitus, hypertension, cancers and osteoporosis in menopausal women.

However, it is worth noting that the intake of all essential nutrients should be within proper limits. For example, one should consume no more than 30% of fats in their daily diet with no more than 10% from saturated fat and 300mg of cholesterol as well as no more than 6g of salt per day. Besides, adequate intake of fruit and vegetable is essential in preventing chronic disorders such as heart diseases, hypertension, cerebrovascular disease, diabetes mellitus and certain cancers.



Useful Websites

Healthy eating:

<http://www.eatsmart.gov.hk>

<http://2plus3.cheu.gov.hk>

Information about nutrients:

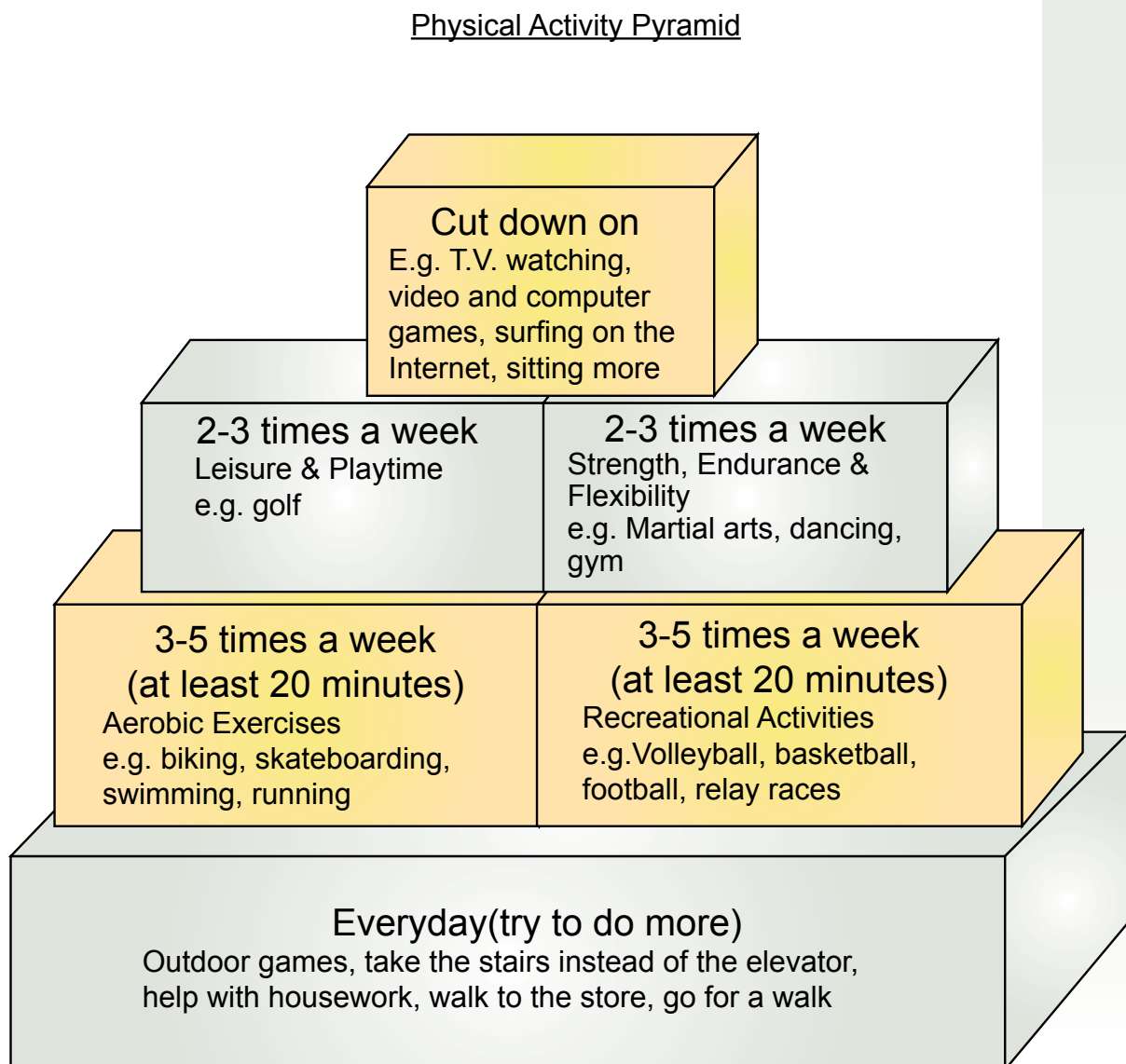
Hospital Authority – Dietetic Information Centre

<http://www.ha.org.hk/dic/home.html>

2. Physical activity

Physical activity is an important component of our daily energy expenditure. The energy expenditure involves the contraction of our muscles. Our daily activities involve different parts of movement, resulting in the movement of our whole body. Physical activities that involve our whole body movement are: occupational activities, household chores, care giving, leisure activities, transport (walking or cycling to work) and sports. Physical activity can be further classified in terms of the frequency, duration and intensity of the activity.

The following physical activity pyramid illustrates a healthy and active lifestyle:



Source : Fun in Seven (<http://octopus.bch.cuhk.edu.hk/fun7/>)

3. Energy Balance – dietary practice and physical activity:

The amount of energy we get from our diet is called the energy input. The amount of energy we spend in physical activities is called the energy output. The more food we eat, the larger the input. The more active we are, the larger the output. Therefore, it is important to keep input and output in balance.

Energy Balance

The same amount of **ENERGY IN** and **ENERGY OUT** over time = **weight stays the same**

More **IN** than **OUT** over time = **weight gain**

More **OUT** than **IN** over time = **weight loss**

The present situation in Hong Kong encourages the consumption of energy-rich foods, and discourages 'energy expenditure'. The availability of a wide variety of tasty, inexpensive, energy rich food served in large portions is a major contributor to the problem. The reduction in 'energy expenditure' is a result of sedentary lifestyle and technological advancement. With spending more time on watching television, playing video games, surfing the Internet and reduction in the number of jobs requiring physical labour, more reliance on labour saving electrical appliances in the household and other settings, and reduction of lesson time for physical education in schools are examples that contribute to the reduction of energy expenditure.

The Department of Health, Hong Kong SAR reported that food intake by the Hong Kong population increased from 567 kg per person per year in 1971 to 678 kg per person per year in 1997. Unless people are much more physically active, the increase in food consumption will certainly lead to energy imbalance and increase the body weight and other health problems.

(B) Interpersonal and Societal Level

If the above healthy practices are good to health, why do some people still fail to maintain such a lifestyle even if they know about those practices? It may be due to the factors beyond the individual level.

1. Support from the Social Network

A social network is the formation of relationships. Members can be an individual or a group such as division, organization or family. Members exchange resources and link up in the social networks. These resources include information, materials, social support and financial support.

The motivation to keep the healthy practices is, to a large extent, influenced by an individual's social network. This social network includes family, relatives and friends whose cultural beliefs and practices impact on an individual's lifestyle. For example, a man/woman who is a member of a jogging team will tend to spend more time on physical activity like jogging than a man/woman whose friends choose a sedentary lifestyle. Therefore, family and peer support is very crucial for an individual to develop and maintain an active and healthy lifestyle.

2. Choice

Healthy lifestyles are collective patterns of health-related behaviors based on choices and options available to people according to their life chances. These life chances are determined by their socioeconomic status, age, gender, race and other factors that have impact on their life choices. For example, families living in poverty may have constraints in their food choices even if they know the importance of a balanced diet. Besides, working mothers who are fully engaged with the demands from work and child rearing may not be able to keep doing physical exercises regularly every week. Therefore, some preventive care, financial subsidies and other resources should be provided to support the health promotion of different population groups, especially the disadvantaged.

Further information on the effects of health on interpersonal relationships and social networks will be discussed in Booklet (5).

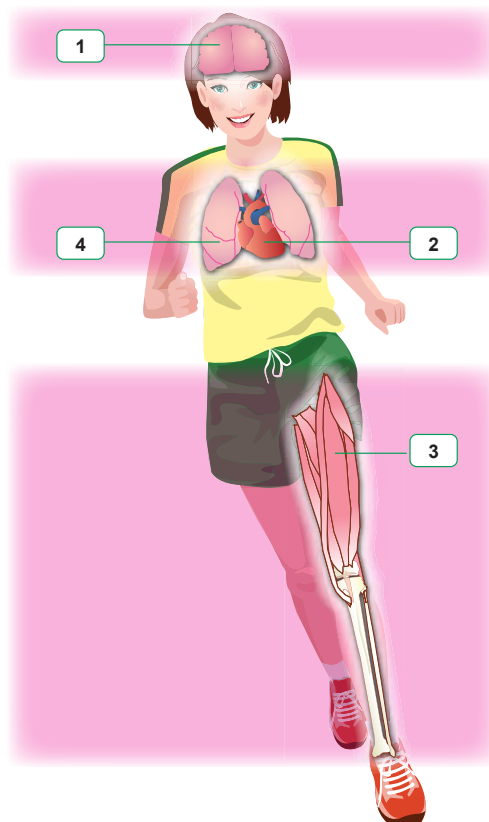
3.3 Understanding Different Body Systems

To achieve a good condition of physical functioning, we should understand different body systems to help us maintain physical health, prevent illnesses and stay healthy.

Running is an example to illustrate how different body systems coordinate and work together:

1. The brain sends out a message: Run! The message is carried through nerves to the muscles. This step involves the nervous system and the muscular system.
2. To get energy, muscles need blood that is pumped by the heart. Blood contains fuel in the form of sugars, as well as oxygen to burn that fuel. This process involves the muscular, circulatory, digestive, and respiratory systems.
3. The muscles burn the fuel and move, causing the bones to move. This activity involves the muscular, skeletal and circulatory systems.
4. Running burns up a lot of fuel. To get more oxygen, the runner gasps for air provided by the lungs. The heart pumps faster. Now the respiratory and circulatory systems are being employed.

Figure 3.9 Cooperation of Different Body Systems



(A) Nervous System

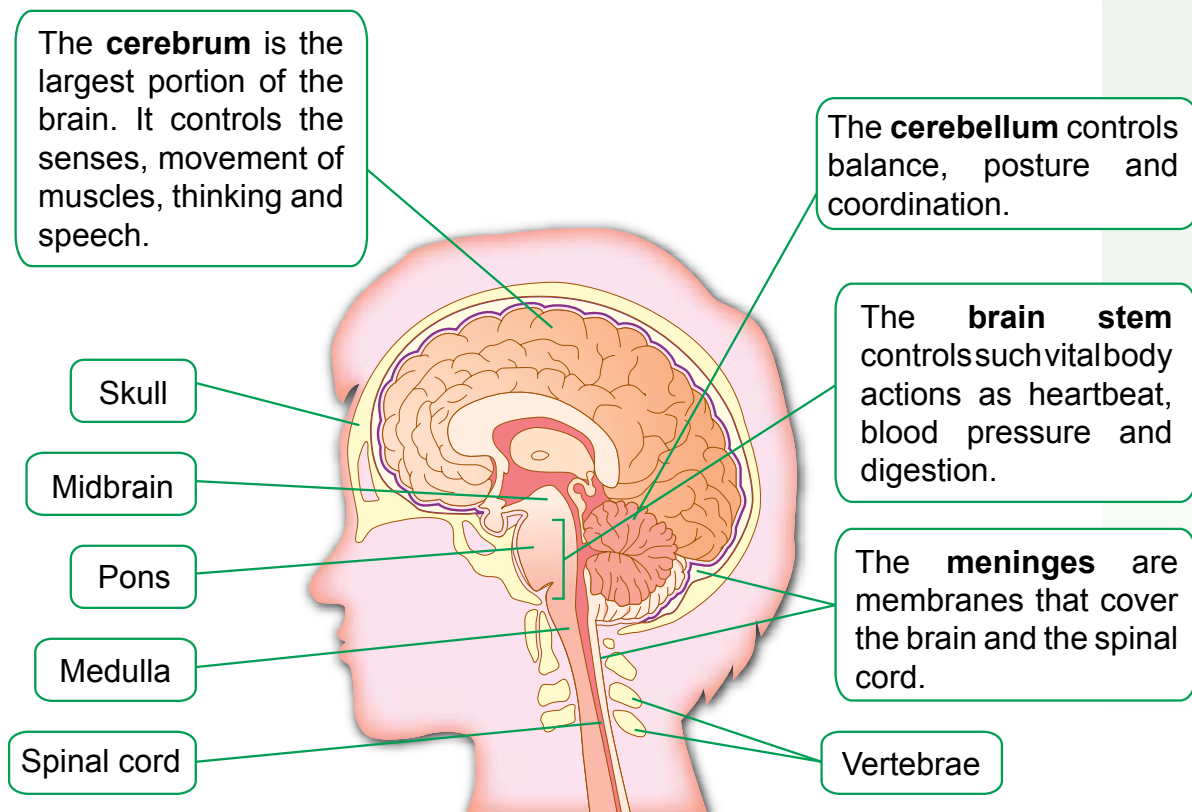
1. Nervous System

The cells that make up the nervous system are called nerve cells, or neurons. Unlike other body cells, they cannot repair or replace themselves if they are damaged. Neurons carry messages to and from different parts of the body. These messages are in the form of very weak electrical signals. Neurons are more acute than other cells. They operate faster.

The nervous system consists of the brain, spinal cord, and many nerves. It controls all of our body's action. It is divided into two main sections: Peripheral nervous system (PNS) and Central nervous system (CNS). The central nervous system and the peripheral nervous system work together (figure 3.11).

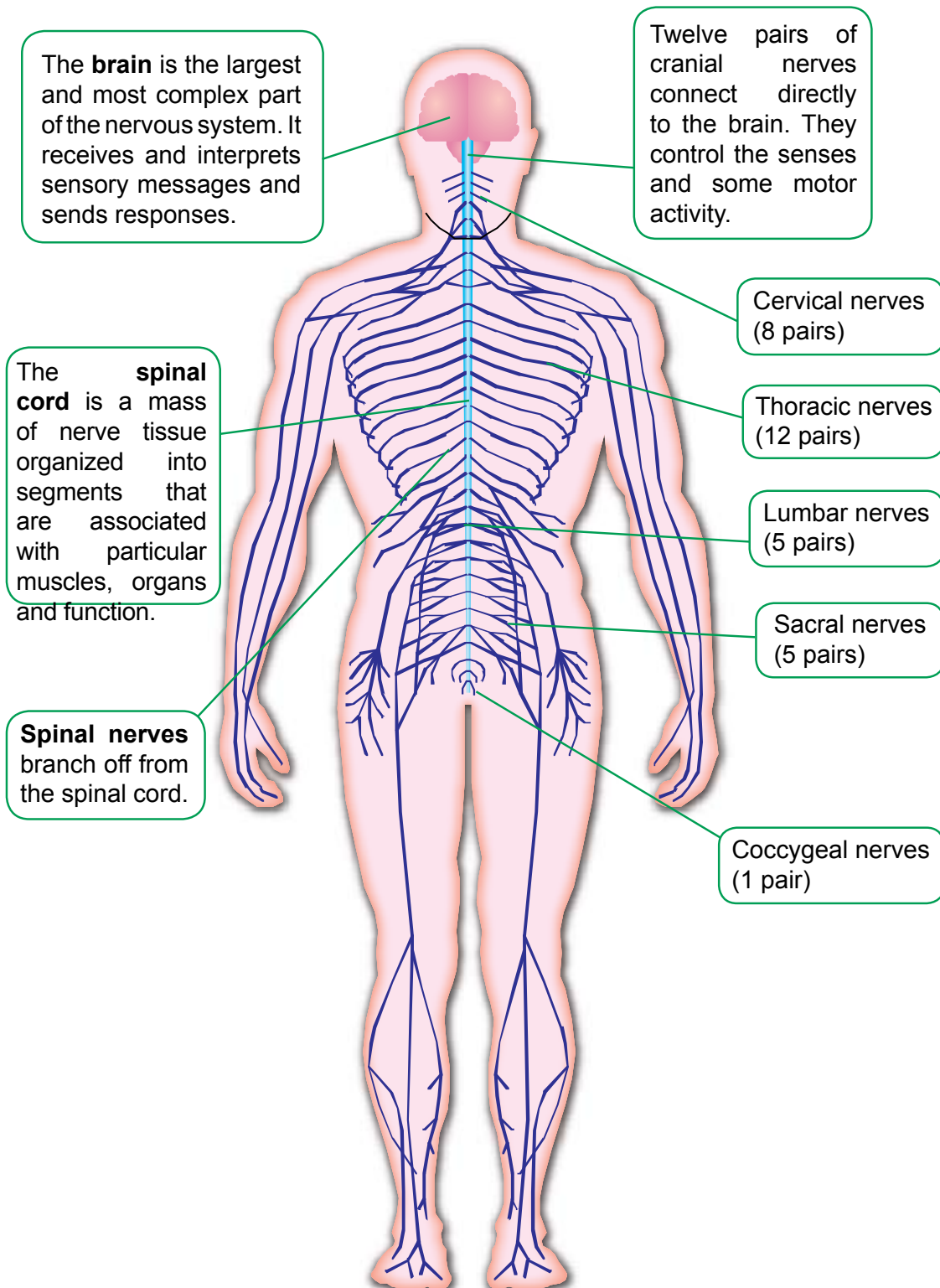
The central nervous system (CNS) includes the brain and the spinal cord. It is the body's main control centre. The CNS controls the body's actions. These actions are divided into two types – voluntary and involuntary. Voluntary actions are those that you can control, such as walking and smiling. Involuntary actions are those that you cannot control, such as breathing and heart beating.

Figure 3.10 Brain



The peripheral nervous system (PNS) includes the nerves that connect the CNS to all parts of the body. They carry messages to and from CNS. Peripheral nerves carry messages to and from your muscles or various body organs. With this system, the brain is able to control the body.

Figure 3.11 Nervous System



2. Problems of the Nervous System

Diseases and Disorders of the Nervous System:

Injuries and Tumors	
(i) Brain Tumor	Uncontrolled cell growth; may be cancerous
(ii) Head Injury	Caused by an impact to the head; blood collects in damaged area and may cause pressure
(iii) Spinal cord injury	Results in partial or total paralysis
Infections	
(i) Polio	Caused by a virus; can result in paralysis (inability to use muscles)
(ii) Rabies	Caused by a virus transmitted by bite of infected animal; may be fatal if untreated
(iii) Meningitis	Inflammation of the membranes that cover the brain and spinal cord
Degenerative Disorders	
Parkinson's disease	Progressive loss of mobility, muscular rigidity, tremors, and speech difficulties
Seizure Disorders	
Epilepsy	Brain disorder that causes uncontrollable muscle activity

3. Protecting the Nervous System

Physical injuries are the most common cause of damage to the nervous system. Any hits on the head can damage the brain. The most common form of brain injury is concussion, which temporarily disturbs the brain function. Injuries to the neck or back may cause spinal cord damage. Such damage may result in partial, or even total, paralysis. Most injuries are the result of accidents or negligence. We can prevent them by acting safely and wearing protective gears when necessary.

(B) Circulatory System

1. Circulatory System

The circulatory system includes the blood, the blood vessels and the heart.

- ✎ **The Blood** - Blood is a mixture of blood cells (red blood cells, white blood cells and cell fragments called platelets) and plasma:
 - Red blood cells carry oxygen to the body cells and carbon dioxide away from the cells.
 - White blood cells help fight diseases and infection by attacking germs that enter the body.
 - Platelets help blood clot, which seals cuts and prevents excess blood loss from a wound.
 - Plasma contains about 92 percent water, which can help the transport of nutrients, hormones and other materials.

- ✎ **The Blood Vessels** - There are three types of blood vessels:
 - Arteries carry blood away from the heart.
 - Veins are the blood vessels that carry blood from the body back to the heart.
 - Capillaries are tiny tubes that carry blood from the arteries to the body's cells and from cells to the veins.

- ✎ **The Heart** -The heart is like a pump. The involuntary muscles of the heart contract and expand, moving blood in two major pathways - pulmonary circulation and systemic circulation.

Systemic circulation moves blood to all the body tissues except the lungs. Pulmonary circulation is the flow of blood from the heart to the lungs and back to the heart.



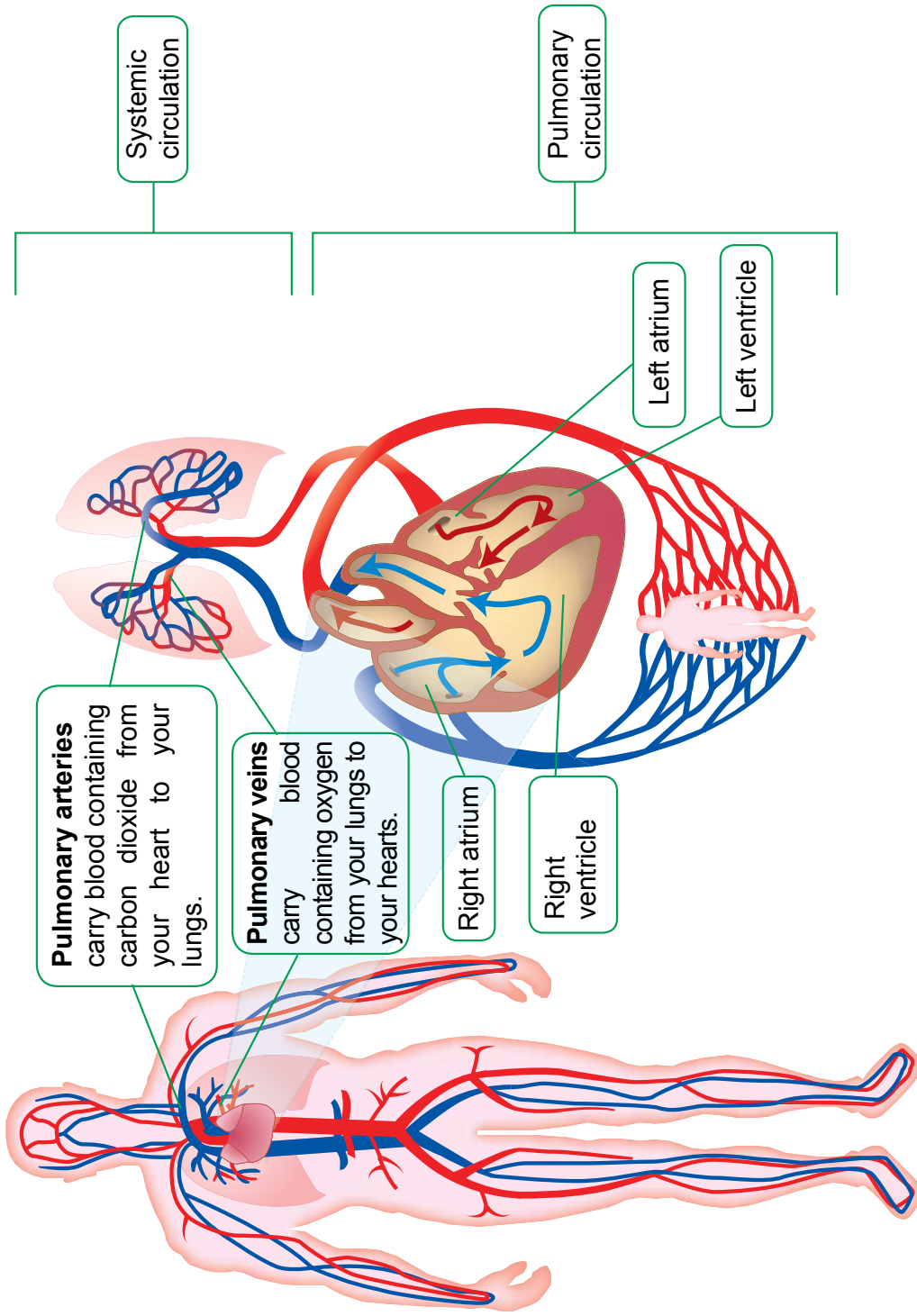
Blood types

- ✧ There are four major blood types: A, B, AB and O.
- ✧ People with blood type O are universal donors, while people with blood type AB are universal recipients during blood transfusion.

Blood type compatibility:

Type	Can Receive	Can Donate to
A	O,A	A,AB
B	O,B	B,AB
AB	all	AB
O	O	all

Figure 3.12 Cerebrum



Your **heart** is divided into four chambers. Each upper chamber is called an **atrium**, and each lower chamber is called a **ventricle**. **Valves** open and close to control the flow of blood in a one-way direction through your heart.

2. Problems of the Circulatory System

The table below gives information about some problems of the circulatory system:

Diseases or Disorders	Description
Hypertension (High blood pressure)	Blood pressure higher than normal for a long time; may lead to heart attack, stroke, kidney failure
Stroke	Cluster of blood cells which blocks the blood vessels in the brain
Heart attack	Stoppage of the in flow of blood to the heart
Arteriosclerosis	Artery walls harden; caused by high fat and cholesterol diets
Anaemia	Lack of red blood cells or cells that do not carry enough oxygen; causing weakness and low levels of energy
Sickle-cell anaemia	Blood unable to circulate properly
Leukaemia	Abnormal white blood cells
Haemophilia	Blood does not clot properly

3. Protecting the Circulatory System

We can protect our circulatory system in several ways. First, we should adopt a low fat and balanced diet. Moreover, we should try to avoid tension as this increases the load on our heart and blood vessels. Being overweight or smoking adversely affects the circulatory system as well. The heart has to work harder in people who are overweight, and chemical substances in cigarettes affect the transportation of oxygen in our blood. On the other hand, physical exercise can help build stronger and thicker muscle fibres in our heart, which makes our heart more powerful, and work more efficiently, eventually reducing the pulse rate. Blood flushes through our arteries during vigorous exercise. This may help reduce clogging by fatty materials in the arteries.

(C) Respiratory System

1. Respiratory System

The respiratory system has two important functions. First, it supplies oxygen to the blood that is carried to different parts of the body. In the cells, oxygen combines with nutrients and provides energy to the cells, carrying out different tasks. When oxygen combines with nutrients, it also produces waste – carbon dioxide. The other function of the respiratory system is to remove carbon dioxide from the blood and carry it away from the body.

2. The Lungs

The lungs consist of clusters of microscopic air sacs, called alveoli. These sacs are at the end of the smallest branches of the bronchi. The exchange of oxygen and carbon dioxide takes place inside the lungs. Thus, the lungs are the most important organ of the respiratory system.

- ✎ Blood from the heart enters the lungs through the pulmonary arteries and capillaries. This blood contains carbon dioxide from the body's cells.
- ✎ Carbon dioxide passes from the blood into the alveoli where it is exchanged for oxygen.

Figure 3.13 Exchange of Oxygen and Carbon Dioxide

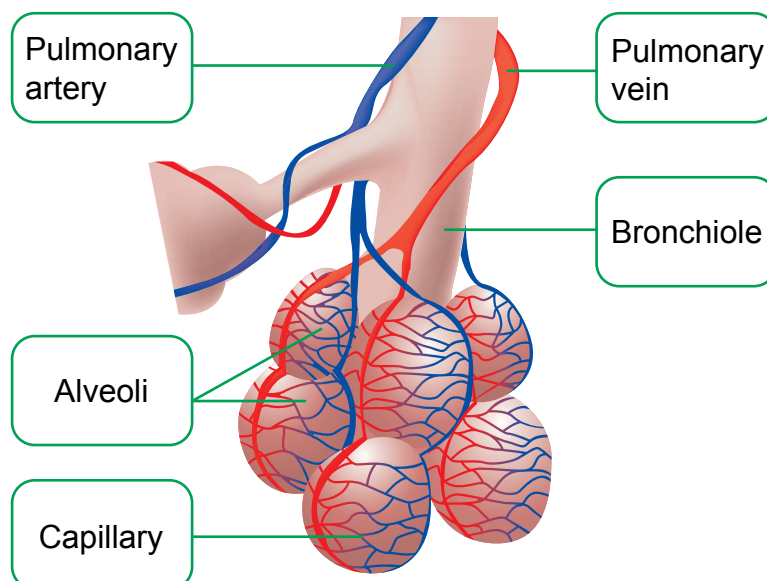
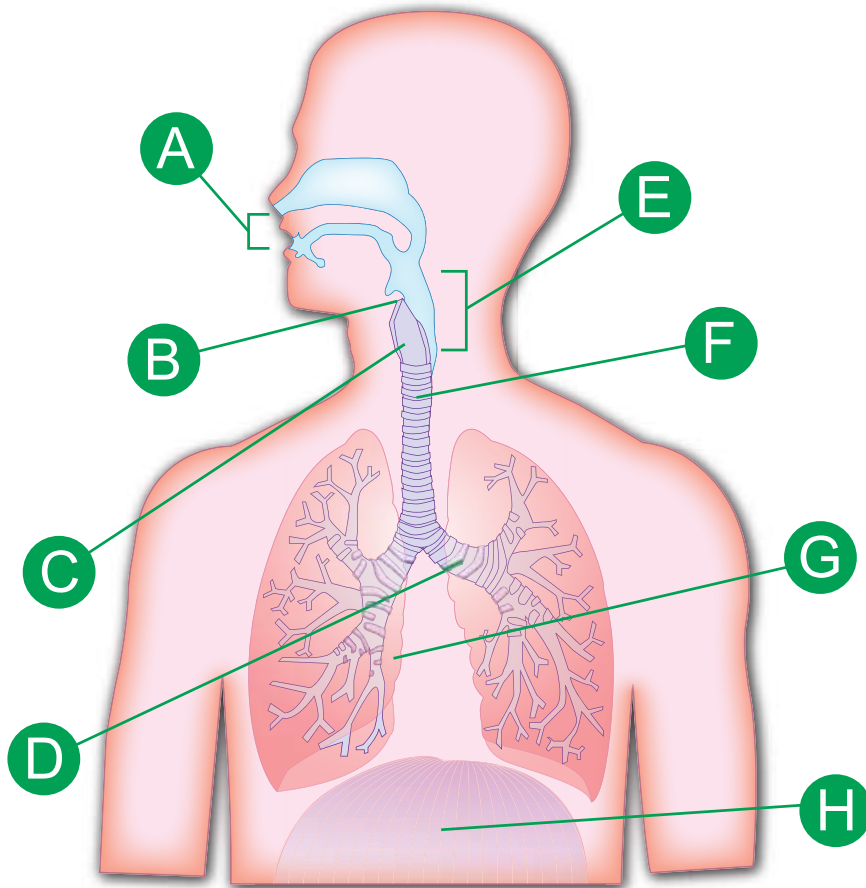


Figure 3.14 Respiratory System



A Air enters through the **nose** and **mouth**, which are lined with mucous membranes. Fine hairs called cilia trap dirt.

B The **epiglottis** is a flap of tissue that closes over the trachea when you swallow.

C The **larynx** contains the vocal cords.

D The **bronchi** are passages through which air enters the lungs.

E The **throat** has two passageways - one for air and one for food.

F The **trachea** directs air to the lungs.

G In the **lungs**, oxygen is transferred into the blood and carbon dioxide is removed from the blood.

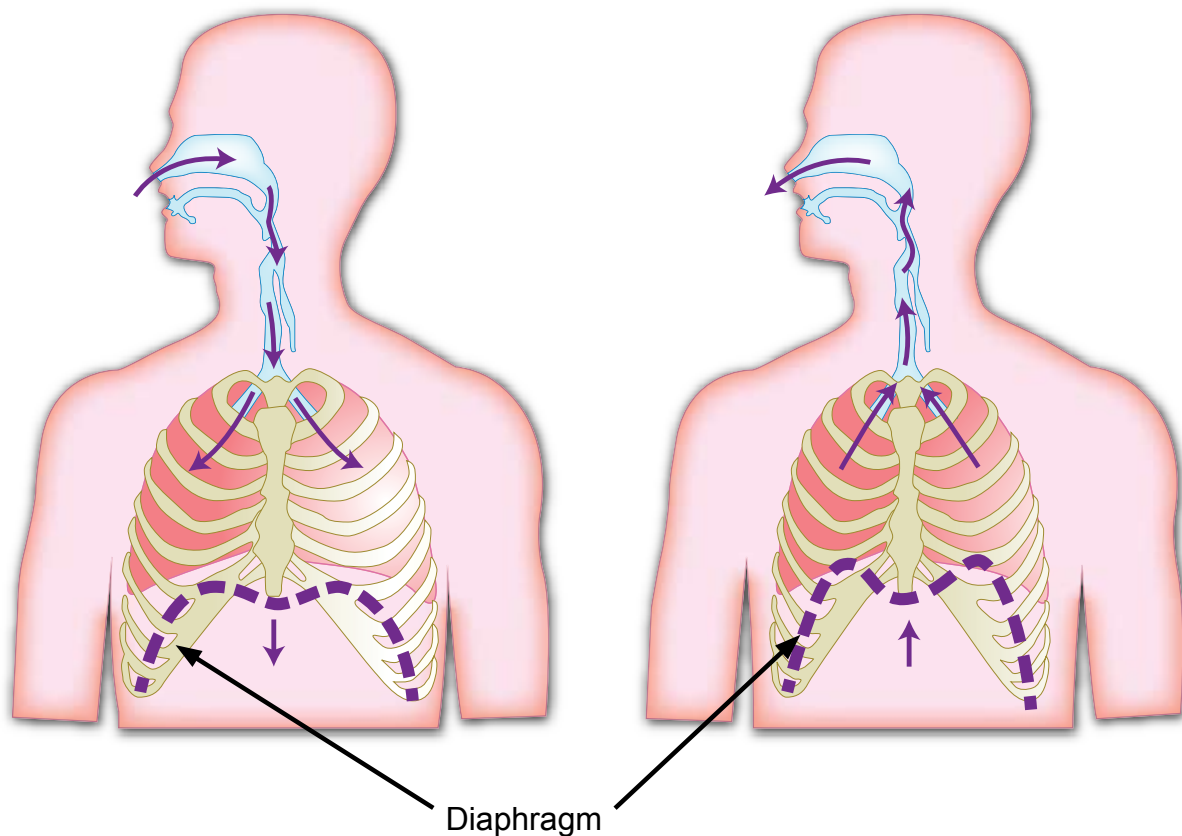
H The **diaphragm** is a large domeshaped muscle that separates the lungs from the abdomen.

3. Breathing

Breathing consists of two actions – inhaling and exhaling. The air we exhale contains more carbon dioxide and less oxygen than the air we inhale.

- ✎ When we inhale, the diaphragm contracts and moves down. The ribs move out and up, increasing the size of the chest cavity. Air enters the nose and mouth and moves into the lungs.
- ✎ When we exhale, the diaphragm relaxes and moves up into the chest cavity. The ribs move in and down, making the chest cavity smaller. Air is forced out of the lungs and leaves the body through the nose and mouth.

Figure 3.15 Inhale and Exhale





4. Problems of the Respiratory System

The respiratory system is a common site of infection because germs can easily enter the body through the nose and mouth. The table below lists some of the problems of the respiratory system:

Diseases or Disorders	Description
Flu/ Colds	Caused by virus: cough, runny nose, aches and fever
Tuberculosis	Bacterial lung infection: dry cough in early stages, chest pain follows
Allergies	Caused by reaction to substances: sneezing, itchy eyes, runny nose and hives
Pneumonia	Lung infection by bacteria or viruses: fever, chest pain and difficulty in breathing
Bronchitis	Swelling of the bronchi due to infection; cough, fever and tightness in chest
Asthma	Bronchial swelling and blockage: wheezing, shortness of breath and coughing
Emphysema	Alveoli destroyed: extreme difficulty in breathing; often fatal
Lung cancer	Alveoli destroyed: often caused by smoking

5. Protecting the Respiratory System

We should take good care of our respiratory system. Here are some of the ways to keep our respiratory system functioning properly:

-  **Exercise:**
Regular exercise keeps our respiratory system working properly.
-  **Breathe clean air:**
If possible, avoid places with a lot of smoke and dust.

 **Breathe deeply:**

Deep breathing improves the efficiency of the respiratory system.

 **Don't smoke:**

Cigarette smoking damages the nose, throat, trachea and lung tissue and can cause fatal diseases. Bronchitis, emphysema and lung cancer are all related to smoking behaviour. Hence, the best way to prevent these diseases is to avoid smoking and second-hand smoke.

 **Appropriate posture:**

Proper standing and sitting postures improve the function of the lungs

 **Take care of your body:**

Nose, throat and lung infections can be serious. Rest and allow time to recover.

(D) Skeletal System

1. Skeletal System

The body's framework, which gives the body strength and shape, is called the skeletal system. It is a system made up of bones, joints and connecting tissue (Figure 3.17).

The skeletal system includes many bones that support the body and protect the organs. The backbone, or spinal column, is made of 24 separate bones called vertebrae. These bones enable us to bend our back in several different directions. The bones form curves.

The skeleton consists of bones and cartilages, the latter of which are strong, flexible tissues that provide cushioning at the joints.

Bones are living tissues composed of cells. Like all body cells, bone cells need food and oxygen to grow, strengthen, work and repair themselves. Bones have many important functions:

 **Movement:**

Bones provide spaces for muscle attachment. Body parts such as arms and legs are able to move when muscles pull on bones.

 **Support:**

The backbone is made up of 24 bones called vertebrae. The backbone

supports the head and upper body and protects the spinal cord.

 **Protection:**

The bones of the skull protect the brain. The ribs protect the lungs and heart from injury.

 **Blood cell formation:**

Bones play a role in the circulatory system too. Red and white blood cells are formed by tissue called marrow, which is in the centre of some bones.

 **Storage:**

Bones store minerals such as calcium and phosphorus for later use.

The inner cavity of the long bones, such as the femur, contains yellow marrow, which is a fatty tissue, and red marrow at the ends. Red marrow produces red blood cells and most of the white blood cells in the blood.

Figure 3.16 Long Bones

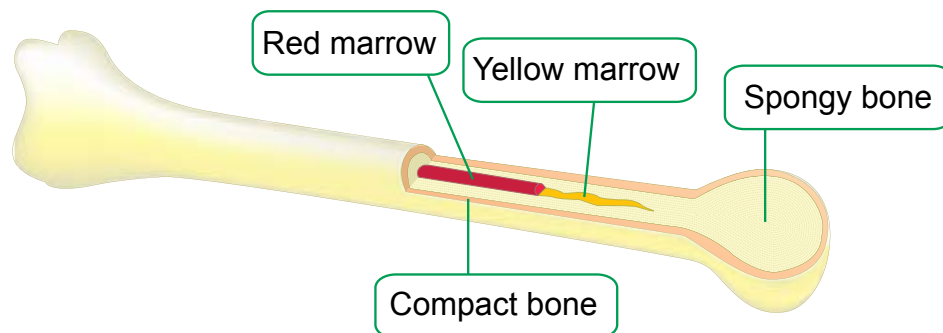
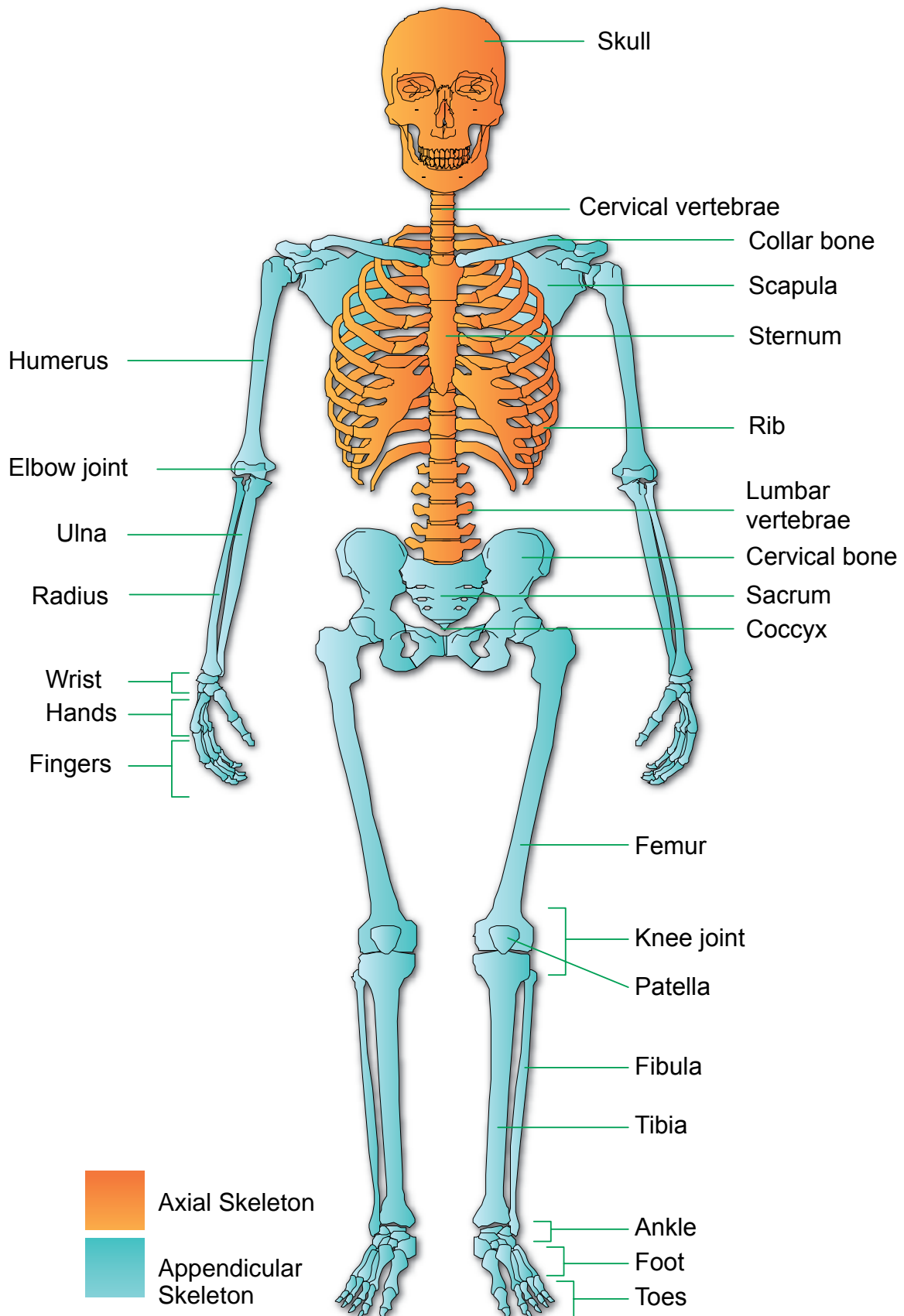


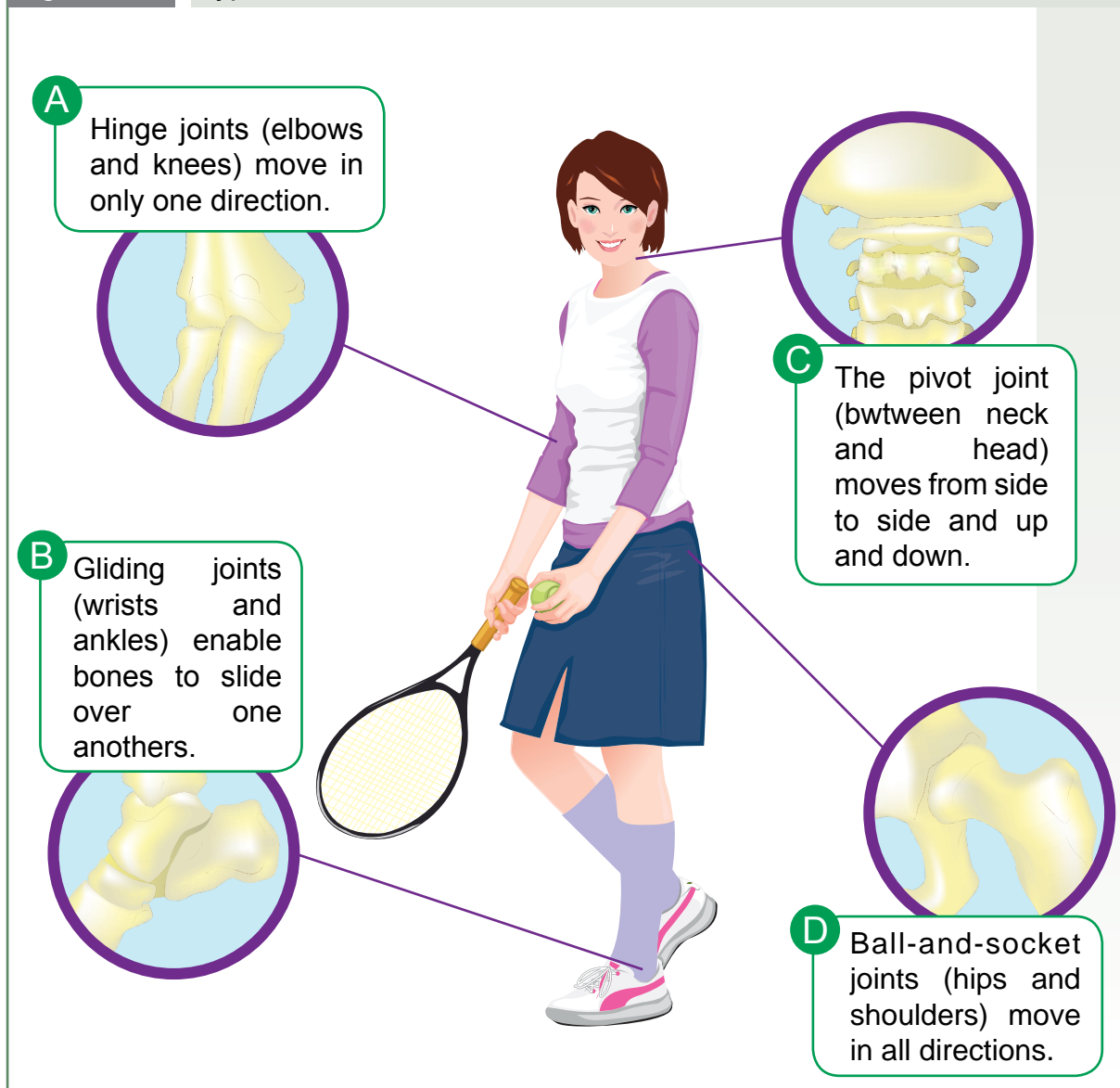
Figure 3.17 Skeleton System






Joints are the points at which bones meet. Joints differ from one another in the type of movement they allow.

- A** Hinge joints (elbows and knees) move in only one direction.
- B** Gliding joints (wrists and ankles) enable bones to slide over one another.
- C** The pivot joint (between neck and head) moves from side to side and up and down.
- D** Ball-and-socket joints (hips and shoulders) move in all directions.

Figure 3.18 Types of Joints



There are three types of joints in the body:

-  **Cartilage** is a tough, flexible tissue that is similar to bone. It acts as a cushion between bones at a joint and protects the bone. The nose and ears are made of cartilage.
-  **Ligaments** are strong cords of tissue that connect bones at the joints. Ligaments hold the bones in place.
-  **Tendons** are tough bands of tissues that attach the muscles to bones.

2. Problems of Skeletal System

Problems of the skeletal system can be the results of accidents, viral infection, poor posture and poor diet. The table below lists some of the problems of the skeletal system:

Diseases or Disorders	Description
Fracture	Break in bones caused by falls or accidents: swelling and extreme pain
Dislocation	Bone pushed out of its joint: usually includes stretching or tearing of a ligament
Sprain	Swelling of a joint caused by stretching or twisting ligaments
Arthritis	Swelling and stiffness of joints caused by wear and tear: usually affects older people
Osteoporosis	Bones become brittle and porous: associated with deficiencies of calcium, protein, and certain hormones. The density of bones is at its peak when women are 30 to 35. Osteoporosis appears when women reach 40. By reaching menopause, menstruation ceases and women are prone to osteoporosis. By the age of 70, femur fractures and breaks are common among both females and males.

3. Protecting the Skeletal System

The following ways will protect the skeletal system:

- ✎ Adequate intake of calcium and vitamin D through daily diet
- ✎ Proper posture to reduce the burden of the spinal cord
- ✎ Regular exercise to improve bone density
- ✎ Be alert to signs of weakened bones, and the risk factors of osteoporosis
- ✎ The elderly may consult medical doctors for a skeletal check up, strengthening bones through medication

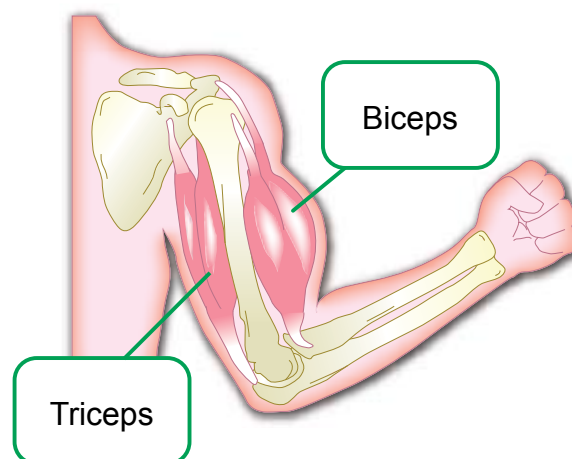
(E) Muscular System

1. Muscular System

The muscular system is a group of tough tissues that allow body movement. The bones serve as a framework that gives the body shape and support. The muscles allow the body to move that framework. We have over 600 major muscles in our body and they are all working in pairs. When one muscle in a pair contracts (shortens), the other muscle relaxes (lengthens). This activity produces movement at a joint.

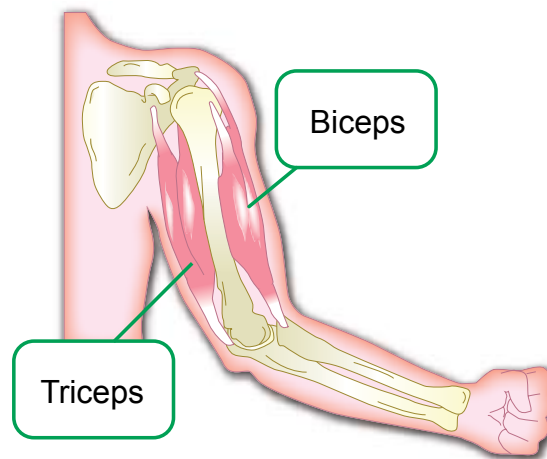
- ✎ To bend your arm, the biceps (flexors) contract and pull on a bone of your lower arm while the triceps (extensors) extend.

Figure 3.19 Bending arm



- ✎ To straighten your arm, the triceps contract and pull on the other bone of the lower arm. At the same time, the biceps extend.

Figure 3.20 Straightening arm



The muscular system consists of three different types of muscle tissue. Each type is designed to carry out certain tasks.

- ✎ **Smooth muscles** are found in various organs in the body, such as the stomach and intestines. We do not control these muscles. For example, once we have swallowed some food, smooth muscles move it through the digestive system.
- ✎ **Skeletal muscles** are attached to bones. They work with the bones of the skeleton that allow us to move. We can control skeletal muscles. For example, we can make our arms and legs move whenever we want. Skeletal muscles make up about 40 percent of our body weight.
- ✎ **Cardiac muscle** is a special type of muscle that is found only on the walls in the heart. Controlled by the brain, the cardiac muscle constantly contracts and relaxes, causing the heart to pump blood to all parts of the body.

2. Problems of the Muscular System

Almost everyone has experienced muscle pains after overworking them. This is usually a temporary condition. Muscles recover after resting. However, some muscular conditions are not temporary. The table below lists some of the disorders that can have an effect on the body's muscular system.

Diseases or Disorders	Description
Pulled or torn muscle	Muscle torn from bone
Strain	Soreness due to overwork
Cramp	Muscle unable to relax: feels very tight and sore
Tendinitis	Stretched or torn tendon; very painful
Muscular dystrophy	The most common type is the inherited disorder characterized by a weakening of the skeletal muscles: causing inability to walk and stand

3. How to keep our skeletal and muscular systems healthy?

The following ways will keep our skeletal and muscular systems healthy:

- ✎ **Exercise regularly:**
Intense exercise will make the bones and muscles stronger. Endurance exercises will strengthen the muscles and make them more efficient. Exercises that require high flexibility will help people to move more flexibly and prevent injuries.
- ✎ **Nutritious diet:**
Foods that are rich in calcium and vitamin D are good for growth and strengthening bones. Carbohydrates provide energy for the muscles whereas protein helps produce muscles.
- ✎ **Watch your posture:**
Sit and stand properly, and relax so that bones, joints and muscles maintain proper position.
- ✎ **Treat injuries promptly:**
Consult a medical doctor if you are injured. Avoid adding stress to the injured position.

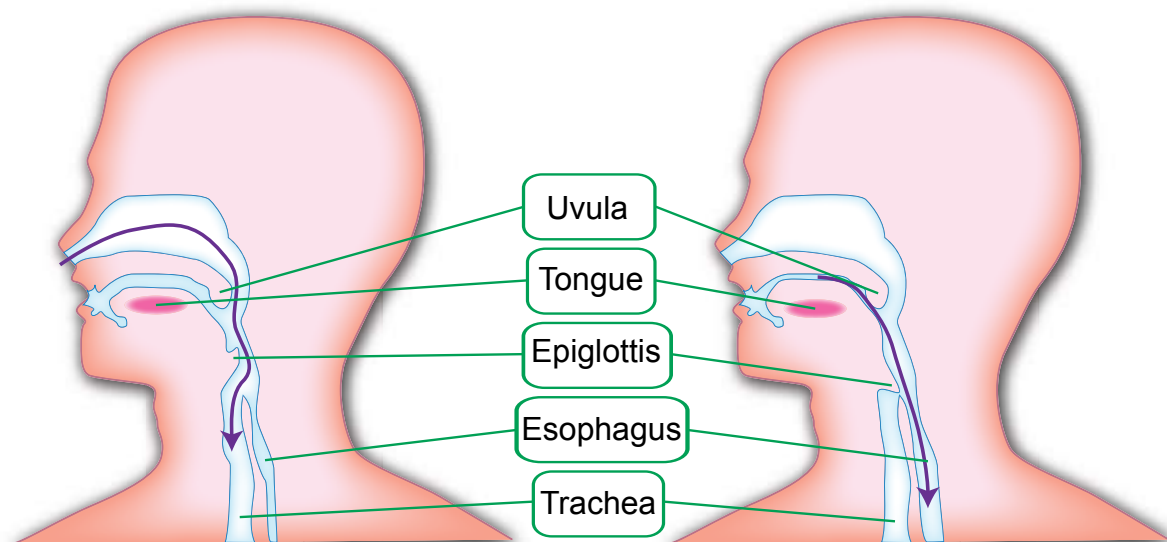
(F) Digestive and Excretory System

1. Digestive System

The digestive system breaks down the food we eat into nutrients and allows absorption. Food is fuel, or the source of energy for our body. The digestive system changes the energy stored in food into a form of energy that the body can use to work properly and to grow and develop.

A chemical reaction takes place when the food moves towards the digestive system. Food is dissolved into particles that can be absorbed into the bloodstream. The process of changing food in this way is called digestion. Digestion begins in the mouth. The teeth cut and grind food into smaller pieces. At the same time, food is being mixed with saliva. Saliva is a liquid produced by the salivary glands. It consists of about 99 percent water and contains an enzyme that digests starch. Saliva also moistens and softens food so the food can be swallowed easily.

Figure 3.21 The Process of Swallowing



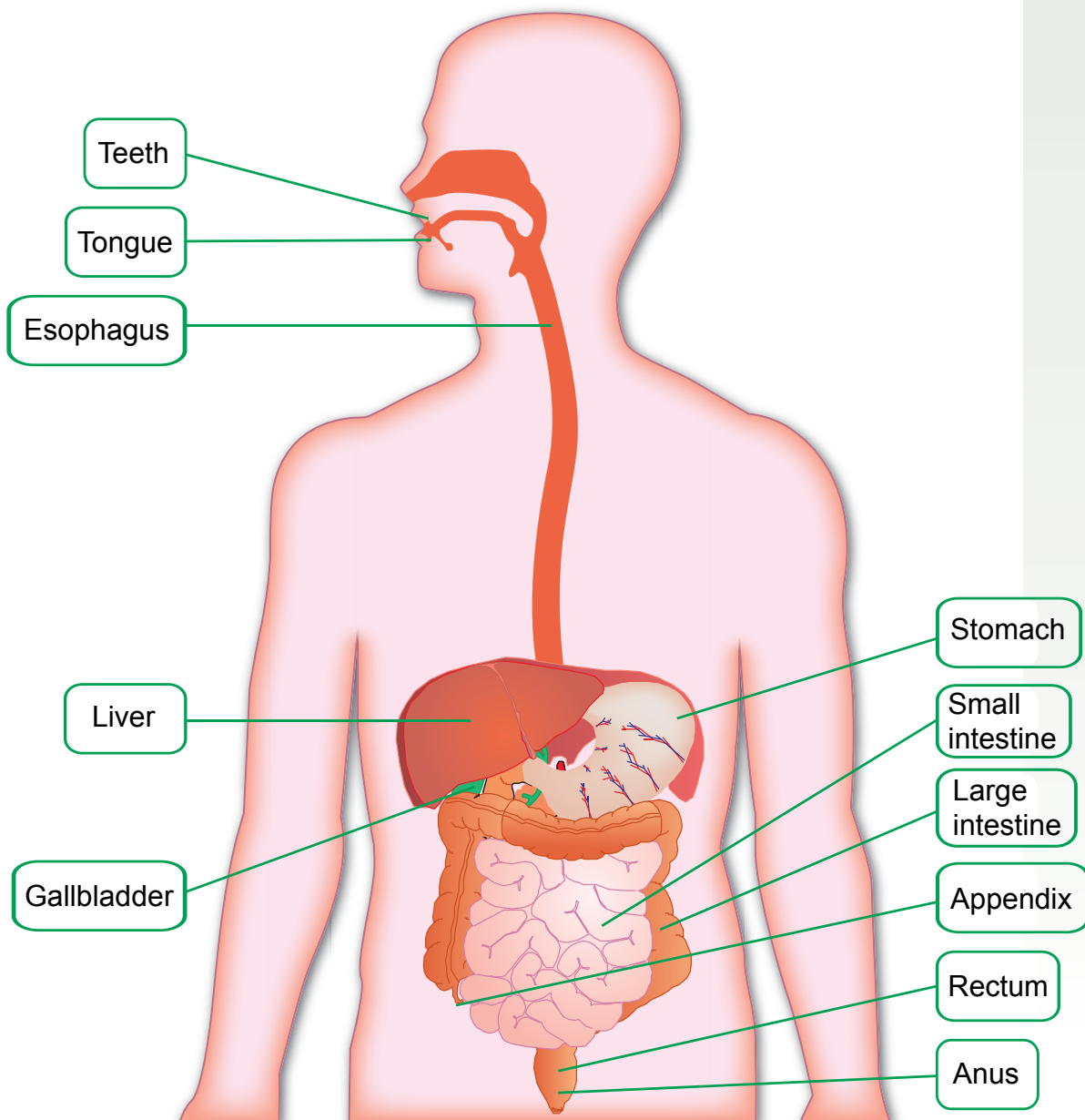
A **Before Swallowing**
Passages from the nose and throat to the trachea are open, allowing air to pass to the lungs.

B **During Swallowing**
Air passages are closed by two flaps of skin. The uvula closes the airway to the nose. The epiglottis closes the opening to the trachea, or windpipe.

After swallowing, the food enters the oesophagus, a muscular tube that pushes food down to the stomach. The stomach is a muscular organ in which food is held while digestion continues. The muscular walls of the stomach churn the food and mix it with gastric juice, a mixture of acid and enzymes, which is produced by the stomach. The enzymes in the stomach begin the digestion of proteins.

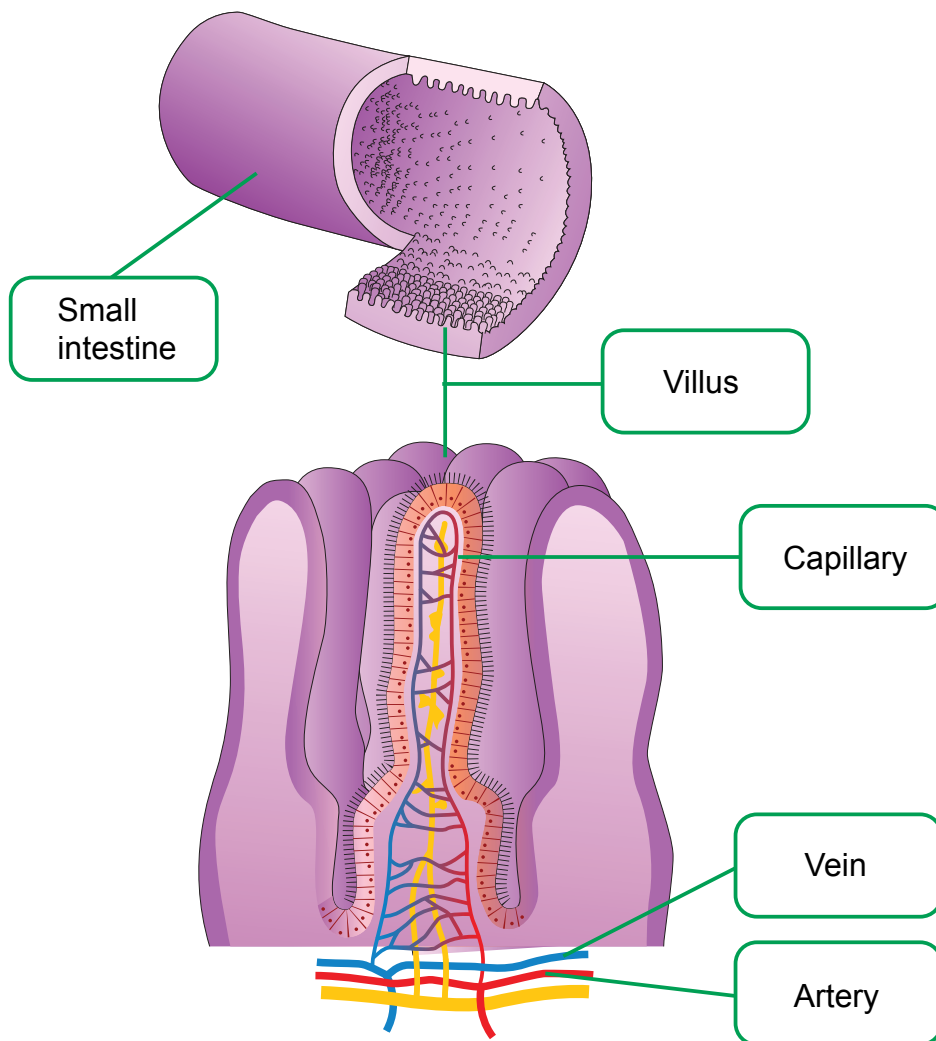
Partially digested food moves from the stomach to the small intestine, which is a long, coiled, tube-like organ. Most digestion takes place in the duodenum, which is the first section of the small intestine. When food has been completely broken down, nutrients are absorbed through the walls of the small intestine into the bloodstream. Blood carries the nutrients to body cells.

Figure 3.22 Digestive System



The inner walls of the small intestine are lined with tiny, finger-like projections called villi. Nutrients enter the bloodstream from the small intestine through the villi.

Figure 3.23 Villi of Small Intestine

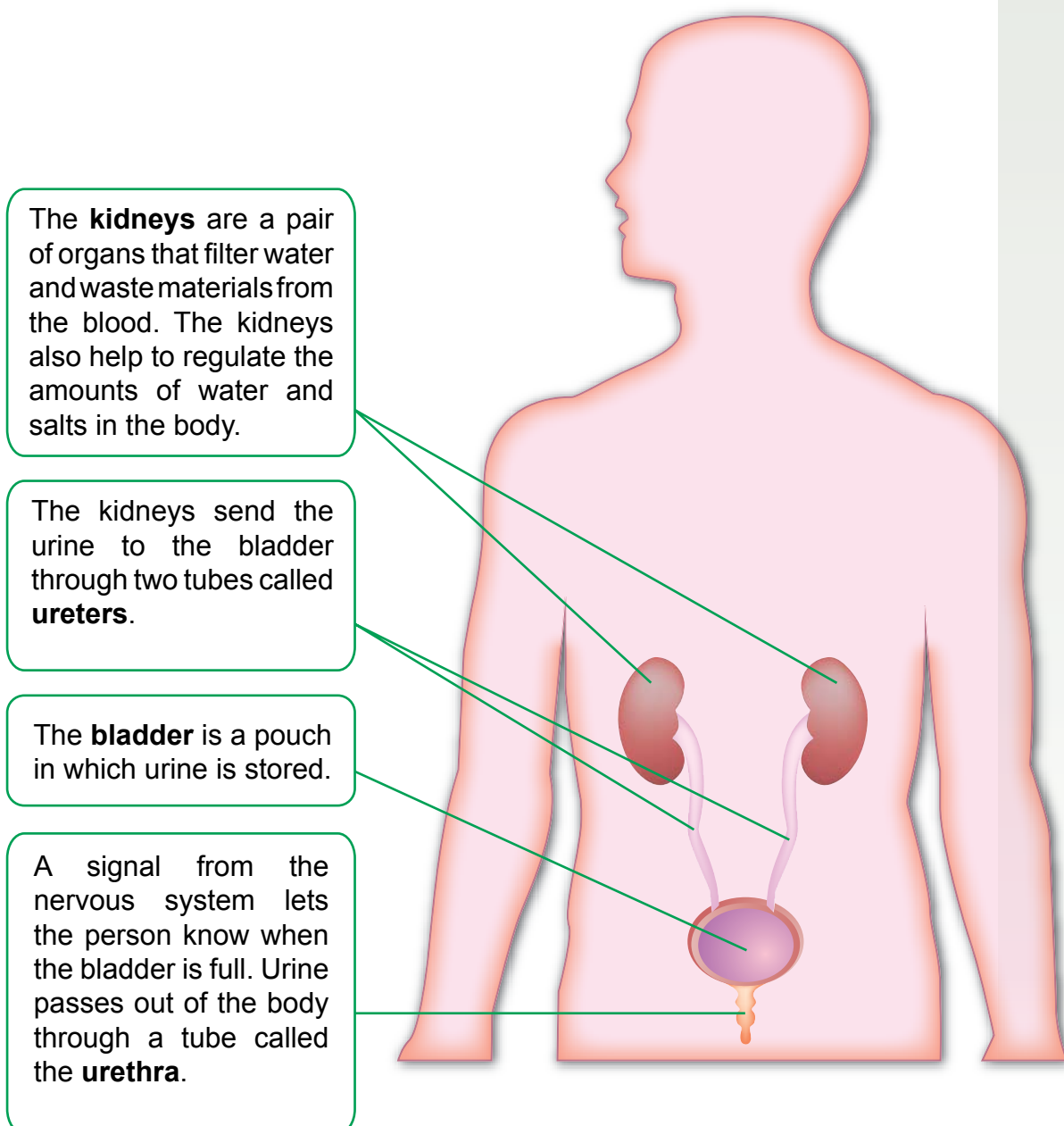


When digestion is completed, the body has to remove the waste. Water and solid waste (dietary fibre) are not absorbed by the small intestine, which will be moved to the large intestine. The rest of the water content will be absorbed by the large intestine and then dissolve in the bloodstream. The rest of the solid waste will become faeces and will be moved out of the body through the anus, known as excretion.

2. Excretory System

Excretion removes wastes from the body. The lungs perform some functions of the excretory system by getting rid of carbon dioxide when we exhale. The skin also gets rid of some waste through sweating such as water and salt; thus reducing the body temperature. The kidneys get rid of waste in the blood.

Figure 3.24 Excretory System



3. Problems of the Digestive System

Most digestive problems are related to eating habits and the kinds of food that we eat. They are usually temporary and minor. However, if the problems persist or if they are accompanied by a fever, a medical check-up may be necessary. The table below lists some of the problems of the digestive system:

Diseases or Disorders	Description
Indigestion	Stomach is too acidic: may be caused by eating too fast, too much, spicy or acidic foods
Diarrhoea	Watery faeces: caused by bacteria, virus, food poisoning and nutritional deficiencies
Ulcers	Sores on the inner walls of the stomach
Cirrhosis	Destruction of liver tissue: caused by drinking too much alcohol
Gallstones	Crystals in the gallbladder: may block the passage of bile to the small intestine
Kidney stones	Crystals in the kidney: may block passage of urine to bladder
Appendicitis	Inflammation of the appendix
Haemorrhoids	Swelling of veins near the opening of the anus
Colon cancer	Uncontrolled growth of abnormal cells in the large intestine
Helicobacter Pylori	Inhabits various areas of the stomach: it causes a chronic low-level of inflammation, oedema, degeneration and necrosis of the stomach lining, resulting in different stomach disorders.

4. Protecting the Digestive and Excretory System

The best way to take care of our digestive and excretory system is to practise healthy eating habits. These include the following:

- ✎ Eat a variety of foods from all groups of food, especially foods that are low in fat, sugar, salt and high in dietary fibre.
- ✎ Eat complete meals at regular intervals during the day, especially breakfast.
- ✎ Eat enough food but never become too full.
- ✎ Take the time to relax and enjoy the meals rather than eating in a rush.
- ✎ Brush and floss your teeth at least twice a day and have regular dental checkups. Strong teeth are necessary to break food into smaller pieces, which aid digestion.
- ✎ Drink six to eight glasses of water every day because water is essential for the digestive system to work properly.

(G) Endocrine System

1. Endocrine System

The endocrine system works closely with the nervous system to regulate body functions. It consists of several glands, which are located throughout the body. A gland is a group of cells, or an organ, that secretes a chemical substance, called hormone. The endocrine glands secrete their hormones directly into the bloodstream, where they are carried to various parts of the body and activate these parts in specific ways. Some hormones are produced continually; others are produced only at certain times.

The endocrine glands work on signals from the brain or from other glands. The brain tracks the presence of substances in the blood. For example, when the brain senses too little thyroid hormone in the blood, it signals the pituitary. The pituitary, in turn, signals the thyroid, which releases more of the hormone.

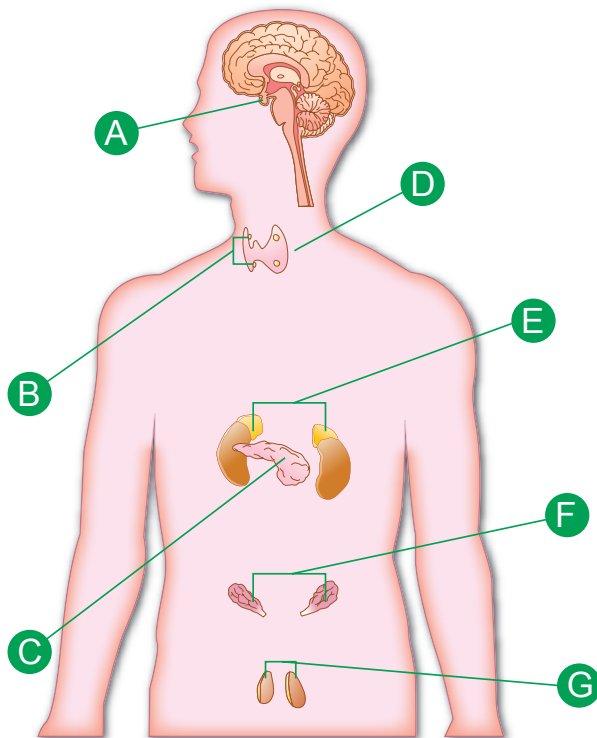
2. The Stress Response

When we are tense or anxious, our body is under stress. Our adrenal glands then release the hormone adrenaline. This response ends when stress is gone, or when our body slows down because it cannot maintain the high level of activity. The stress response can be harmful if it persists or occurs too often. We should avoid the negative influences of stress by learning stress management.

When we are under stress, the effects of the increase of adrenaline on the body are as follow:

Body Part	Under Stress	After Stress
Brain	Blood flow to brain increases	Blood flow to brain decreases
Sweat glands	Sweat production increases	Returns to normal
Lungs	Air passageways expand	Air passageways contract
Circulatory system	Heartbeat increases; blood pressure rises; blood to skeletal muscles increases	Returns to normal
Digestive system	Digestion slows down	Digestion increases

Figure 3.25 Endocrine System



A The **pituitary gland** is located at the base of the brain. Because it regulates other endocrine glands, it is called the master gland. The pituitary gland secretes several hormones. These regulate the thyroid gland, adrenal glands, and kidneys. They also regulate your growth and development.

C The **pancreas** is part of two body systems - the digestive system and the endocrine system. The pancreas is located behind the stomach and supplies the small intestine with digestive juice. The pancreas contains small clusters of cells called the **islets of Langerhans**, which control blood sugar levels.

E The **adrenal glands** are located on your kidneys. They secrete hormones that help the body maintain its levels of sodium and water, aid the digestive process, and control your body's response to emergencies.

F The ovaries are the female reproductive glands. They control the development of secondary sex characteristics during adolescence.

B The **parathyroid glands** regulate the distribution of certain minerals in your body.

D The **thyroid gland** is the largest gland in the endocrine system. It is located where the larynx and trachea meet. It regulates the chemical reactions of nutrients in the cells.

G The testes are the male reproductive glands. They control the development of secondary sex characteristics during adolescence.

3. Disorders of the Endocrine System

Most endocrine disorders are related to the production of too many or too few hormones. The following table describes some disorders of the endocrine system:

Disorders	Description
Diabetes mellitus	Loss of nutrients and energy due to inadequate insulin production by the islets of Langerhans: symptoms include lack of energy, extreme thirst, and frequent urination
Goitre	Enlargement of the thyroid gland: visible as a swelling of the lower neck, caused by too little iodine
Growth extremes	Caused by the release of abnormal amounts of growth hormones: too little growth hormone causes dwarfism, too much growth hormone causes gigantism
Diseases of thyroid glands	Problems arise when the thyroid gland produces too much or not enough hormone. Hypothyroidism is a condition in which the body lacks sufficient thyroid hormone. Symptoms of hypothyroidism are hair loss, weight gain, cold intolerance and constipation. Hyperthyroidism is a condition caused by the effects of too much thyroid hormone. Symptoms are nervousness, irritability, hyperactivity, weight loss, exophthalmos, fast or irregular heart rate and heat intolerance.



Diabetes

There are two major types of **diabetes**, called type 1 diabetes or insulin dependent diabetes mellitus and type 2 diabetes or non-insulin dependent diabetes mellitus. Type 1 diabetes is also called juvenile diabetes. The pancreas undergoes an autoimmune attack by the body itself, and is rendered incapable of making insulin. This tends to occur in young people. Type 2 diabetes is also referred to as adult onset diabetes mellitus. Patients can still produce insulin, but inadequate for their body's needs, particularly in the face of resistance and worsening glucose control. Finally, the liver continues to produce glucose through a process called gluconeogenesis despite elevated glucose levels. This mostly occurs in individuals over 40.

(H) Reproductive System

Reproduction is the process by which life is maintained from one generation to the next. All human life begins with the union of two cells, one from the mother and one from the father. These cells are produced in the reproductive system.

1. Male Reproductive System

The male reproductive system produces sperm. Sperm is the male reproductive cells. These cells join with female reproductive cells (egg cells) to produce a new life. The union of male and female reproductive cells is called fertilization. Males begin to produce sperm when they reach puberty, usually between the ages of 12 and 15.

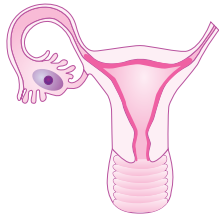
Sperm is produced in the testes and stored in the epididymis. When sperms leave the epididymis, they travel to the vas deferens and mix with seminal fluid that is produced by the seminal vesicles, the prostate glands, and the Cowper's glands. The mixture of sperm and fluids is called semen. The action that forces the semen through the urethra and out of the body is called ejaculation.

2. Female Reproductive System

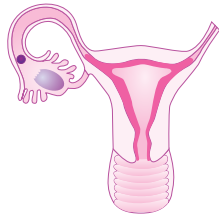
The female reproductive system has three important functions. They are to produce and store egg cells, to get the egg fertilized, and to nourish and protect the fertilized egg until it is delivered.

As females reach puberty, egg cells become mature due to the production of hormones. The ovaries begin to release one mature egg cell each month. That is called ovulation. The uterus thickens in preparation to receive and begin to nourish a fertilized egg. If fertilization does not occur, the thickened lining breaks down. This material is then expelled from the female's body. This is called menstruation. Menstruation usually lasts from 5 to 7 days. The menstrual cycle is the time from one menstruation to another. A cycle is usually about 28 days, but it may differ from individuals. Most girls begin menstruation between age of 9 and 16.

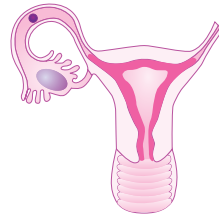
Figure 3.26 Cycle of Menstruation



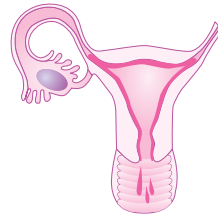
1 On day 1 through 13 of the cycle, even while menstruation is occurring, a new egg cell is maturing inside the ovary.



2 On day 14 of the cycle, ovulation occurs and the mature egg is released into one of the fallopian tubes.



3 From day 15 through day 20, the egg travels through the fallopian tube.



4 on day 21 the egg enters the uterus. After 7 days, if the egg has not been fertilized, menstruation begins.

Figure 3.27 Male Reproductive System

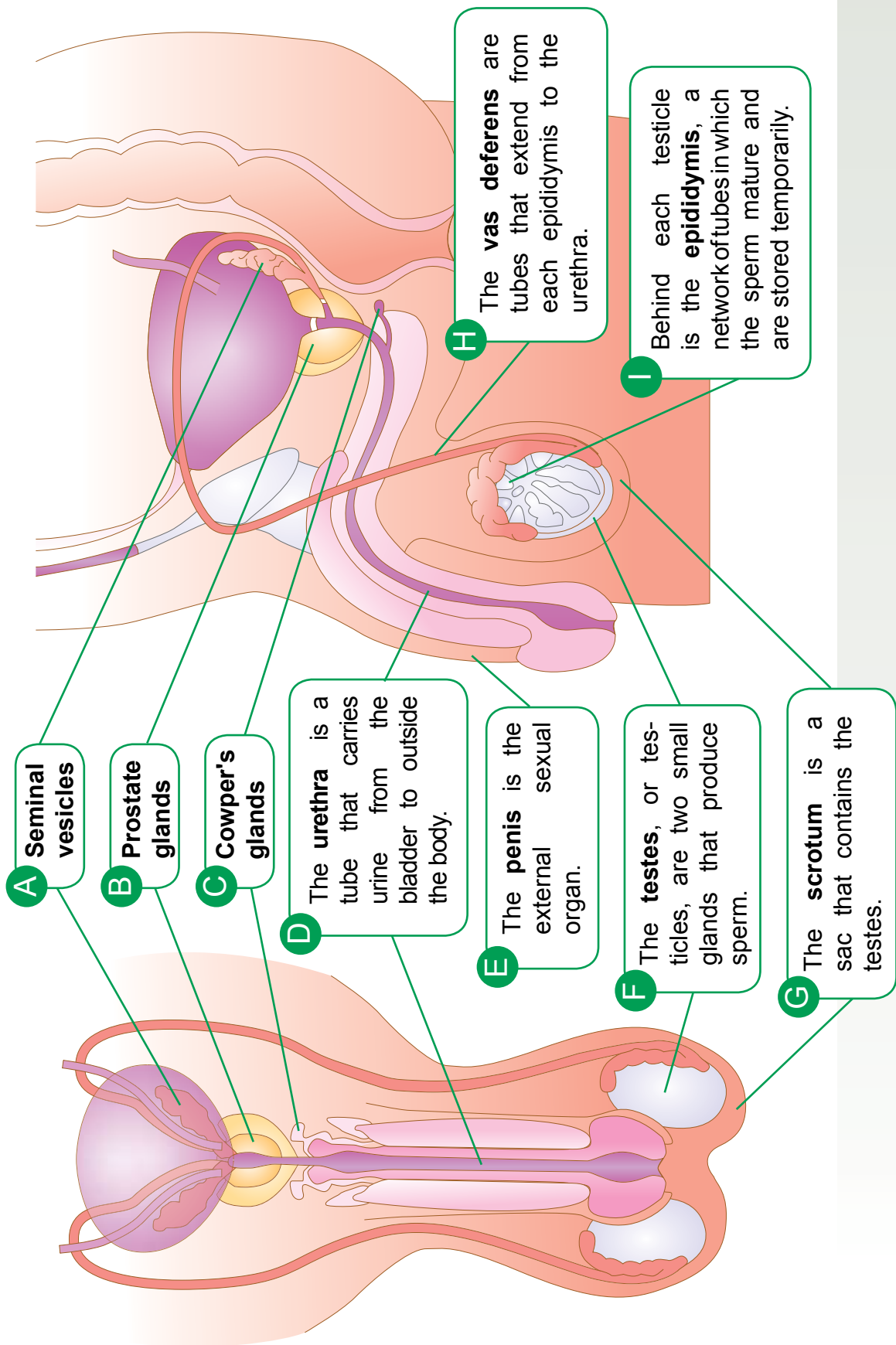
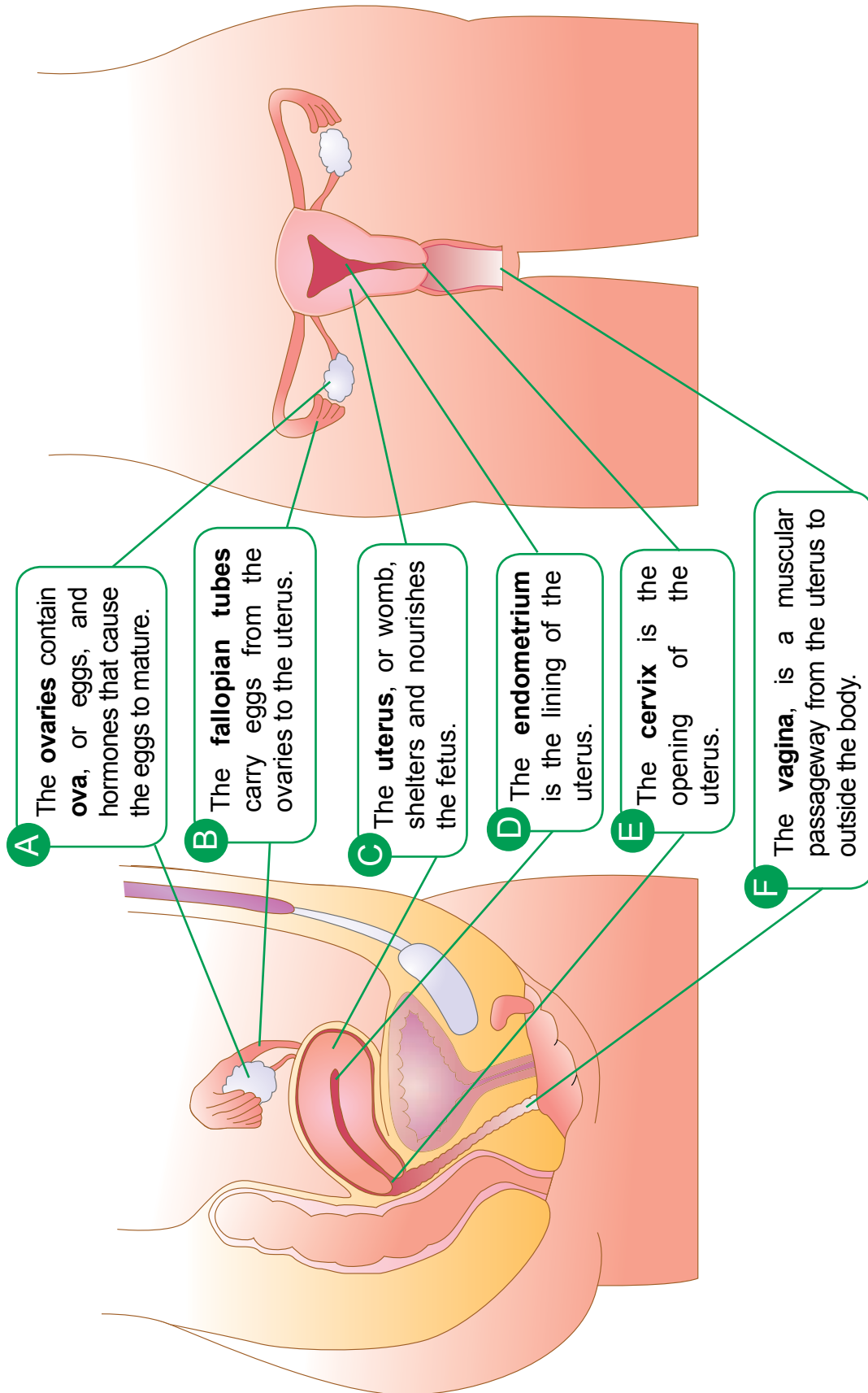


Figure 3.28 Female Reproductive System





Menopause

Menopause is a normal change in a woman's life when her menstrual cycle ceases. It is often called the "change of life". During perimenopause, females produce less estrogen and progesterone. This often happens between the age of 45 and 55. A woman is considered having reached menopause when her menstrual cycle does not occur for the past 12 months, with no other cause for this change. At this stage, females usually find that their body, mind and emotions are changing. Due to the fluctuation of the production of hormones, symptoms like unstable activity of the nervous system, hot sweats, sweating, depression and dizziness occur. Hot sweats are a particular sign of menopause. (Please see Booklet 1 for further explanation on menopause)

3. Fertilization

When a male's sperm enters a female's vagina, it travels to the fallopian tube. Fertilization occurs, if a sperm cell unites with an egg cell to produce a fertilized egg. The small hairs lining the fallopian tube move the egg through the tube into the uterus. The fertilized egg attaches itself to the wall of the uterus and begins to grow and develop into a baby. The uterus has several layers of tissue and a rich supply of blood to nourish the baby during its development. The mother's body provides the baby with food and oxygen throughout its development. After about 40 weeks in the uterus, the baby is ready to be delivered. At that time, muscles on the wall of the uterus begin to contract. The contraction of the uterus forces the cervix to open. The baby is pushed out of the uterus through the cervix. It passes through the vagina and leaves the mother's body.

4. Problems of the Reproductive System

The following are possible problems of the reproductive system:

Male




Diseases or Disorders	Description
Testicular or prostate cancer	Uncontrolled cell growth that destroys glands and surrounding tissue
Enlargement of prostate gland	A common problem associated with aging
Sterility	Inability to produce healthy sperm in sufficient numbers to reproduce: caused by exposure to certain drugs or illness

Female

Diseases or Disorders	Description
Premenstrual syndrome	Physical and emotional changes before menstruation; headaches, moodiness, irritability
Vaginitis	Infection of vagina: painful, itching, and vaginal discharge
Ovarian cysts	A fluid-filled sac within the ovary
Infertility	Inability to reproduce due to the blockage in fallopian tubes or failure of ovaries to produce eggs
Cancer	Affecting breasts, ovaries, uterus and cervix

5. Protecting the Reproductive System

The following actions can be taken to keep the reproductive system healthy:

-  Bathe or shower daily to keep the external reproductive organs clean.
-  Males should avoid underwear or clothing that is too tight. They should wear protective gear when playing vigorous sports. Males should do self-examinations of their testes and have regular body checkups.
-  For females, cleanliness is especially important during menstruation. Females should do breast self-examinations and have regular checkups by a gynaecologist.

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Learning and Teaching References

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- 2** Health and Well-being
- 3** **Physical Well-being – Healthy Body**
- 4** Mental Well-being – Healthy Mind
- 5** Social Well-being – Inter-personal Relationship
- 6** Healthy Community
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