RTO 46044

HARVARD MANAGEMENT INSTITUTE

HLTAAP001

Recognise healthy body systems

LEARNER GUIDE

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This Learner Guide

HLTAAP001 - Recognise healthy body systems (Release 1)

This unit describes the skills and knowledge required to work with basic information about the human body and to recognise and promote ways to maintain healthy functioning of the body.

This unit applies to any worker who needs to use and interpret information that includes references to client anatomy and physiology.

The skills in this unit must be applied in accordance with Commonwealth and State/Territory legislation, Australian/New Zealand standards and industry codes of practice.

A complete copy of the above unit of competency can be downloaded from the TGA website:

https://training.gov.au/Training/Details/HLTAAP001

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About this Unit of Competency Introduction

As a worker, a trainee, or a future worker, you want to enjoy your work and become known as a valuable team member. This unit of competency will help you acquire the knowledge and skills to work effectively as an individual and in groups. It will give you the basis to contribute to the goals of the organisation which employs you.

It is essential that you begin your training by becoming familiar with the industry standards to which organisations must conform.

This Learner Guide Covers

Recognise healthy body systems

I. Work with information about the human body

II. Recognise and promote ways to support healthy functioning of the body

Learning Program

As you progress through this unit of study, you will develop skills in locating and understanding an organisation's policies and procedures. You will build up a sound knowledge of the industry standards within which organisations must operate. You will become more aware of the effect that your own skills in dealing with people have on your success or otherwise in the workplace. Knowledge of your skills and capabilities will help you make informed choices about your further study and career options.

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Additional Learning Support

To obtain additional support you may:

- Search for other resources. You may find books, journals, videos and other materials which provide additional information about topics in this unit.
- Search for other resources in your local library. Most libraries keep information about government departments and other organisations, services and programs. The librarian should be able to help you locate such resources.
- Contact information services such as Infolink, Equal Opportunity Commission, Commissioner of Workplace Agreements, Union organisations, and public relations and information services provided by various government departments. Many of these services are listed in the telephone directory.
- Contact your facilitator.

Facilitation

Your training organisation will provide you with a facilitator. Your facilitator will play an active role in supporting your learning. Your facilitator will help you at any time during working hours to assist with:

- How and when to make contact
- What you need to do to complete this unit of study
- What support will be provided

Here are some of the things your facilitator may do to make your study easier:

- Give you a clear visual timetable of events for the semester or term in which you are enrolled, including any deadlines for assessments
- Provide you with online webinar times and availability
- Use 'action sheets' to remind you about tasks you need to complete, and updates on websites
- Make themselves available by telephone for support discussion and provide you with industry updates by email where applicable
- Keep in touch with you during your studies

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Flexible Learning

Studying to become a competent worker is an interesting and exciting thing to do. You will learn about current issues in this area. You will establish relationships with other students, fellow workers, and clients. You will learn about your own ideas, attitudes, and values. You will also have fun. (Most of the time!)

At other times, studying can seem overwhelming and impossibly demanding, particularly when you have an assignment to do and you aren't sure how to tackle it, your family and friends want you to spend time with them, or a movie you want to see is on television.

Sometimes being a student can be hard.

Here are some ideas to help you through the hard times. To study effectively, you need space, resources, and time.

Space

Try to set up a place at home or at work where you can:

- Keep your study materials
- Be reasonably quiet and free from interruptions
- Be reasonably comfortable, with good lighting, seating, and a flat surface for writing

If it is impossible for you to set up a study space, perhaps you could use your local library. You will not be able to store your study materials there, but you will have a quiet place, a desk and chair, and easy access to the other facilities.

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Study Resources

The most basic resources you will need are:

- A chair
- A desk or table
- A computer with Internet access
- A reading lamp or good light
- A folder or file to keep your notes and study materials together
- Materials to record information (pen and paper or notebooks, or a computer and printer)
- Reference materials, including a dictionary

Do not forget that other people can be valuable study resources. Your fellow workers, work supervisor, other students, your facilitator, your local librarian, and workers in this area can also help you.

Time

It is important to plan your study time. Work out a time that suits you and plan around it. Most people find that studying, in short, concentrated blocks of time (an hour or two) at regular intervals (daily, every second day, once a week) is more effective than trying to cram a lot of learning into a whole day. You need time to 'digest' the information in one section before you move on to the next, and everyone needs regular breaks from study to avoid overload. Be realistic in allocating time for study. Look at what is required for the unit and look at your other commitments.

Make up a study timetable and stick to it. Build in 'deadlines' and set yourself goals for completing study tasks. Allow time for reading and completing activities. Remember that it is the quality of the time you spend studying rather than the quantity that is important.

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Study Strategies

Different people have different learning 'styles'. Some people learn best by listening or repeating things out loud. Some learn best by 'doing', some by reading and making notes. Assess your own learning style and try to identify any barriers to learning which might affect you. Are you easily distracted? Are you afraid you will fail? Are you taking study too seriously? Not seriously enough? Do you have supportive friends and family? Here are some ideas for effective study strategies:

1. **Make notes.** This often helps you to remember new or unfamiliar information. Do not worry about spelling or neatness, as long as you can read your own notes. Keep your notes with the rest of your study materials and add to them as you go. Use pictures and diagrams if this helps.
2. **Underline keywords** when you are reading the materials in this Learner Guide. (Do not underline things in other people's books.) This also helps you to remember important points.
3. **Talk to other people** (fellow workers, fellow students, friends, family, or your facilitator) about what you are learning. As well as help you to clarify and understand new ideas, talking also gives you a chance to find out extra information and to get fresh ideas and different points of view.

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Using this Learner Guide

A Learner Guide is just that, a guide to help you learn. A Learner Guide is not a textbook. Your Learner Guide will:

1. Describe the skills you need to demonstrate to achieve competency for this unit.
2. Provide information and knowledge to help you develop your skills.
3. Provide you with structured learning activities to help you absorb knowledge and information and practice your skills.
4. Direct you to other sources of additional knowledge and information about topics for this unit.

How to Get the Most Out of Your Learner Guide

Some sections are quite long and cover complex ideas and information. If you come across anything you do not understand:

1. Talk to your facilitator.
2. Research the area using the books and materials listed under Resources.
3. Discuss the issue with other people (your workplace supervisor, fellow workers, fellow students).
4. Try to relate the information presented in this Learner Guide to your own experience and to what you already know.
5. Ask yourself questions as you go. For example, 'Have I seen this happening anywhere?' 'Could this apply to me?' 'What if...' This will help you to 'make sense' of new material, and to build on your existing knowledge.
6. Talk to people about your study. Talking is a great way to reinforce what you are learning.
7. Make notes.
8. Work through the activities. Even if you are tempted to skip some activities, do them anyway. They are there for a reason, and even if you already have the knowledge or skills relating to a particular activity, doing them will help to reinforce what you already know. If you do not understand an activity, think carefully about the way the questions or instructions are phrased. Read the section again to see if you can make sense of it. If you are still confused, contact your facilitator or discuss the activity with other students, fellow workers or with your workplace supervisor.

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Additional Research, Reading, and Note-Taking

If you are using the additional references and resources suggested in the Learner Guide to take your knowledge a step further, there are a few simple things to keep in mind to make this kind of research easier.

Always make a note of the author's name, the title of the book or article, the edition, when it was published, where it was published, and the name of the publisher. This includes online articles. If you are taking notes about specific ideas or information, you will need to put the page number as well. This is called the reference information. You will need this for some assessment tasks, and it will help you to find the book again if you need to.

Keep your notes short and to the point. Relate your notes to the material in your Learner Guide. Put things into your own words. This will give you a better understanding of the material.

Start off with a question you want answered when you are exploring additional resource materials. This will structure your reading and save you time.

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Introduction

The body parts, structures, and functions are already part of early education. In the early years of child growth (as early as two years), different body parts are already being introduced. As you go through your formative education, you learn more about the other body systems and their respective functions. It has become common knowledge that people tend to set this knowledge aside through the years. This learner guide will serve as a review and reinforcement of this knowledge.

When your clients tell you that their 'tummy' is aching, your immediate thought is that something may be wrong in their stomach. However, how far can you provide medical assistance if your knowledge is limited to a picture of an upset stomach? Knowledge about the body systems can help you provide support and care more effectively. Some of the work applications are:

- Recognising symptoms of health issues in your clients
- Having a better understanding of your client's health condition
- Being able to administer medications correctly or help your client administer medications to their body
- Being able to assist other health professionals should needs arise

In your line of work, your cases will not be limited to a simple stomach-ache or slight dizziness. You can encounter emergency cases that will be a matter of life and death. It is crucial that you can quickly provide the proper medical attention. You will be able to do this if you can identify the particular injury. You can work in emergencies if you know the connection between the injury and the affected body part.

This learner guide will help you understand useful health terminology in your practice. You can use health terminology correctly because you understand how the body works. You will also appreciate the different factors that keep the body functioning well. This learner guide will also help you establish what a healthy body system looks like.

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For the purpose of discussion, this Learner Guide will use 'workers' to refer to relevant job roles and positions that will use and interpret information about human anatomy and physiology. It will also use the term ‘clients’ to refer to the person who will receive care or service.

The table below shows examples of the possible settings, context and work roles that this unit may apply.

Workplace Setting and Context	Work Role
▪ Community and health services ▪ Home or residential services ▪ Hospitals or clinics ▪ Educational facilities ▪ Medical or utility vehicles ▪ Rehabilitation centres	▪ Disabilities support officer ▪ Personal care assistant ▪ Disability support assistant (schools) ▪ Social educator ▪ Local area coordinator ▪ Community development officer ▪ Project officer ▪ Radio despatcher ▪ Ambulance call taker ▪ Physiotherapy assistant ▪ Nutrition assistant ▪ Retail supervisor ▪ Front of pharmacy supervisor

In this learner guide, you will learn how to:

- Work with information about the human body
- Recognise and promote ways to support healthy functioning of the body

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I. Work With Information About the Human Body

The complexity of human beings, perhaps, stems from the complexity of how the human body is made. The *human body* is a single structure composed of trillions of cells organised into tissues, organs, and systems. This chapter will cover the following structures of the human body.

You must understand the role of each body system in how an individual can function well. When you do, you can make reasonable decisions when you provide medical assistance. You will also be able to relay information to other health professionals clearly because you can talk in the same language.

You may also be in situations where your client will ask you for information about diagnosis and treatment. You need to be able to explain the medical intervention you are doing in their body. You need to understand how the body systems are supposed to work so you can explain what is going wrong.

What you will learn from this learner guide can help you make informed choices about your limitations in providing support and care. You will know if the condition is beyond your capabilities. Having enough knowledge about the medical condition can also help you identify who will be the right personnel to refer to your client.

In this chapter, you will learn how to:

Use and interpret health terminology that describes the anatomy and physiology of the major body systems

Use and interpret information about the interrelationships between major body systems

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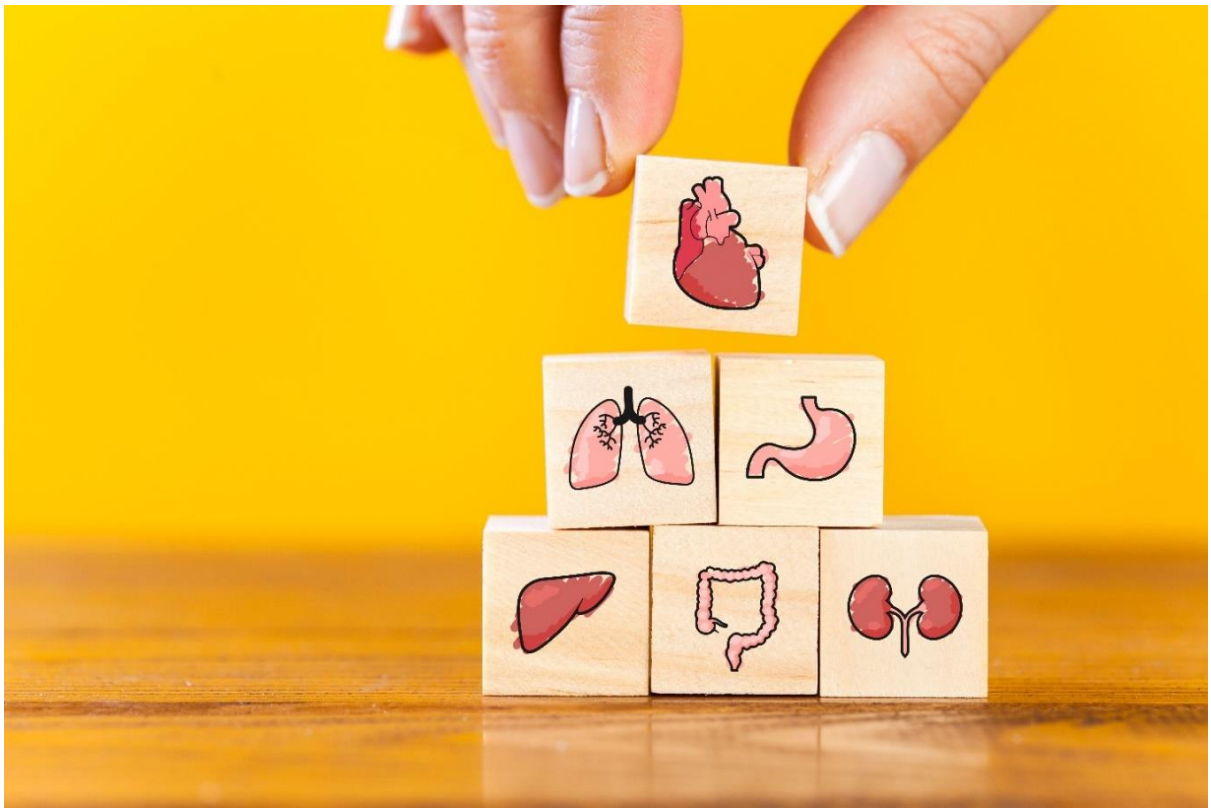
1.1 Use and Interpret Health Terminology That Describes the Anatomy and Physiology of the Major Body Systems



Health terminology or medical terminology is the common language used by healthcare workers. Health professionals like doctors and nurses are not the only ones who should master the medical terms. Anyone working in the healthcare industry should be knowledgeable as well.

You need to use health terminology to describe the client's condition or their treatments and medications. If you are not familiar with the medical terms, you can potentially hurt your client. For example, you receive instructions on where you will administer certain medications. If you do not know the medical terms in the instructions, you might administer the medication incorrectly. That lack of knowledge will compromise the health of your client.

In this subchapter, you will understand terms that describe the anatomy and physiology of the major body organ systems. *Anatomy* pertains to the structures of the human body. These structures include parts from the microscopic level up to the parts you can identify with your naked eye. *Physiology*, on the other hand, is about the functions of these structures. The body systems are grouped in sections in this subchapter. The health terminology will be discussed in each section accordingly.

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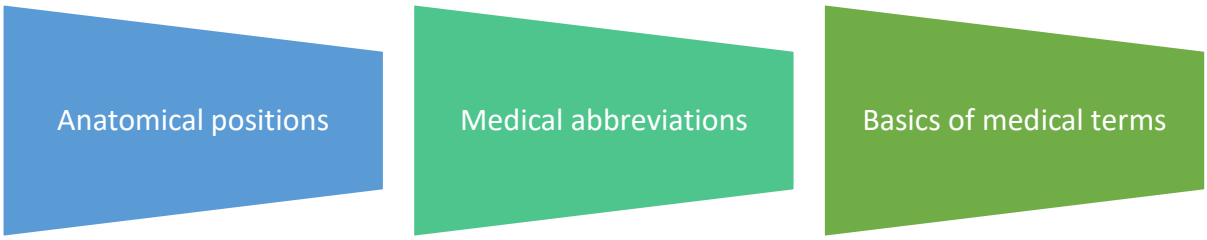
Before you start learning and reviewing the complex body structures, be familiar first with the following:



Anatomical Positions

Standard *anatomical position* refers to the body orientation used in describing one's anatomy. Most organisms can take various positions that may change the location of organs. So, it is necessary to standardise the positions to avoid confusion.

- **Directional terms**

  Directional terms are used to describe the relative location of the body structures. The following terminologies may also be recurring terms used in different body systems. Knowing these terms will make it easier for you to understand body systems-related topics in this subchapter.

  - **Medial and lateral**

    The median or midline is the imaginary line down the middle of the body. It splits the body into two equal parts – left and right. *Medial* is the direction towards the median, and *lateral* means away from the midline towards the side of the body. For example, the nose is medial to the eye.

  - **Anterior and posterior**

    Anterior or ventral indicates that the body part is in or towards the front of another body part. *Posterior* or dorsal is the opposite. It means that a particular body part is behind or towards the back of another body part. For example, toes are anterior to the foot.

  - **Superior and inferior**

    Superior or cranial refers to a position above or higher than another body part. On the other hand, *inferior* or caudal describes a position that is usually below or lower than another part of the body. For example, the eyes are superior to the nose.

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- **Proximal and distal**

  These terms are used in structures that are deemed to have a beginning or an end. They describe the position of something with reference to its origin. *Proximal* means closer to its origin, while *distal* means it is farther away. Usually, it is used in relation to the trunk of the body. For example, the hand is distal to the shoulder.

- **Superficial and deep**

  Superficial describes a position that is closer to the surface of the body. *Deep* means the position is far away from the surface of the body. For example, skin is superficial to the bones.

- **Planes of the body**

  Planes are the two-dimensional imaginary surfaces that divide the body. They describe the location of structures in the body as a whole. They are used to describe medical images captured by CAT scans, MRIs, etc. The following are the commonly referred planes in human anatomy.

Terminology	Description
Sagittal plane (lateral plane)	A vertical plane from the front to the back that divides the body into the right and left sides
Median plane	A sagittal plane through the middle of the body that divides it or any of its parts into right and left halves
Coronal plane (frontal plane)	A vertical plane that divides the body into anterior and posterior portions from side to side
Axial plane (transverse plane)	A horizontal plane that divides the body into upper and lower parts

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Medical Abbreviations

The table below lists some of the common medical abbreviations in Australia.

Abbreviation	Meaning
A&E	accident and emergency
ac	before meals
ALS	advanced life support
AXR	abdominal x-ray
Bid	twice a day
BGL	blood glucose level
BP	blood pressure
BPM	beats per minute
BSL	blood sugar level
CXR	chest x-ray
Dx	diagnosis
ECG	electrocardiogram
EEG	electroencephalograph
ENT	ear, nose and throat
FBC	full blood count
Fhx	family history
GA	general anaesthesia
Hb	haemoglobin
Hx	history
HR	heart rate
IM	intramuscular
IO	intraosseous
IV	intravenous
LA	local anaesthesia
lat	lateral
LOC	loss of consciousness

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Abbreviation	Meaning
MO	medical officer (doctor)
MVA	motor vehicle accident
MRI	magnetic resonance imaging
NAS	intranasal
NOK	next of kin
Obs	observations / vital signs
OR	operating room
P	pulse
PMHx	past medical history
PO	per os (by mouth or orally)
post-op	post-operative
Pt	patient
Rx	treatment/therapy
q4h, q6h	every 4 hours, every 6 hours
qid	four times a day
sc	subcutaneous
SL	sublingual
SOB	shortness of breath
STAT	immediately
Tid or Tds	three times a day
Tx	transplant
US	ultrasound
VC	vital capacity
WNL	within normal limits
Wt	weight
6MWT	6-minute walk test

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Basics of Medical Terms

Most medical terms are composed of three parts:

Prefix – the beginning of the word

- Usually describes the number, size, location, etc.

Root – the middle of the word

- Usually tells about the subject or the body part involved

Suffix – the ending of the word

- Usually describes the condition, process or procedure

Below are some examples:

Examples of Medical Prefixes, Root Words and Suffixes	
Prefixes ▪ A-/An – absent; lacking ▪ Brady – slow ▪ Di – double ▪ Endo/Intra – inside ▪ Exo/Extra – outside ▪ Hyper – high; above normal ▪ Hypo – low; below normal ▪ Inter – between ▪ Leuko – white ▪ Macro – large; visible to the naked eyed ▪ Melan – black ▪ Micro – very small; requires a device to be seen ▪ Mono – single ▪ Poly – many ▪ Tachy – fast ▪ Trans – across	**Root** ▪ abdomino – abdominal ▪ arthro – joint ▪ cephalo – head ▪ derm – skin ▪ haemo – blood ▪ lith – stone ▪ neuro – nerve ▪ osteo – bone ▪ thoraco – chest **Suffixes** ▪ -ase – enzyme ▪ -itis – inflammation ▪ -oxia – oxygen ▪ -philia – love of ▪ -phobia – fear of ▪ -pnea – breathing ▪ -tension – pressure

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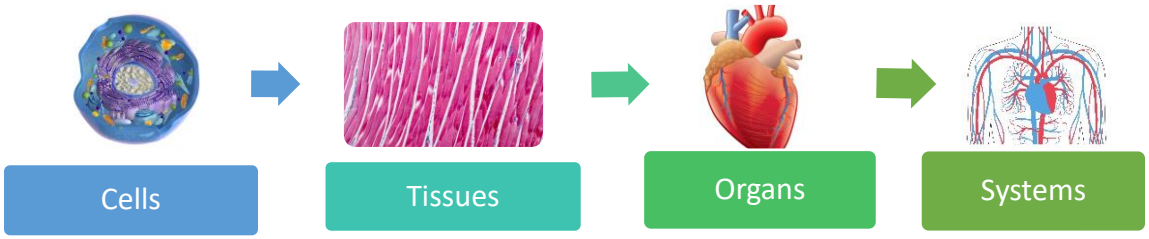
1.1.1 Cells, Tissues and Organs

The human body is a complex yet very organised structure. The diagram below shows the levels of organisation in the human body.



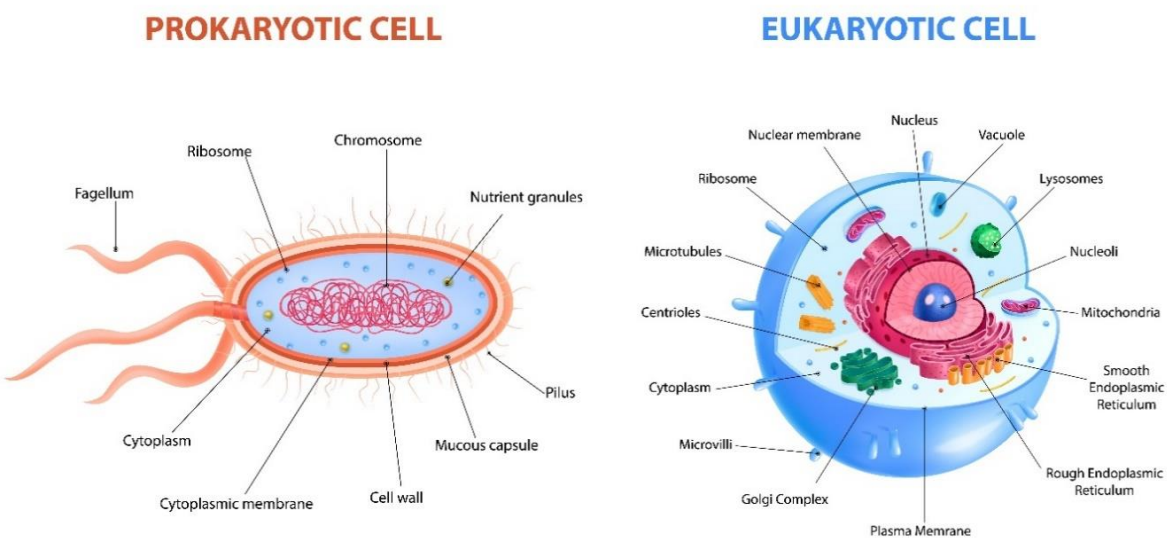
Cells

Cells are considered the most basic structure or the simplest functional unit of the human body. There are trillions of cells in the human body, each capable of metabolism and growth.

The following are the basic functions of cells:

- Provide structure for the body
- Take in nutrients from food
- Convert those nutrients into energy
- Carry out specialised functions
- Contain the body's hereditary material and can make copies of themselves.

Before you review the intricate parts of a human cell, study first the following image.



The image above shows the two types of cells – prokaryotic and eukaryotic cells.

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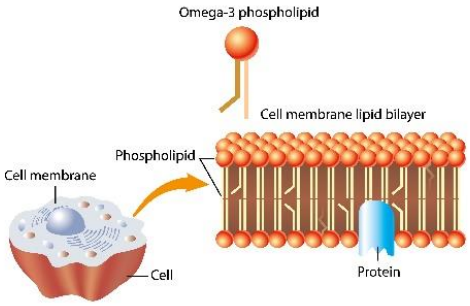
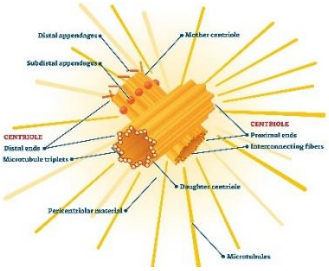
A *prokaryotic cell* is smaller and simpler than a eukaryotic cell. It is a single-celled organism that has no nucleus or membrane-bound organelle. The organisms containing prokaryotic cells are called prokaryotes. The common examples of prokaryotes are bacteria and archaea.

A *eukaryotic cell* is bigger and more complex. It has a membrane-bound nucleus with cell organelles performing special functions. Eukaryotes such as plants, animals, fungi and protozoa are organisms containing eukaryotic cells.

This learner guide will focus on eukaryotic cells since human cells are classified as eukaryotic. You can see the different cell organelles from the image on the previous page. Again, the *cell organelles* are the membrane-bound bodies inside the cell with unique roles. These organelles work together to keep the cell healthy. The table below specifies these organelles and their special functions.

Cell Structure	Parts and Functions
	**Cell Membrane** ▪ Is the semi-permeable outer layer of the cell ▪ Contains the fluid inside the cell and separates the other organelles from the external environment **Cytoplasm** ▪ Is the fluid inside the cell where all the cell organelles are ▪ Is where the metabolism and other cell activities happen
	**Centrosome** ▪ Is made up of centrioles that organise into microtubules ▪ Is involved in the cell division process

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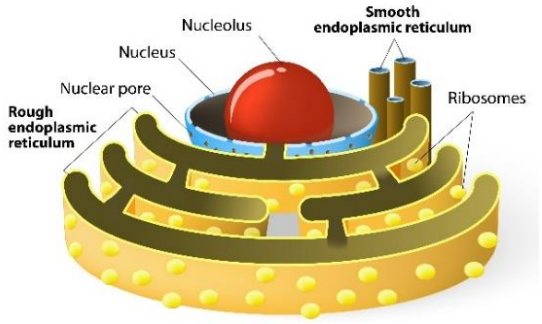
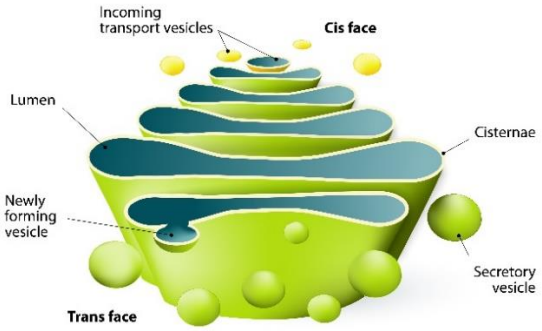
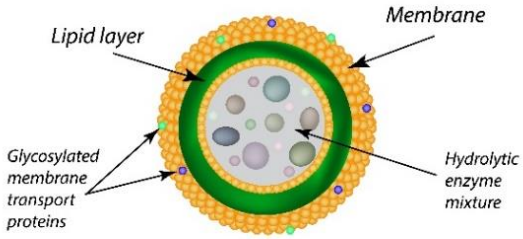
Cell Structure	Parts and Functions
	**Endoplasmic Reticulum** Has two portions called rough endoplasmic reticulum and smooth endoplasmic reticulum ▪ Rough ER has attached ribosomes on its sides. It synthesises proteins. ▪ Smooth ER does not have attached ribosomes. It synthesises phospholipids.
	**Golgi Apparatus** ▪ Acts as the storage house of the cell and is also involved in the transportation of protein ▪ Is also called the 'post office' of the cell because it is involved in processing and packaging
	**Lysosome** Helps digest and break down food material in the cell

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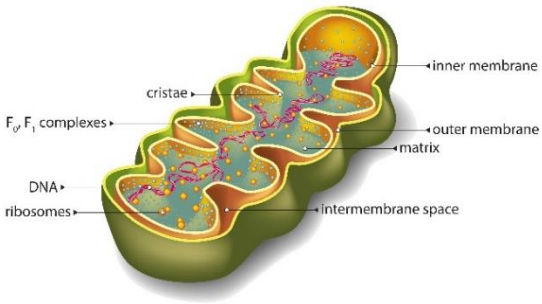
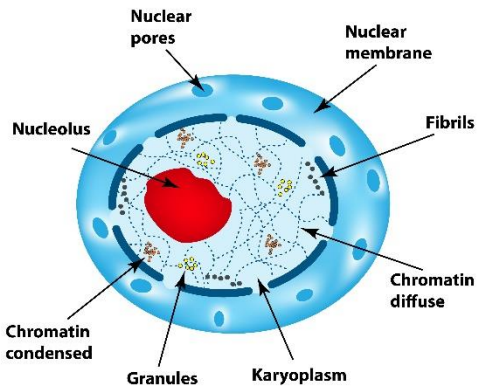
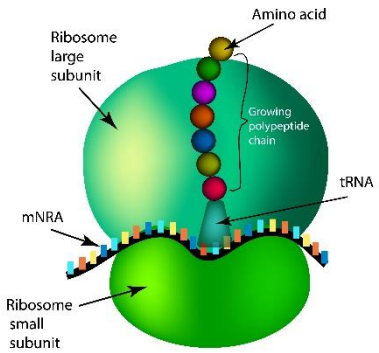
Cell Structure	Parts and Functions
	**Mitochondria** ▪ Is the powerhouse of the cell because this is where cellular respiration happens ▪ Produces Adenosine triphosphate (ATP), the cell's energy currency
	**Nucleus** ▪ Is the most prominent cell organelle ▪ Is the cell's control centre because it contains genetic information **Nuclear Membrane** Is a bilipid layer that acts as a barrier to protect the cell's DNA **Nucleolus** ▪ Is the spherical body inside the nucleus ▪ Is made of protein, RNA and DNA ▪ Is where ribosomal RNA is produced
	**Ribosome** ▪ Is the organelle where protein synthesis occurs ▪ Contains proteins and RNA

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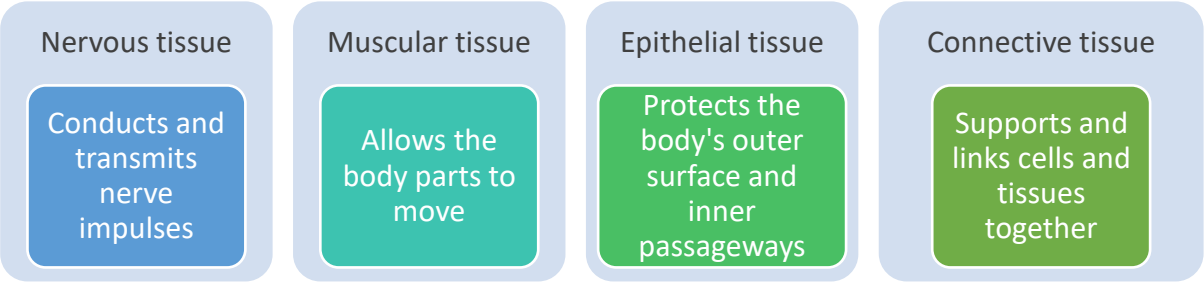
As mentioned earlier, all these cell structures work together to ensure the cell is healthy and functioning well. Energy production, which powers you to move and think, happens in the cell. The trillions of cells making up the human body are the foundation of a person's general well-being.

It is only essential that you have the basic knowledge about the cell because humans are multicellular organisms. Can you imagine what will happen when a large number of cells malfunction? You will start to see signs and symptoms of illness in the body. There are diseases, illnesses and injuries that can cause problems at the cellular level.

Tissues

When the cells are grouped to perform a specific function, they form the *tissues*. There are four basic types of human tissues:



The following are the five basic functions of tissues:

- **Nervous tissue**

  Nervous tissue is made of nervous cells sensitive to stimuli. They link and transmit nerve impulses around the body. There are two main types of cells found in nervous tissue:

  - **Neurons**

    Neurons are the basic functional unit of the nervous system. They generate signals called *nerve impulses* or action potentials. These allow neurons to rapidly transmit signals from one neuron to the next across long distances.

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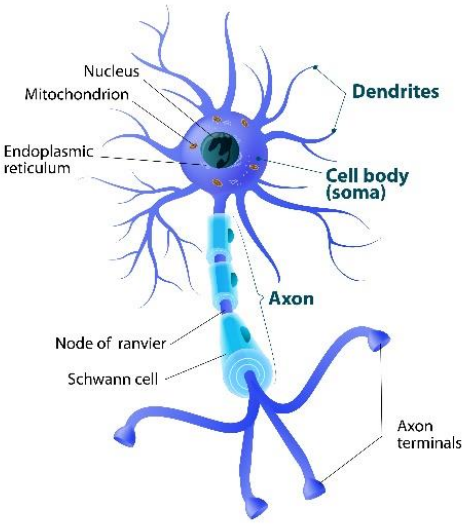
It has three main parts:

- *Dendrites* are branched extensions or projections of the neuron. They are responsible for receiving and processing signals from receptors or other neurons.
- *Cell body* or soma is the bulbous body of the neuron that contains the nucleus.
- *Axon* is the neuron's fibrous extension responsible for transmitting the signals.



- **Glia**

  Glia, or neuroglia, are supporting cells of the nervous tissue. They supply neurons with nutrients and get rid of dead cells and pathogens. Glia forms insulation between neurons so that the signals do not get crossed.

  Neuroglia is more numerous in the brain compared to neurons. It does not have the long extensions of the dendrite and the axon.

- **Muscular tissue**

Muscular or muscle tissues are specialised tissues composed of muscle fibres. They can contract, which allows the body to move. These tissues are both extensible and elastic, so they can be stretched and returned to their original size and shape. They even help pump blood and push food through the digestive tract.

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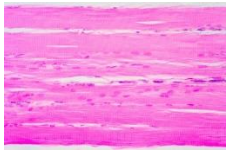
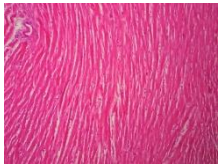
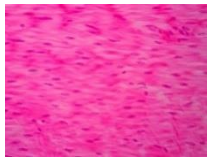
There are three main types of muscle tissues. The table below compares the structure and properties of muscle tissue types.

Muscle Tissue	Histology	Function	Location
Skeletal 	Long cylindrical fibre, striated, many peripherally located nuclei	▪ Moves voluntarily ▪ Produces heat ▪ Protects organs	Attached to bones and around entrance points to the body (e.g. mouth, anus)
Cardiac 	Short, branched, striated, single central nucleus	Contracts to pump blood	Heart
Smooth 	Short, spindle-shaped, no evident striation, single nucleus in each fibre	▪ Moves involuntarily (moves food) ▪ Controls respiration involuntarily (moves secretions) ▪ Regulates the flow of blood in arteries by contraction	Walls of major organs and passageways

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- **Epithelial tissue**

  The *epithelial tissue* is a very cellular tissue. It lines the surfaces of an organ as a protective barrier. Anything that enters the body must pass through at least a layer of epithelial tissue. Epithelial cells are often associated with the outer layer of the skin or epidermis. However, there are other areas of the body where you can find epithelial tissue. Some of these are in the respiratory, urinary and gastrointestinal systems.

- **Connective tissue**

  Connective tissues are found between other tissue types and organs and, as the name suggests, connect them. They contain high quantities of water, various kinds of cells, and a fibrous extracellular matrix. The extracellular matrix is usually composed of a ground substance and protein fibres.

  Connective tissues also have a significant role in protecting delicate organs. They have specialised cells that can defend the body from unwanted microorganisms. There are three broad categories of connective tissues as presented below:

Connective Tissue Proper	Supportive Connective Tissue	Fluid Connective Tissue
Loose connective tissues are found between many organs. ▪ Areolar – distributed in random, web-like form and fills the spaces between muscle fibres ▪ Adipose – made up of fat cells that stores energy ▪ Reticular – net-like framework that provides support to soft organs	**Cartilage** is made up of cartilage cells or chondrocytes inside a space called lacunae. ▪ Hyaline – the most common type of cartilage in the body (e.g. the cartilage in your rib cage and nose) ▪ Fibrocartilage – has thick bundles of collagen fibres (e.g. in knee joints and intervertebral discs) ▪ Elastic – contains elastic fibres, collagen and proteoglycans (e.g. in earlobes)	**Blood** – cells circulate in a liquid extracellular matrix ▪ Erythrocytes – red blood cells that transport oxygen in the body ▪ Leukocytes – white blood cells that defend the body from harmful microorganisms ▪ Platelets – cell fragments that are involved in blood clotting

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Connective Tissue Proper	Supportive Connective Tissue	Fluid Connective Tissue
Dense connective tissues have more collagen fibres, making them more resistant to stretching. ▪ Dense regular – fibres are parallel to each other ▪ Elastic – with elastin fibres in addition to collagen fibres ▪ Dense-irregular – with fibres that are in a random direction	**Bone** is the hardest connective tissue. It protects the internal organs and supports the body.	**Lymph** contains a liquid matrix and white blood cells.

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Organs

An *organ* is a self-contained group of different tissues that perform a specific bodily function. For example, the lungs take in oxygen and eliminate carbon dioxide, and the heart pumps blood. Most organs contain all four types of tissues. They may be solid or hollow and differ in size and complexity.

Systems

Body systems, or organ systems, are a group of organs that work together to execute a particular body function. The groupings of organ systems are based on the bodily function they perform. For example, the respiratory system comprises the nasal passage, trachea, and lungs. They work together to take in oxygen and eliminate carbon dioxide. The human organ systems are categorised into 11 groups. The following sections will discuss the different body organs in detail.

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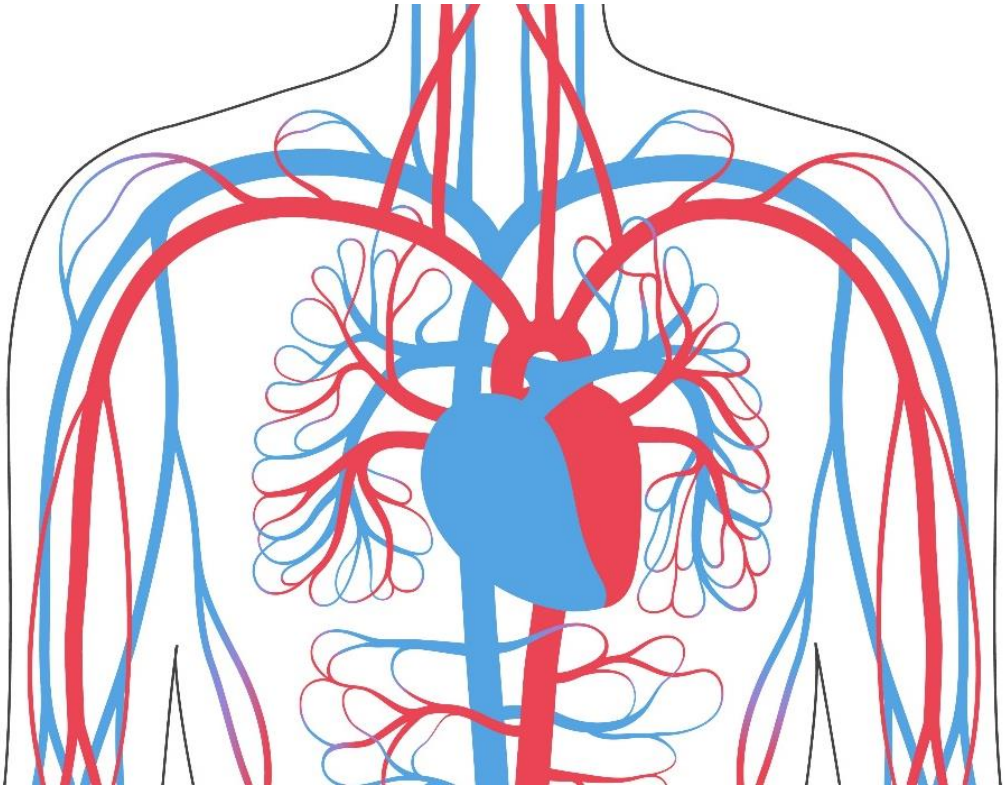
1.1.2 Cardiovascular System



Also known as the circulatory system, the *cardiovascular system* is a vital organ system that delivers important substances to all cells for them to function. It is a simple loop that starts and ends with your heart. The main function of this system is to provide oxygenated blood to the tissues and remove the carbon dioxide produced. It transports blood from the heart to the other parts of the body.

The cardiovascular system is divided into two loops:

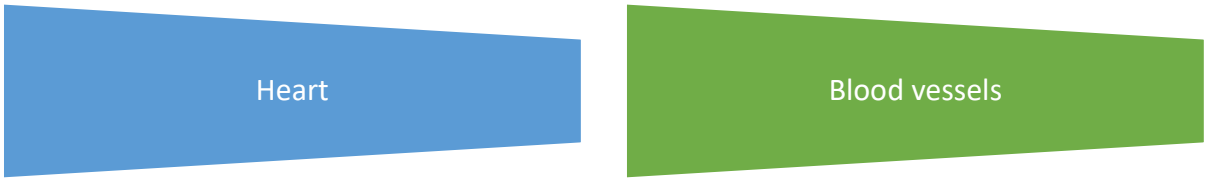
- **Pulmonary circulation**

  This circulation moves blood between the heart and the lungs. It is the process of transporting deoxygenated blood from the tissues to the lungs. Then, the lungs absorb the oxygen and release carbon dioxide.

- **Systemic circulation**

  Systemic circulation is the process of delivering oxygenated blood from the heart to the rest of the body. It sends the oxygenated blood and returns the deoxygenated blood to the heart.

The cardiovascular system is a network composed of the following:



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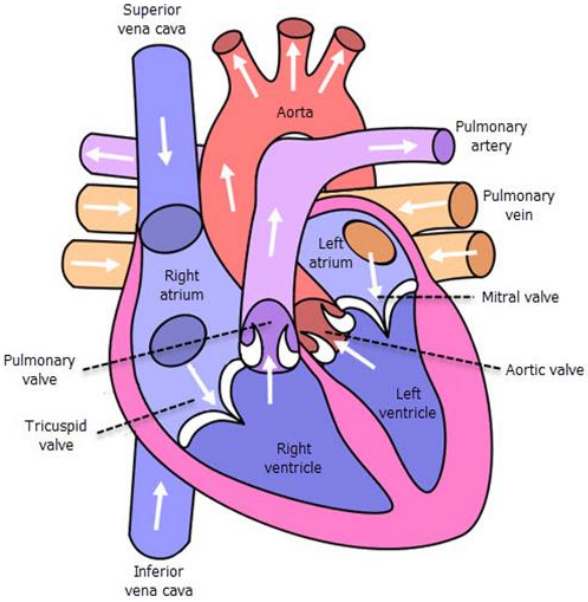
Heart

The *heart* is a muscular pump that supplies the necessary force to circulate blood throughout the body. Without blood, the cells and tissues will undergo irreversible changes that lead to death.



The heart sits inside the chest, in front of the lungs. It is slightly to the left side. The two-layered serous sac called pericardium encloses the heart. It is shaped and sized roughly like a man's closed fist.

The human heart is a four-chambered organ: right and left atria and ventricles. These chambers help in the pumping of blood through the following process:

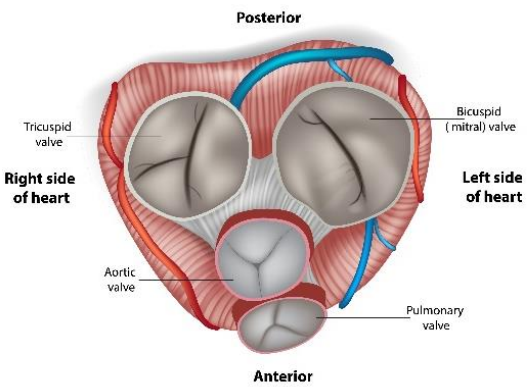
1. The *right atrium* receives deoxygenated blood from the cells and tissues and pumps it to the right ventricle.
2. The *right ventricle* pumps this deoxygenated blood to the lungs.
3. Once the lungs eliminate the carbon dioxide and take in oxygen, the *left atrium* receives the oxygenated blood. It pumps blood to the left ventricle.
4. Lastly, the *left ventricle* pumps the oxygen-rich blood to the rest of the body.

Pumps need a set of valves to ensure that the fluid will only flow in a single direction. The heart is no exception to this. The heart has different valves to ensure the proper dissemination of blood within the different chambers. The valves are the following:

- **Atrioventricular valves**

  These are also known as the *cuspid valves*. These valves separate the atria and ventricles. It also prevents the backflow from the ventricles to the atria. There are two types of atrioventricular valves:

  - The *bicuspid valve*, known as the mitral valve, separates the left atrium from the left ventricle.
  - The *tricuspid valve* is between the right atrium and the right ventricle.



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- **Semilunar valves**

  These separate the ventricles from the blood vessels that carry blood away from the heart. They prevent the backflow from the vessels back to the ventricle.

  There are two types:

  - The *aortic valve* can be found between the left ventricle and the aorta, the main artery that carries the blood away from the heart.
  - The *pulmonic valve* is between the right ventricle and the pulmonary artery. This artery carries the blood to the lungs.

The cardiovascular system follows the cardiac cycle. This is the performance of the human heart from one heartbeat to the next. It is divided into two phases:

- *Diastole* is the first cardiac cycle phase in which the heart muscle relaxes and refills with blood.
- The second phase is the *systole*, where the ventricles contract and pump blood.

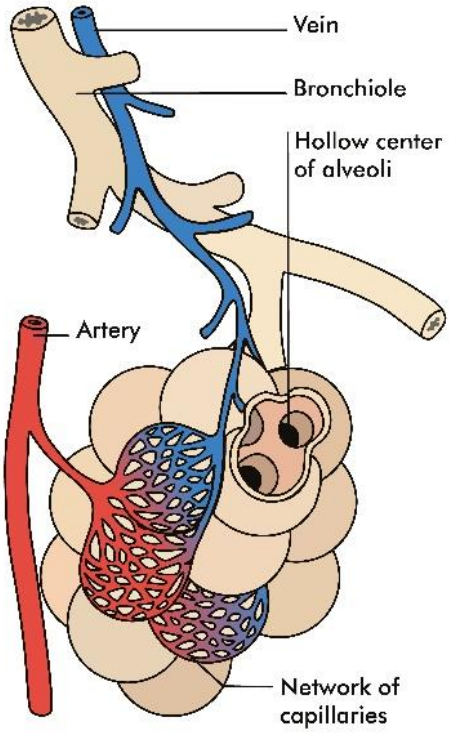
Blood Vessels

Blood is the fluid of life. It is delivered throughout the body via *blood vessels*. The blood vessels act as the channels for the oxygen-rich blood to reach the body tissues. Blood vessels can be classified as arteries, capillaries, or veins based on their structure.

- **Arteries**

  Arteries are the vessels that carry the blood away from the heart. Pulmonary arteries carry deoxygenated blood from the heart to the lungs. Systemic arteries, on the other hand, transport oxygenated blood to the body tissues.

  The wall of an artery consists of three layers. The tunica intima, or tunica interna, is the innermost layer. The thickest layer, called the tunica media, can be found in the middle layer. This supports the vessel and changes its diameter to regular blood flow and pressure. The outermost layer is the tunica extrema.



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- **Veins**

  Veins carry deoxygenated blood to the heart, where it can be sent to the lungs. Veins have one-way valves to avoid blood flowing the wrong way.

- **Capillaries**

  Capillaries are the smallest and most numerous of the blood vessels. They form the connection between the vessels that carry the blood away from the heart and the vessels that return the blood to the heart. Capillaries are so small that only a single blood cell can move through them at a given time.

Cardiovascular System Problems

Diseases related to the cardiovascular system are one of the leading causes of death globally. However, this can be prevented, mainly by changing into a healthy lifestyle. Not all heart problems come with definite signs or symptoms. So, it is better to watch out for the following signs:

- Heartburn
- Palpitations
- Shortness of breath
- Numb legs and/or arms
- Chest pain or discomfort
- Dizziness

If the client experiences a sudden numbness in their left arm, report it immediately. It can occur for several reasons, like sleeping in the wrong position. However, it can be a severe medical condition like a heart attack.

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The following are some of the common heart and cardiovascular conditions:

Aneurysm

- An abnormal bulge or dilation in the arterial wall due to the weakening or thinning of the wall

Bradycardia

- A condition where the heart rate is slower than normal

Coronary Heart Disease (CHD)

- The most common heart disease where the heart's major blood vessels become narrowed, causing reduced blood supply to the heart

Cardiomyopathy

- A condition where the heart muscles get damaged, making it difficult for the heart to pump and supply blood to the body

Heart arrhythmia

- A condition where there are irregularities in the heartbeat (i.e. the heartbeat is either too fast or too slow)

Heart attack

- A condition when the blood flow to the heart is blocked

Tachycardia

- A condition where the heart rate is faster than normal

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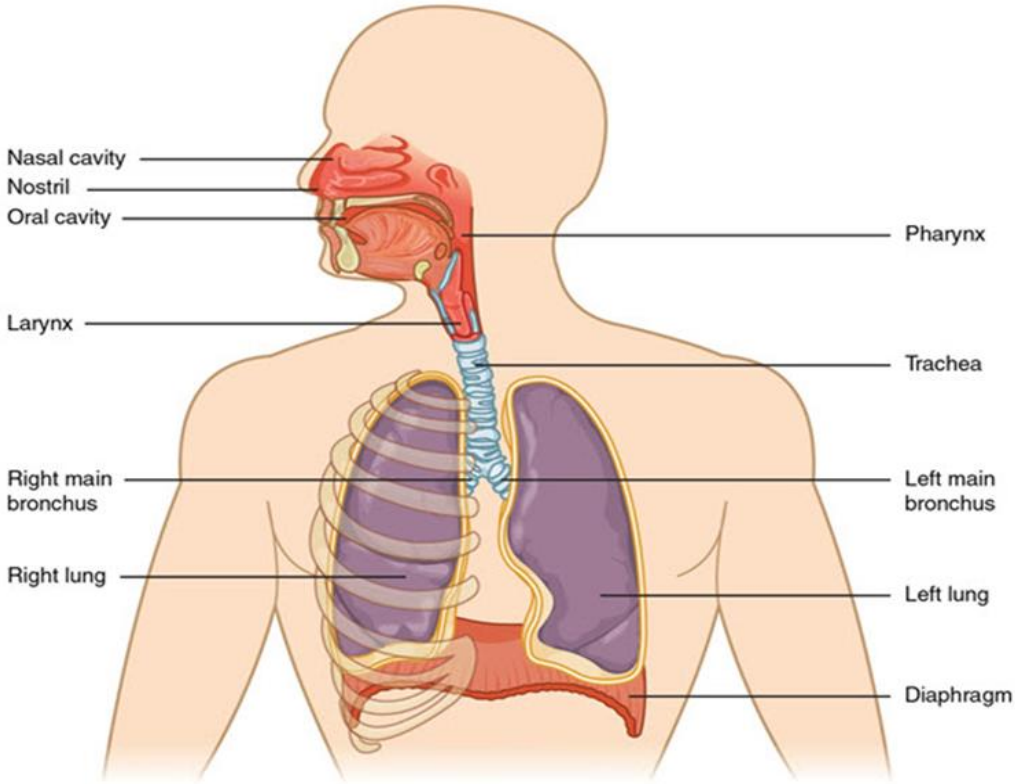
1.1.3 Respiratory System



Your lungs are part of the *respiratory system*. This system is a group of organs and tissues that work simultaneously to help you breathe. The main job of this organ system is to provide oxygen to the body tissues and remove the waste product. It functions to bring oxygen in and carbon dioxide out. It also helps to maintain the pH balance of the blood.

Ventilation, or *breathing*, is the process of air flowing into and out of the lungs. Inspiration is the process of taking air into the lungs. This is also called *inhalation*. This is an active breathing phase because it results from muscle contraction. Expiration or exhalation is the process of letting the air out of the lungs. The respiratory system is deeply connected with the circulatory system. They work together to take in oxygen and remove carbon dioxide.

The main organ of the respiratory system is the *lungs*. This organ system includes the nose, trachea, pharynx, larynx, and bronchi.

- **Nose**

  The primary entrance and exit for the respiratory system is through the nose. It can be divided into two major sections – external nose and internal nose.

  The *external nose* is the protruding part of the face where you can find the nostrils. This allows entry into the nasal cavity. The *internal nose*, or nasal cavity, is the inside of your nose and is lined with mucous membrane, nasal hairs, and cilia. They help your nose maintain moisture by making mucus. They also prevent large particles from reaching your lungs.

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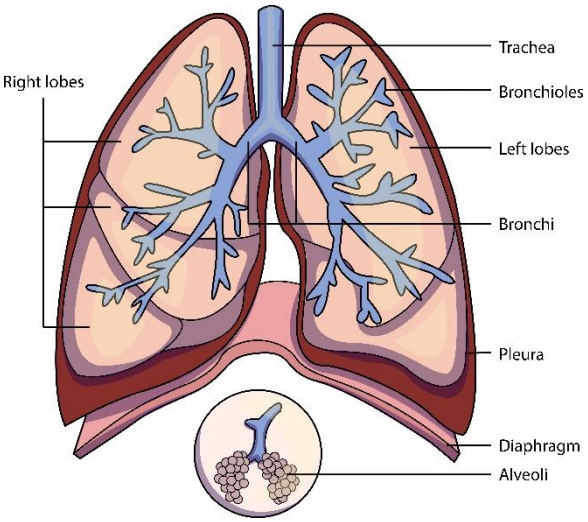
- **Lungs**

  The *lungs* occupy most of the thoracic cavity and are protected by the rib cage. They are soft and spongy because they are mostly air spaces surrounded by alveolar cells and connective tissues. They are filled with thousands of tubes that are branching smaller and smaller.

  The right lung is shorter, broader, and has more volume. The left lung is longer and narrower.



- **Trachea**

  This is also known as the *windpipe*. This is the main airway to the lungs and is connected by the bronchi to the two lungs.

- **Pharynx**

  The *pharynx* is the passageway that receives air from the nasal cavity. It also works with the digestive system as it receives air, food, and water from the oral cavity. The pharynx is divided into three regions based on location. The three regions are the nasopharynx, oropharynx, and laryngopharynx.

  The nasopharynx is the upper region of the pharynx that is posterior to the nasal cavity. The oropharynx is the middle portion of the pharynx. Laryngopharynx is the part that connects to the oesophagus and trachea.

- **Larynx**

  The *larynx* is the voice box or glottis, the passageway for air between the pharynx and trachea. The vocal folds of the larynx have two positions. During breathing, these folds remain open, but they close during swallowing or talking. The most notable function of the larynx is producing voice. When the air from the lungs passes through the closed folds during exhalation, these folds vibrate and make sounds.

- **Bronchi**

  The *bronchi* refer to the division into the right main stem bronchus and left main stem bronchus from the trachea. They branch into smaller passageways until they end in tiny air sacs called *alveoli*.

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Respiratory System Problems

Physical activity is required for some of the clients' interventions and therapies. These activities may cause discomfort if they have respiratory problems. Prolonged symptoms without a proper diagnosis can also have serious or fatal consequences. As you work through the exercises, keep an eye out for the following signs:

- Wheezing
- Stubborn cough
- Difficulty in breathing
- Severe chest retractions
- Breathing noisily, such as grunting
- Bluish colour on the skin around the mouth, inside the lips, or on fingernails

The following are some of the common respiratory conditions:

Allergic rhinitis	• Also known as hay fever, is an inflammation in the nose caused by allergens
Asthma	• An inflammation in the lungs' airways, making it narrow and constricted. This condition makes breathing difficult
Common cold	• A viral infection in the upper respiratory tract
Influenza	• A highly contagious disease in the respiratory tract caused by the influenza virus
Lung cancer	• A disease with uncontrolled cell growth in the lung tissues
Pneumonia	• An inflammation in either one or both air sacs of the lungs
Tonsillitis	• An inflammation of the tonsils
Tuberculosis	• An infectious lung disease caused by the Mycobacterium tuberculosis bacteria
Whooping cough	• Uncontrollable, violent coughing caused by the infection of the bacterium Bordetella pertussis

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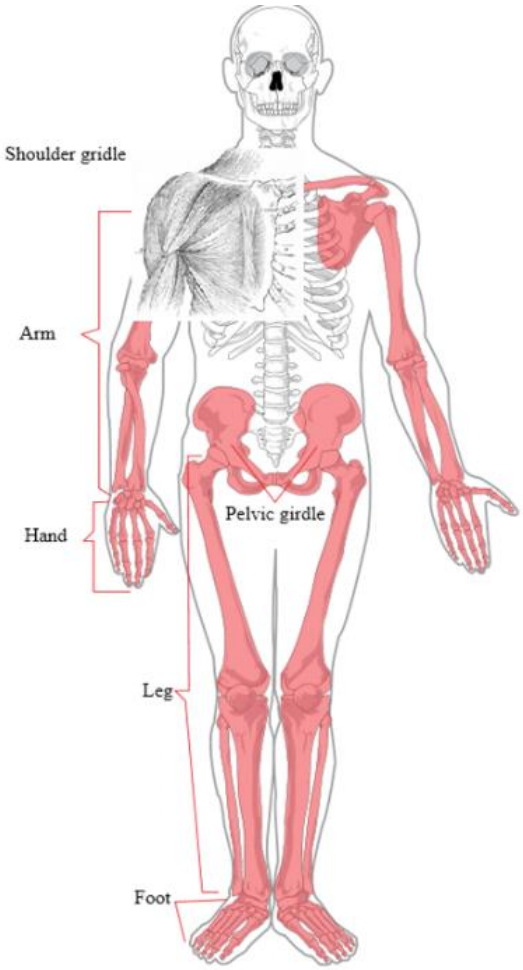
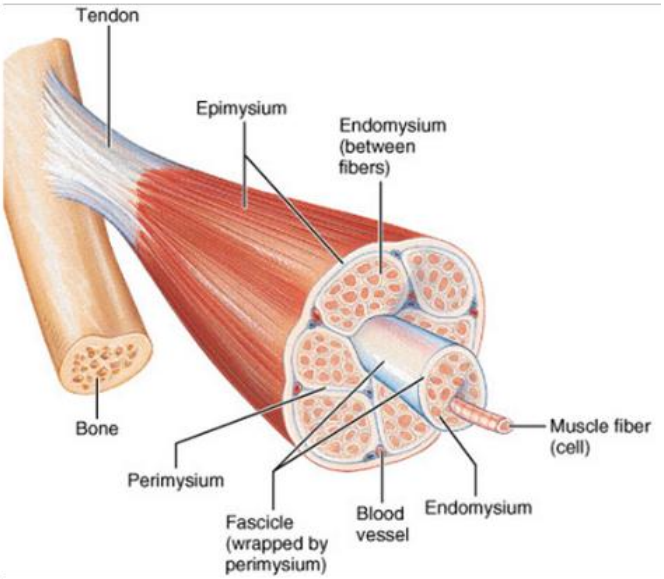
1.1.4 Musculo-Skeletal System





The *musculo-skeletal system* is in charge of the body's movement and framework. It facilitates movement and locomotion. It can be divided into two broad systems – the muscular and skeletal systems.

The diagram below shows the parts of the musculoskeletal system:

Muscular System

The *muscular system* comprises various muscle types that contract as their predominant function. There are more than 600 muscles attached to the bones responsible for movement. They make up roughly 40% of a person's body weight. These muscles allow a person to move, speak, and chew.

Aside from moving, muscle contraction also accomplishes other essential bodily functions. These include posture, heat production, and joint stability. Sitting and standing are maintained as a result of this action. Heat production is an important outcome of muscle contraction. Nearly 85% of the heat produced in the body is a result of this. The tendons of many muscles, especially in the knee, extend over the joints and provide stability.

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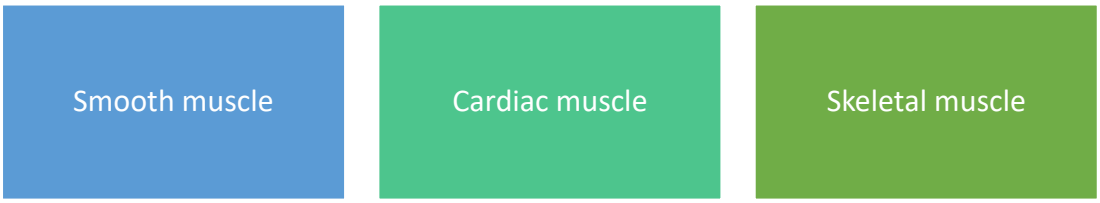
There are three types of muscle tissue. These are:



- **Smooth muscle**

  Smooth muscle is also known as visceral muscles. These muscles are found inside organs like the stomach and intestines. They are involuntary muscles, as the conscious mind cannot control them.

- **Cardiac muscle**

  Cardiac muscles surround the chamber of the heart. They are responsible for pumping blood throughout the body. Just like smooth muscles, they cannot be controlled consciously.

- **Skeletal muscle**

  The *skeletal muscle* is the only voluntary muscle tissue in the human body. These are attached to the bones and are responsible for skeletal movements.

No matter what you are doing, you have muscles working. Some of the main functions of the muscular system are as follows:

- **Posture**

  These muscles help keep the body in the upright and correct position. Good posture depends on strong and flexible muscles.

- **Stability**

  Your tendons stretch over the joint and contribute to its stability. This is crucial, especially for the knee joints and shoulder joints.

- **Digestion**

  Your smooth muscles in the gastrointestinal tract control digestion. This tract stretches from the mouth to the anus.

- **Circulation**

  Your blood is pumped by a muscle – the heart. The heart contracts to help pump blood throughout the body.

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- **Movement**

  This is the main function of the muscular system – mobility. When the muscles contract, they contribute to fine and gross movement. Most muscle movements are under conscious control.

- **Respiration**

  When breathing, you involve the use of the diaphragm muscle. When the diaphragm contracts, it pushes downward and fills the lung with air. When it relaxes, it pushes the air out.

Skeletal System

The *skeletal system* is your body's central framework. This body system comprises bones, cartilages, ligaments, and other tissues. An adult human body usually has 206 named bones. These bones are grouped into two divisions:

- **Axial skeleton**

  The 80 bones of the head and trunk make up the *axial skeleton* of an adult. It includes the skull, vertebral column, and thoracic cage. The axial skeleton functions as a support and protects the organs in the anterior and posterior locations.

- **Appendicular skeleton**

  The *appendicular skeleton* consists of 126 bones. It is comprised of the upper and lower extremities. It is involved in the movement and the manipulation of the objects in the environment.

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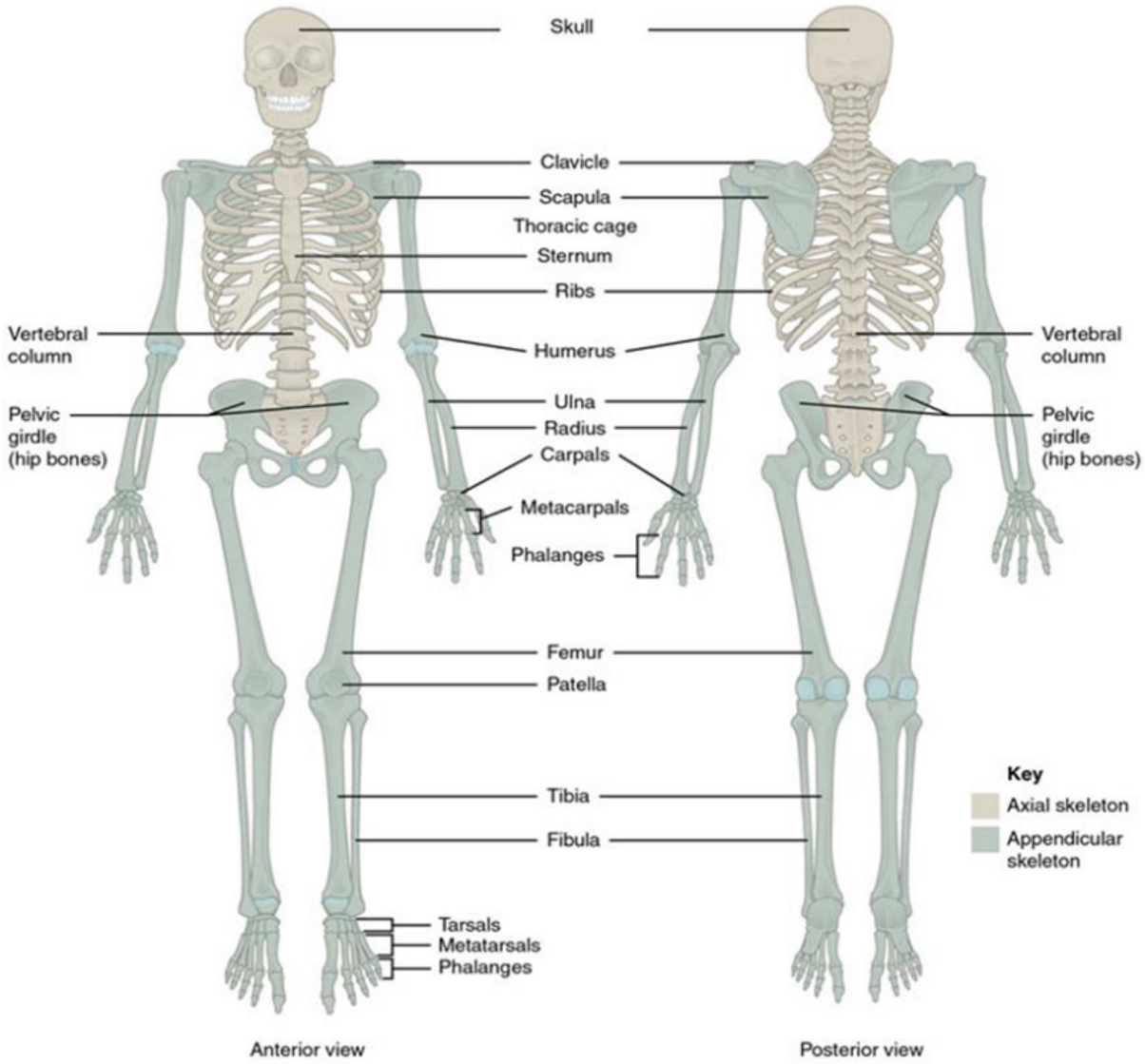

Aside from the two main skeletal system divisions, it also consists of other structures, like bones, cartilage, and joints. *Bones*, or osseous tissues, are hard, dense connective tissues that support the framework of the body. The five classifications of bones are the following:

- Flat bone
- Long bone
- Short bone
- Sesamoid bone
- Irregular bone

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- **Flat bone**

  Flat bones are a type of bone that has a flattened, broad surface. Their prime function is to protect internal organs such as the brain and heart. Due to their flat shape, they provide ample areas for muscles to attach. Your rib bones are examples of this.

- **Long bone**

  Long bones have a long, thin shape. They work as levers to permit movement with the help of the muscles. An example of this is the humerus which is in the upper arm.

- **Short bone**

  Short bones are usually as long as they are wide. Their primary function is to provide stability and a little movement. The carpals in the wrist are an example of short bones.

- **Sesamoid bones**

  Sesamoid bones are embedded within the tendons. These bones are usually small and oval. An example is the patella bone in the kneecap.

- **Irregular bones**

  Irregular bones have unusual and variable shapes. Because of this, they do not fit in any category. They have a complex form that helps protect certain internal organs. An example of irregular bone is vertebrae and coccyx.

In areas where a bone moves against another bone, the *cartilage*, a supple connective tissue, acts as a shock absorber. It prevents abrasion and damage that can help in prolonged use. Additionally, *ligaments* are bands of tissues that help bones, joints, and organs connect and stay in place. These are tissues, but they help bind the bones together to create stability. They ensure that the bones, especially those in the joint, do not twist too much or too far apart. The *joint* is where two or more bones meet to allow movement. It also helps the skeletal system function well by being part of the lever system. Together, they perform the following:

- Support the body
- Produce blood cells
- Facilitate movement
- Protect internal organs
- Store and release fats and minerals

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Musculo-Skeletal System Problems

The musculo-skeletal system oversees the body's form and movement. It wears down over time due to age and frequent use. It is the reason why it is very common to experience disorders that involve the muscles, bones, joints, ligaments, and tendons.

The disorder varies, and so do the signs and symptoms. However, some of the common symptoms include:

- Fatigue
- Stiffness
- Pain while moving
- Bruising and discolouration
- Inflammation and swelling
- Muscle spasms and twitches

The following are some of the common musculoskeletal conditions:

Arthritis	• Inflammation of one or more joints
Carpal tunnel syndrome	• A condition where the pressure in the median nerve causes pain and numbness to the base of the palm
Epicondylitis	• Inflammation of the epicondyle, located at the tendons surrounding the elbow (also known as tennis elbow)
Ligament sprain	• A stretching or tearing of a ligament
Muscle strain	• A stretching or tearing of a muscle
Osteoporosis	• A skeletal disorder where bone becomes weak and brittle
Sarcopenia	• An age-related condition characterised by loss of skeletal muscle mass
Tendonitis	• Inflammation of a tendon

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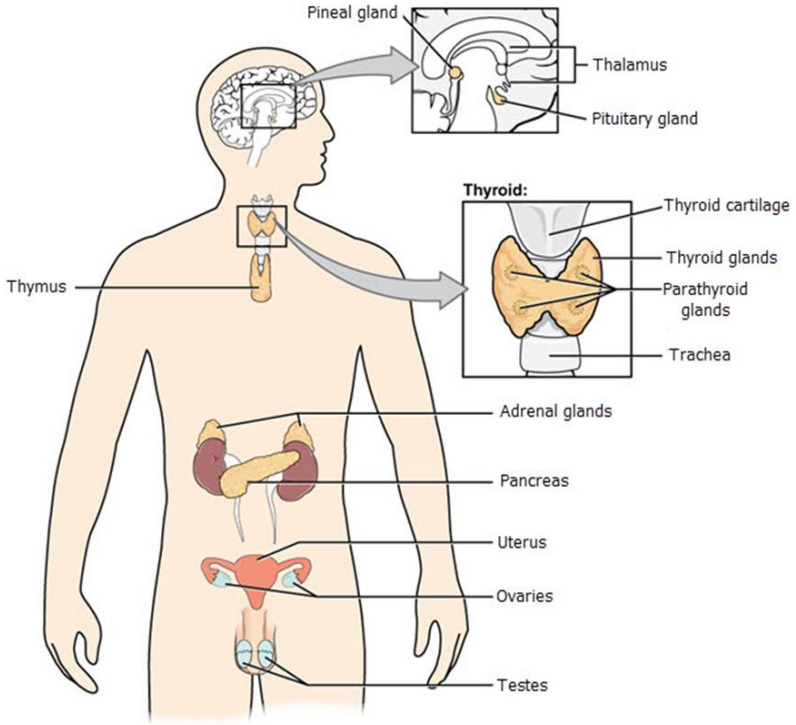
1.1.5 Endocrine System



The *endocrine system*, also called the hormone system, is a group of ductless glands that produces hormones in the bloodstream. However, it only affects certain cells with receptor sites for that hormone. These hormones control and regulate the development and growth of the biological processes in the body from birth to old age. The endocrine system works with the nervous system to control body activities. They both use chemical messengers to reach the cells at different speeds. It secretes hormones into the circulatory system. Though relatively slow, the hormones produced by the endocrine systems have prolonged effects.

There are various endocrine glands scattered throughout the body. Even though they are far from each other, they are still considered part of one system as they have similar functions and mechanisms. The following are the organs comprising the endocrine system:

Hypothalamus	Pituitary gland	Pineal gland	Thyroid gland	Parathyroid gland
Thymus	Pancreas	Enteric endocrine system	Suprarenal (adrenal) gland	Testes and ovaries

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- **Hypothalamus**

  The *hypothalamus* is an almond-shaped structure that links the endocrine and nervous systems. It acts as the control centre of the endocrine system and is located below the thalamus. The hypothalamus secretes hormones that activate or stop the release of hormones in other parts of the body, especially in the pituitary gland.

- **Pituitary gland**

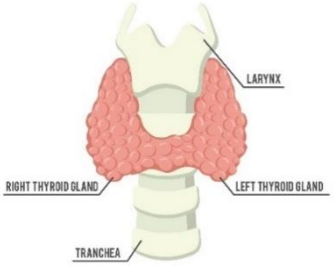
  The *pituitary gland* is a pea-sized gland located below the hypothalamus. It is called the 'master gland' since it produces and sends many hormones that help process many functions throughout the body.

- **Pineal gland**

  The *pineal gland* is situated in the middle of the brain and is named for its pinecone shape. One of the hormones it produces is melatonin, which plays a role in regulating the internal clock of the body.

- **Thyroid gland**

  The *thyroid gland* is the largest gland of the endocrine system and is located at the base of the neck. It is a very vascular organ that focuses on the regulation of metabolism.

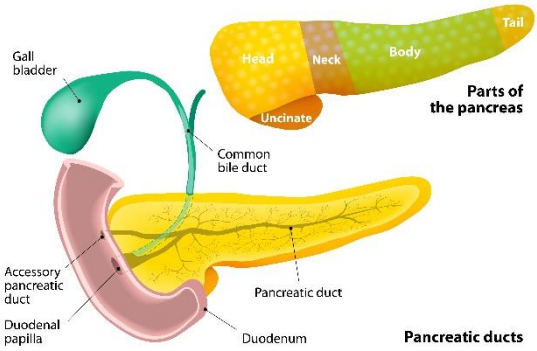


- **Parathyroid gland**

  Located at the base of the neck, the *parathyroid gland* comprises four small epithelial tissues. It secretes the parathyroid hormone, also known as parathormone. This hormone is an essential regulator of calcium ions in the blood. It is triggered once the blood calcium level is low since it is important in bone health and nervous system function.

- **Pancreas**

  This long, soft organ found anterior to the stomach plays an important role in the digestive and endocrine systems. The *pancreas* produces digestive enzymes, as well as the hormones insulin and glucagon. These hormones are essential in regulating the blood sugar levels in the body.



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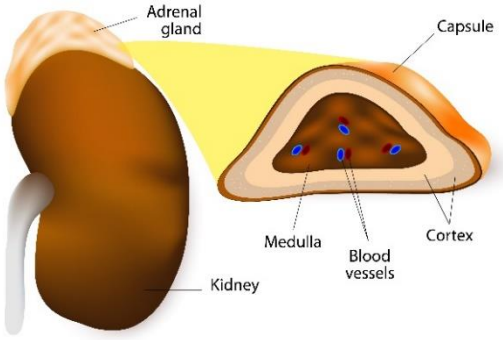
- **Enteric endocrine system**

  The *enteric endocrine system* comprises the cells within the largest endocrine organ, the gastrointestinal tract. It works with the pancreas to regulate the digestive processes.

- **Suprarenal (adrenal) gland**

  The *adrenal glands* are yellowish triangular-shaped glands situated at the top of the kidneys. It secretes hormones responsible for properly regulating blood pressure, metabolism, stress response, and the immune system.



- **Testes and ovaries**

  Testes and ovaries are the primary reproductive organs known as gonads. They secrete hormones such as androgens for males and estrogens and progesterone for females. The main androgen is *testosterone*, and some of its effects are:

  - Growth of the muscles and bones
  - Development of reproductive structures
  - Enlargement of the larynx
  - Growth of body hair

  On the other hand, female sex hormones contribute to the development of the female reproductive organs. *Progesterone* helps in preparation for pregnancy by thickening the uterine lining. Estrogens mainly focus on:

  - Distribution of fat to the breast, hips, and legs
  - Development of the breasts
  - Maturation of the reproductive organs

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Endocrine System Problems

The endocrine system uses glands to produce hormones that regulate several body functions. It may cause problems if there is an irregular hormone level or the body does not respond to hormones properly. It affects different organs and may have different symptoms. However, here are some of the common symptoms of endocrine system problems:

- Tiredness
- Weakness
- Mood swings
- Changes in blood glucose level
- Unintentional weight fluctuations

The following are some of the common endocrine system conditions:

Addison's disease

- Also known as primary adrenal insufficiency
- A condition where the cortex of adrenal gland malfunctions, causing insufficient production of essential hormones

Diabetes

- A metabolic disorder where the body is either incapable of insulin production or unable to use the insulin it produces properly

Dwarfism

- A growth hormone deficiency where the pituitary gland produces insufficient growth hormone
- Characterised by a significant defect in body growth

Hyperthyroidism

- A condition where the pituitary gland produces excessive thyroid hormones

Hypothyroidism

- A condition where the pituitary gland produces insufficient amounts of thyroid hormones

Thyroid nodules

- A condition where lumps form in the thyroid gland because of the abnormal growth of thyroid cells

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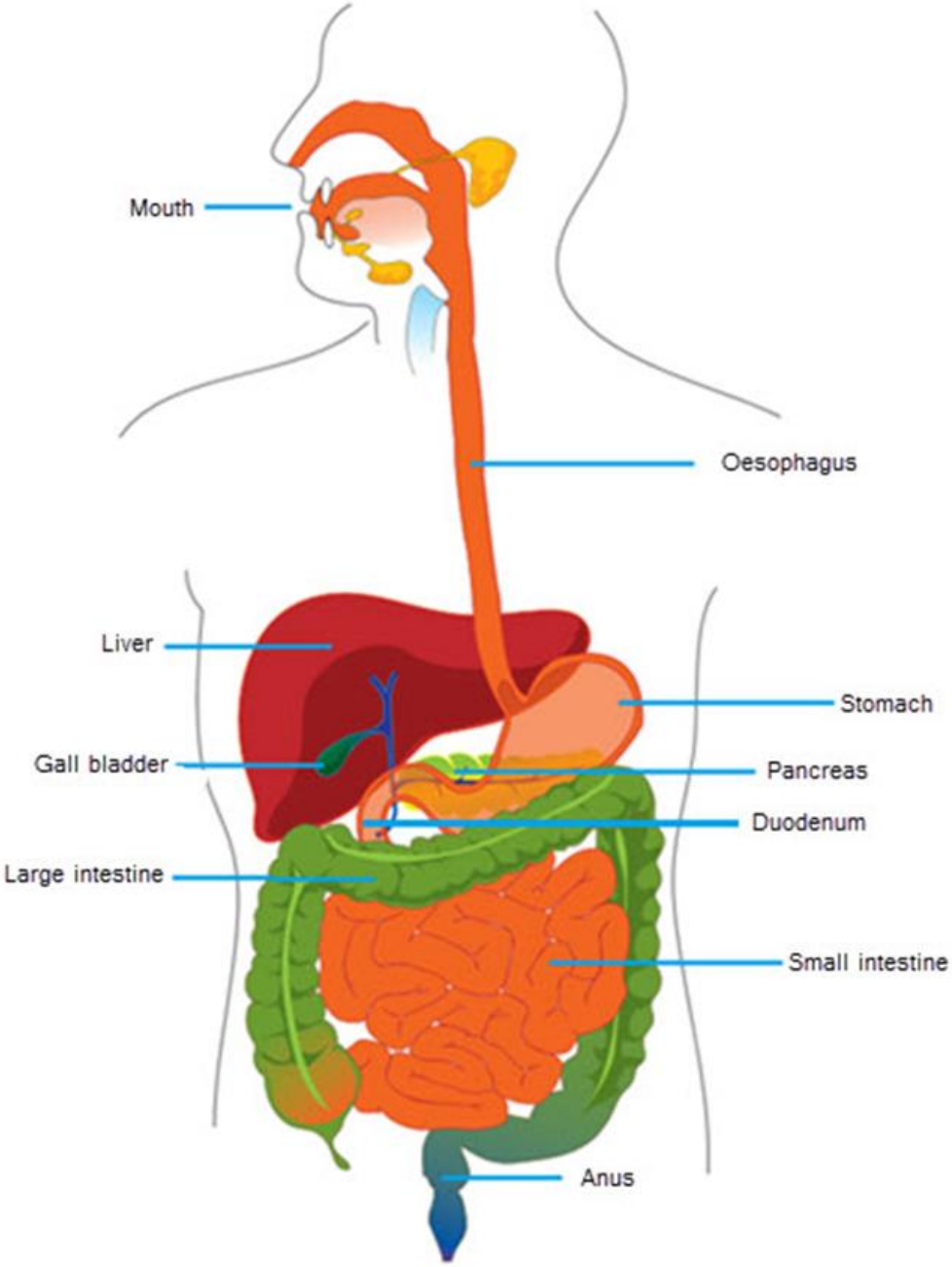
1.1.6 Digestive System



The *digestive system* is considered one of the human body's largest systems. This system is a tube running from the mouth to the anus. The main function of this system is to break down the food into smaller molecules, absorb the nutrients, and distribute it throughout the body. This provides the needed energy to sustain it.

This system includes the following organs:

- **Mouth**

  The *mouth* is the first part of the digestive tract. It is used to receive food by ingestion and breaking it into small particles.

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- **Pharynx and oesophagus**

  After ingestion and chewing, the food is pushed into the pharynx by the tongue. The sensory receptors around respond and initiate the involuntary swallowing reflex. This process propels food from the pharynx down to the oesophagus.

- **Stomach**

  The *stomach* receives food from the oesophagus. Here, the broken-down molecules are mixed with the gastric juices. The stomach is a muscular bag that helps break down food mechanically and chemically. Afterwards, the food is squeezed through a second sphincter towards the first part of the small intestine, the duodenum.

- **Small and large intestines**

  The *small intestine* finishes the process of digestion, absorbs the nutrients, and passes the excess to the large intestines. The *large intestine* is in charge of compacting waste material, removing water, and producing the solid waste product – *faeces*.

- **Rectum**

  The *rectum* is the lower part of the large intestine, where the body stores the digested waste until it is pushed through the anus.

- **Anus**

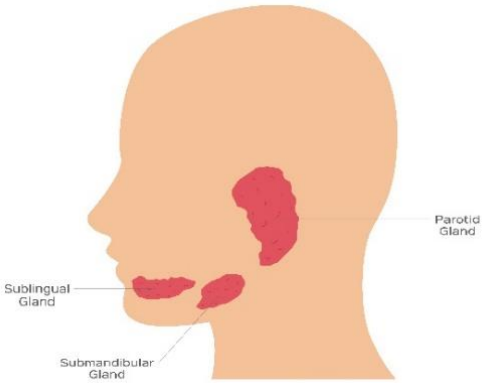
  The *anus* is the last part of the digestive tract. It identifies whether the contents of the rectum are solid, liquid, or gas and regulates when they should or should not pass through it.

- **Salivary glands**

  The *salivary glands* secrete saliva into the oral cavity, which is mixed with the food during mastication or chewing. Saliva includes water, mucus, and amylase enzyme that helps the body digest starches.

  The function of saliva includes:

  - Cleaning of the teeth
  - Dampening and lubricating food during chewing and swallowing
  - Dissolving specific molecules for the taste of the food



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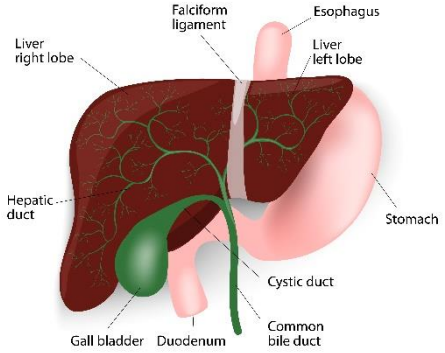
- **Liver**

  The *liver* is the largest gland in the body. It is located on the upper right part of the abdomen. It regulates most chemical levels in the blood and produces a product called bile. It processes the nutrients absorbed by the body from the small intestine. The bile secreted helps the small intestine in digesting fats and some vitamins.



- **Gallbladder**

  The *gallbladder* is a pear-shaped sac that resides on the posterior surface of the liver. Most of the bile produced by the liver is stored in the gallbladder.

- **Pancreas**

  The *pancreas* also provides enzymes for digestion. These enzymes break down fats, starches, and sugars. The pancreas helps the digestive system by making hormones.

Digestive System Problems

Digestive or gastrointestinal issues are extremely common. People have a variety of digestive problems. These sometimes come and go without a clear cause. However, serious consequences may occur if these digestive issues are not addressed in the early stages. Some of the common symptoms of gastrointestinal problems are:

- Constipation
- Vomiting
- Blood in stool
- Bloating
- Nausea
- Abdominal pain

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The following are some of the common endocrine system conditions:

Crohn's disease

- Inflammation in any segment of the digestive tract

Diarrhoea

- Frequent watery bowel movement

Gallstone

- Hardened stone-like mass that forms in the gallbladder

Gastroenteritis

- Inflammation of the stomach and the intestines

Gastro-oesophageal reflux

- A condition where the stomach acid leaks into the oesophagus

Irritable bowel syndrome

- A disorder affecting the large intestine

Pancreatitis

- Inflammation of the pancreas

Stomach cancer

- Abnormal growth of cells in the inner lining of the stomach

Peptic ulcer disease

- A sore or break in the inner lining of the oesophagus, stomach or duodenum

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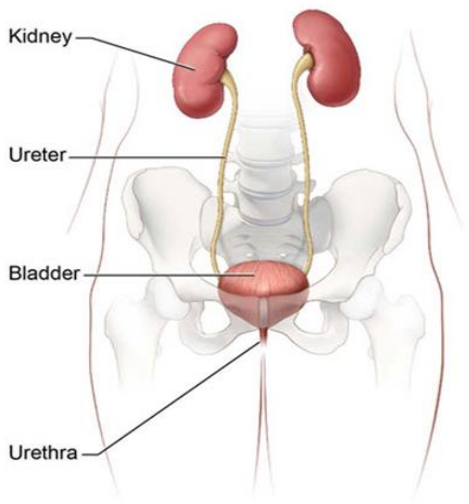
1.1.7 Urinary System

The *urinary system* is a group of organs that filters excess fluids and other substances to maintain its volume and composition within normal limits. Its basic function is to remove liquid waste from the blood to keep a stable balance of salts and other substances in the blood. It is also called the excretory system. It is because it holds the various excreted products, such as by-products like drugs, electrolytes, urea, and uric acid.



The purpose of the urinary system is to:

- Remove wastes from the body
- Regulate blood pH, pressure, and volume
- Control the levels of electrolytes and metabolites

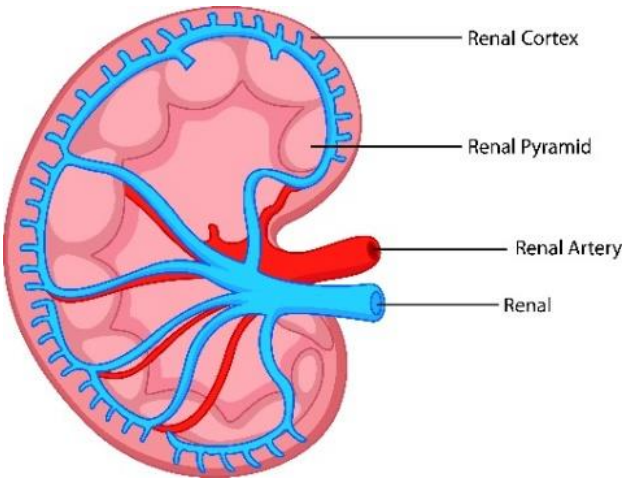
The urinary system includes the kidneys, ureters, urinary bladder, and urethra. These organs filter the metabolic wastes and excess ions from the blood, along with the water, and excretes it from the body in the form of urine.

Even though the excretion of waste is mainly happening in the urinary system, other systems have their own way of removing waste. For example, the respiratory system eliminates carbon dioxide through exhalation. The skin gets rid of the wastes through the sweat gland. However, the primary task of excretion still falls under the urinary system. If the urinary system fails, other organs cannot take over.

The following are the organs involved in the urinary system:

- **Kidneys**

  Kidneys are the main organs of the urinary system. They are two bean-shaped organs located below the rib cage. Each is about the size of a fist on each side of the spine. The kidneys create balance in the internal environment. They filter out the blood, remove the wastes, and excrete it through the urine. Every day, the kidneys filter about 120 to 150 quarts of blood and produce about one to two quarts of urine a day.



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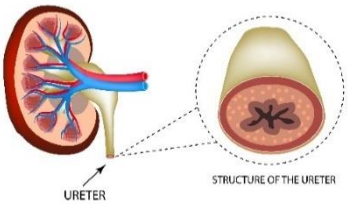
- **Ureters**

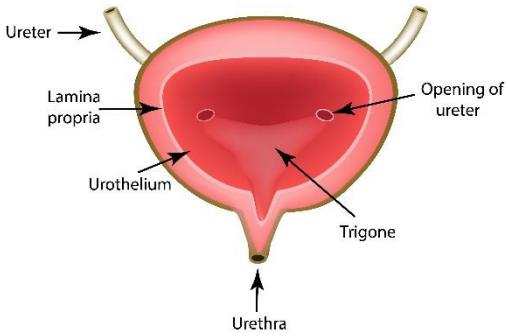
  Ureters are the thin tubes of muscles, about 25 centimetres long, that attach the kidneys to the urinary bladder. They receive blood supply from different sources and deliver urine to the bladder.



  Since ureters are small and narrow, they can become blocked by debris like salt crystals that will turn into urinary stones. *Urinary stones* are hard deposits in the ureter blocking the connection of the kidney to the bladder. A tube blockage causes pressure and urine build-up in the connected kidney and may require emergency surgery.

- **Urinary bladder**

  The *urinary bladder* is a hollow, balloon-shaped organ that acts as a temporary storage reservoir for urine. The size and shape of the bladder vary depending on the amount of urine it contains and the pressure it receives from the nearby organs. It is located in your pelvis and can hold up to two cups of urine.



- **Urethra**

  The *urethra* is the final passageway of urine. The urethra is a thin-walled tube that receives urine from the floor of the urinary bladder to the outside. The length differs between male and female urinary systems. It is 20 centimetres long for males and only four centimetres for females.

Urinary System Problems

Urinary tract infections are the most common problems of the urinary system. However, it involves a lot of organs, so there are also other signs and symptoms for you to watch out for. Some of these are:

- Leaking urine
- Fever and chills
- Lower back pain
- Blood in the urine
- Trouble in urinating
- Abdominal or pelvic pain
- Change in the colour and consistency of the urine

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The following are the other common urinary system conditions:

Urothelial carcinoma

- Commonly known as bladder cancer
- Abnormal growth of urothelial cells in the urinary bladder

Cytitis

- Inflammation of any part of the urinary tract caused by Escherichia coli (E. coli)

Incontinence

- A condition where there is involuntary control in the urination or defecation

Kidney failure

- A condition where the kidneys can no longer function

Nephrolithiasis

- Commonly known as kidney stones
- Hard deposits inside the kidney

Prostate cancer

- The most common cancer in men
- Cancer cells in the prostate gland

Urethritis

- Inflammation of the urethra

Urinary retention

- A condition where there is difficulty or inability to empty the bladder

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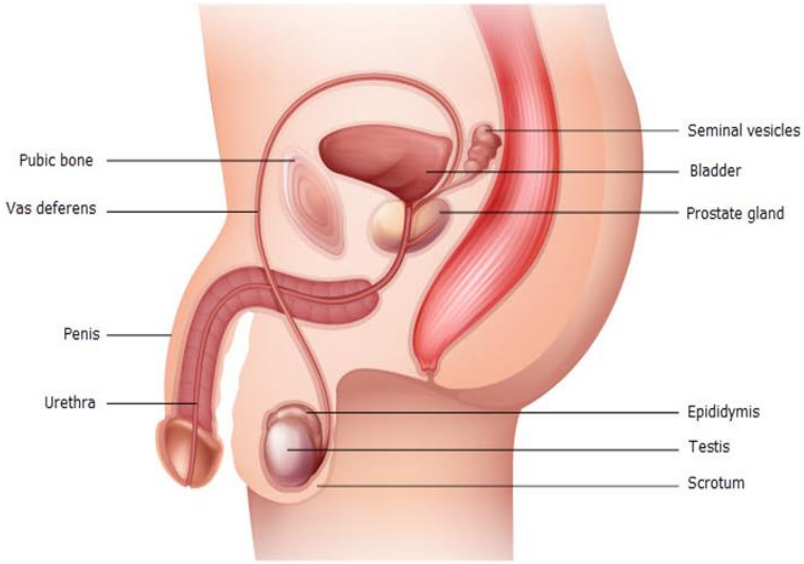
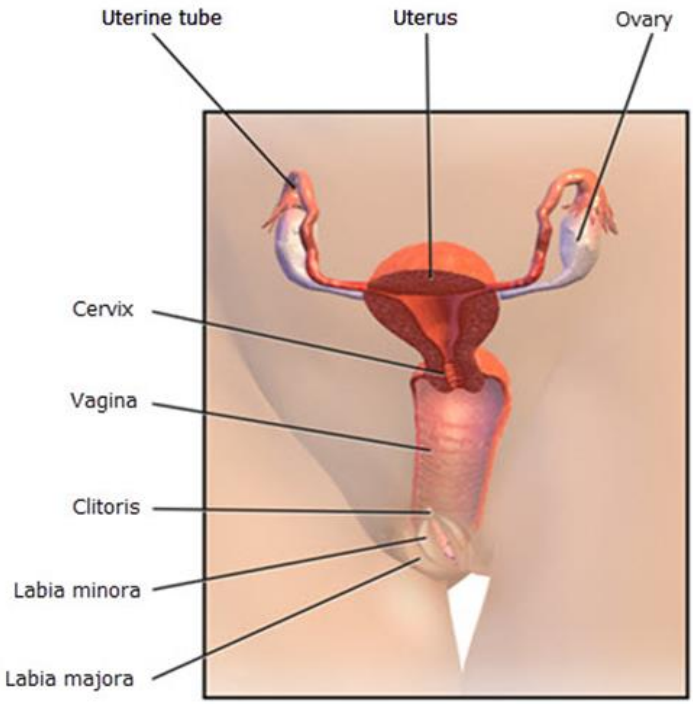
1.1.8 Reproductive System

The main purpose of the *reproductive system* is to reproduce and guarantee the survival of organisms. This is a set of organs that works together to produce offspring. Significant differences in an organism's reproductive system depend on its sexes. These differences allow the genetic material of two organisms of different sexes to be combined to produce offspring.





In this context, this system has three main functions:

- Produce hormones, egg cells and sperm cells
- Transport and sustain these cells
- Nurture the developing offspring

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The following table presents the parts and functions of the male and female reproductive systems:

Male Reproductive System	Female Reproductive System
The *male reproductive system* consists of a certain arrangement of external and internal sex organs. The primary function of this system is to provide the sperm that will fertilise the ovum. It produces, transports, and sustains sperm cells.	Like the male reproductive system, the *female reproductive* system comprises both external and internal genital organs. It is usually situated around the pelvic region. It functions to produce, transport, and sustain egg cells. It also nurtures the developing offspring. Female reproductive organs undergo changes every month in preparation for pregnancy. If it does not occur, the lining inside breaks down and sheds, becoming the menstrual blood.
Testes The testes are the oval-shaped male genital organs found in the scrotum. These are responsible for producing sperm and the hormone testosterone.	**Ovaries** Ovaries are the female gonads. There are two ovaries present in the human female body. Each ovary produces eggs for fertilisation. They also produce estrogen and progesterone.

Male Reproductive System	Female Reproductive System
Epididymis This long tube can be found at the back of each testicle. The epididymis holds and keeps sperm cells that come from the testes. Their main job is to ensure that the sperm will develop and be capable of fertilisation.	**Vagina** This is the outermost internal sex organ of the females. It extends from the uterus to the external genitalia or vulva. The vagina is a muscular canal that acts as the entrance of the female genital tract. It has three main purposes: ▪ Pathway for the baby during childbirth ▪ Place where the penis is inserted during intercourse ▪ The trail where the menstrual blood passes through during the monthly period
Vas Deferens This is also known as the ductus deferens and is in charge of bringing the mature sperm from the epididymis to the urethra for ejaculation.	
Seminal Vesicle This muscular tissue moves the seminal fluid and sperm into the urethra by contracting.	

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Male Reproductive System	Female Reproductive System
Urethra The urethra is a long passageway that starts from the urinary bladder to the tip of the penis. This is where the fluids and sperm pass through before they are secreted out of the body.	**Fallopian Tubes** The uterine tubes attached to the upper part of the uterus are called oviducts or fallopian tubes. They serve as the pathway for the egg cells when it goes from the ovaries to the uterus. Fertilisation usually happens here.
Prostate Situated below the bladder, the prostate gland produces the fluid that transports the sperm or the seminal fluid out of the system.	**Uterus** The uterus, or womb, is a muscular organ of the female genitalia shaped like a pear. It serves as the house of the growing foetus and its placenta should fertilisation occur.
Penis The penis is an external genital organ that transfers sperm into the vagina.	**Vulva** This is the external genital part of the female reproductive system. Its main purpose is to safeguard the internal sex organs and play a role in arousal and stimulation. It comprises of labia minora and majora, clitoris, mons pubis, and the vestibule.

Reproductive System Problems

Unlike the other organ systems, the reproductive system has two types depending on the sex of the individual. If you are a female, watch out for the following common signs of reproductive system problems:

- Bleeding between periods
- Intense pain in the bladder or pelvic area
- Painful, heavy or prolonged menstrual flow

For males, the signs and symptoms you may observe include:

- Rashes in the groin area
- Problems with sexual functions
- Pain, swelling or a lump in the testicle area

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The following are the other common reproductive system conditions:

Endometriosis

- A female reproductive disease where the endometrial cells abnormally grow outside the uterus

Erectile dysfunction

- A male sexual dysfunction where there is difficulty or inability to erect the penis

Infertility

- A condition that can happen to either male or female reproductive system
- Inability to reproduce

Ovarian cancer

- Abnormal growth of cells in the ovary/ovaries

Polycystic ovarian syndrome (PCOS)

- A hormonal imbalance in women where the ovaries produce abnormal amounts of male hormones

Sexually transmissible infection (STI)

- Infections that can be transmitted through unprotected sexual activity

Testicular cancer

- Abnormal growth of cells in the testicles

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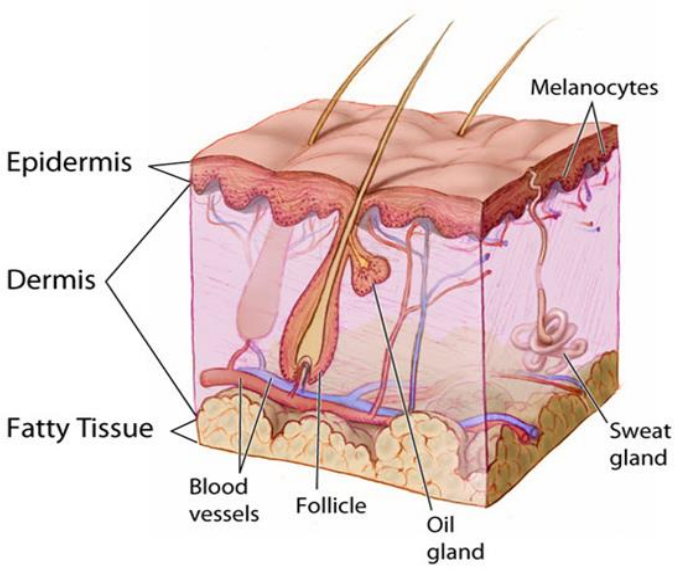
1.1.9 Integumentary System



The *integumentary system* consists of the set of organs that forms the external barrier of the body. It includes the skin and skin appendages. Its basic function is to serve as a barrier to protect the inside of the body from the elements in the environment, such as bacteria, pollution, and UV rays from the sun. It protects the internal organs from physical damage. This system also protects the body against virus invasion, dehydration, and sunburn. The skin is the largest organ of the body, and it has three main parts – the epidermis, dermis, and hypodermis.

Epidermis

The *epidermis* is composed of keratinised squamous epithelium. This epithelium contains numerous stratified squamous cells or keratinocytes. *Keratinocytes* have the protein keratin as their cytoplasm. This protein makes the epithelium dry and impermeable to water. It makes the epidermis an effective barrier against abrasions.

Depending on its location, it can be made of four to five layers of epithelial cells. Skin with four layers of epithelial cells can be called 'thin skin'. These layers are the stratum basale, stratum spinosum, stratum granulosum, and stratum corneum. 'Thick skin', on the other hand, can only be found on the palms of the hands and the soles of the feet. Its fifth layer is called the stratum lucidum.

Dermis

Beneath the epidermis is the *dermis*. This layer of connective tissues contains:

- Collagen fibres which are responsible for giving the skin strength and a little elasticity
- Blood and lymph vessels that nourish the skin with oxygen and nutrients
- Nerve endings that help relay signals from the skin, such as touch, pain and itching
- Various glands, like sweat glands
- Hair follicles

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Hypodermis

The *hypodermis*, also known as the subcutaneous layer or subcutis, is the deepest layer of the skin. It contains blood vessels and nerves, just like the dermis. It serves as the connection between the skin to the underlying fibrous tissue of the bones and muscles. It also contains a layer of fat that maintains the appropriate body temperature and takes the impact of the physical trauma on the internal organs.

Integumentary System Problems

The integumentary system comprises the largest organ of the body – the skin. Skin is very susceptible to various ailments and injuries. It can be bacterial or fungal infections, skin cancers, or burns that can be fatal. It is important to watch for signs and symptoms of skin problems. These may affect the client's performance and progress during interventions and therapy. Here are some signs and symptoms that the client might be suffering from a certain skin disorder:

- Ulcers
- Open sores
- Dry, cracked skin
- Rough or scaly skin
- Itchy or painful rash
- Loss of skin pigment
- Changes in mole colour or size
- Raised bumps, usually red or white

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The following are some of the common integumentary system conditions:

Acne vulgaris

- Inflammation of the skin glands and hair follicles

Atopic dermatitis

- Also known as eczema
- Inflammation of the skin

Jaundice

- A condition with a high level of bilirubin (yellow substance produced when hemoglobin the red blood cells break down) in the blood causing the yellow pigmentation of the skin, mucous membrane and white of the eyes

Psoriasis

- A chronic inflammatory skin disorder

Skin cancer

- A condition where there is an abnormal growth of skin cells

Tinea pedis

- Commonly known as athlete's foot
- An infection on the skin of the feet caused by fungus

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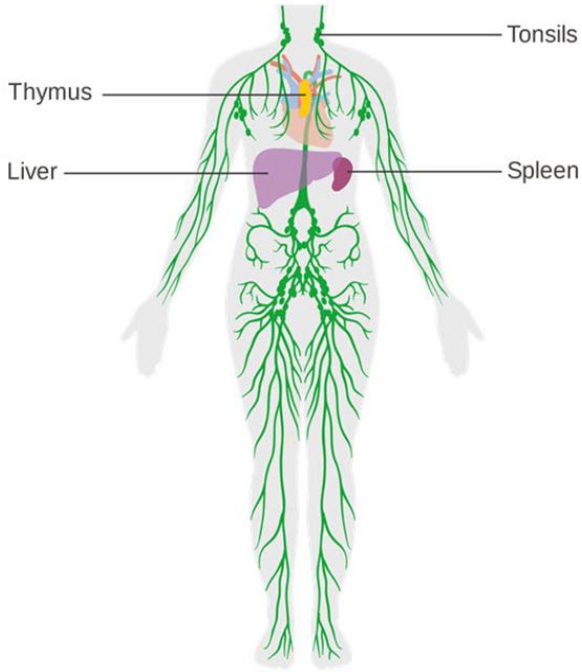
1.1.10 Lymphatic System



The *lymphatic system* is a group of vessels and organs focusing on bringing the lymph from the tissues to the bloodstream. It transports fluid containing infection-fighting white blood cells throughout the body. It also acts as the 'sewage system' of the body since it filters the microbes, toxins, and other organic wastes. It prevents the development of edema, which is a swelling of tissues due to the increased flow of fluid in it. It also checks whether some foreign bodies could pass through the lymph vessels. *Foreign bodies* are unwanted organisms that can cause irritation, inflammation or infection to the body systems.

The lymphatic system either takes care of the foreign bodies or alerts the immune system about it. This system has three primary purposes:

- Removal of fluid from the tissues
- Absorption of fat
- Immune response

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The lymphatic system has three main parts:

Lymph	Lymphatic vessels	Lymphatic organs

- **Lymph**

  Lymph is a clear to yellowish fluid that starts as blood plasma that was forced out of the blood vessels. It is carried along the lymphatic system. It is mainly made up of white blood cells or lymphocytes that fight against infections.

- **Lymphatic vessels**

  The *lymphatic vessels* are thin tubes that are the merged form of lymph capillaries that carry lymph throughout the lymphatic system. They are found in all body parts except the bone marrow, central nervous system, and tissues.

- **Lymphatic organs**

  The *lymphatic organs* are where the lymphocytes originate or where the elimination of foreign bodies happens. Some of the lymphatic organs are:

  - Lymph Nodes
  - Tonsils
  - Spleen
  - Thymus

Multimedia

The video below gives more information about the lymphatic system.

Lymphatic System: Crash Course Anatomy & Physiology #44

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Lymphatic System Problems

The lymphatic system is in charge of defending the body against disease-causing invaders, maintaining body fluid levels, and eliminating cellular waste. It collaborates with the immune system to keep the body disease-free. It will be a major issue if it does not do its job. If this system malfunctions, the body can suffer from conditions like the ones listed below. Furthermore, the other body systems may not be able to have protection against foreign bodies. So, watch out for the following symptoms of lymphatic system dysfunction:

- Fever
- Itchy skin
- Night sweats
- Puffiness of the skin
- Swelling of lymph nodes
- Arms or legs appear to be of different size

The following are some of the common lymphatic system conditions:

Bubonic plague

- Infection of the lymphatic system caused by the bacterium Yersinia pestis

Castleman disease

- A condition where there is abnormal growth of cells in the lymphatic system

Elephantiasis

- A condition where there is an obstruction of the lymphatic vessels, causing the unusual enlargement of limb or other body parts

Lymphadenitis

- Inflammation of the lymph nodes

Lymphangitis

- Inflammation of the lymphatic vessels

Lymphocytosis

- A condition where the amount of lymphocytes in the body is higher than normal

Lymphoma

- Malignant tumour of the lymphocytes
- Cancer of the lymphatic system

Tonsilitis

- Infection of the tonsils

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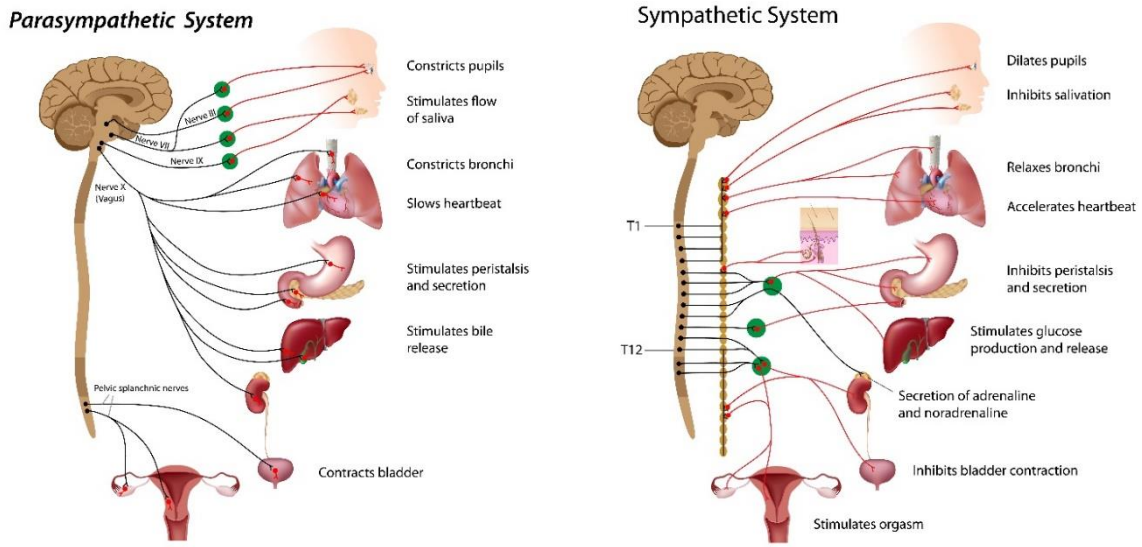
1.1.11 Nervous System, Including Sensory Systems – Eye and Ear



The *nervous system* is the body's command centre. It functions to carry information from the brain to other parts of the body. It controls your movements, thoughts, and responses to everything surrounding you. Since this serves as the body's command centre, it controls the other body systems and their processes. It comprises the brain, sensory organs, spinal cords, and neurons that serve as the channels between the body's organ systems. The nervous system is divided into two major subdivisions:

Central Nervous System (CNS)

The *central nervous system* includes the brain and the spinal cord. It serves as the central controller of the body. Since it is an integral part of the body systems, it is housed within the skull and the vertebral column.

- **Brain**

  The *brain* is situated within the cranial cavity of the skull. It is a soft and wrinkled organ weighing about three pounds. It has three main areas:

  - **Forebrain**

    The *forebrain* is the largest brain division. It includes the cerebrum, thalamus, and hypothalamus.

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The *cerebrum* is the largest part of the brain, making up around 85% of it. It is made primarily of grey matter, which is the major component of the CNS. Its outer layer is called the cerebral cortex. The cerebrum is divided into two hemispheres. Each hemisphere is divided into four lobes – frontal, occipital, parietal, and temporal. The most important brain functions happen in the cerebrum. Examples of these functions are thinking, reasoning, and processing of inputs from the senses.

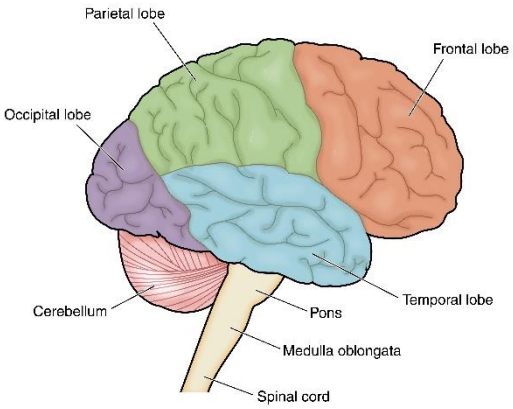
The *thalamus* is the main processing centre of sensory information and consists of two lobes or grey matter under the cerebral cortex. It also controls sleep. Underneath the thalamus is the *hypothalamus*, which is about the size of an almond. It acts as the coordinating centre of the body and aims to keep the body in a stable condition called homeostasis.

- **Midbrain**

  The *midbrain* is a small region in your brain that serves as the connection between its other major regions. It is situated between the forebrain's thalamus and the hindbrain's pons. Also called the mesencephalon, the midbrain is formed by the tectum and tegmentum.

- **Hindbrain**

  The other term for *hindbrain* is the brainstem. It consists of the pons, cerebellum and medulla oblongata and connects the brain to the spinal cord. The *pons* is located at the base of the brain. It relays the signals that give you the sensation from anywhere below your neck. The *cerebellum* helps you coordinate movement, especially of the hands and feet. Found at the back of your brain, it helps you with your balance and posture. Lastly, the *medulla oblongata* transmits signals between the higher parts of the brain and the spinal cord.



- **Spinal cord**

  The *spinal cord* starts at the medulla oblongata of the brain and continues to the central part of the spine. It carries nerve signals from the brain and delivers them to other body parts. It also receives sensory inputs, processes them partially, and delivers the information back to the brain. The 26 bones of the vertebrae protect the spinal cord.

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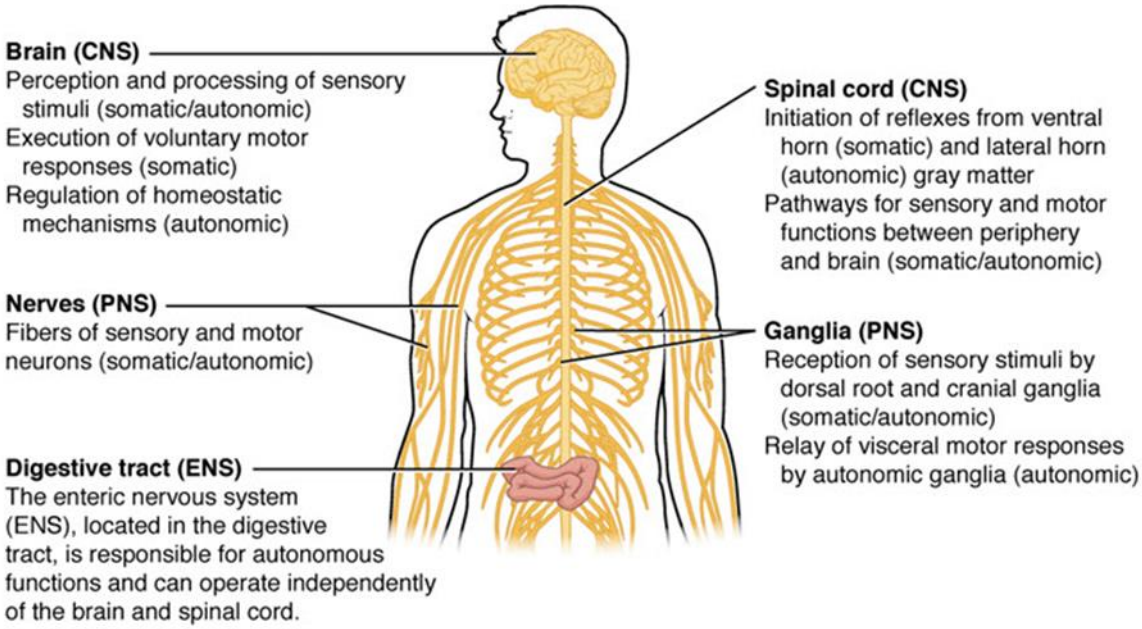
Peripheral Nervous System (PNS)



The *peripheral nervous system* includes all parts of the nervous system that are not part of the CNS. The main function of the PNS is to connect the CNS to the rest of the body, like the organs and limbs. It is divided into two parts:

- **Somatic system**

  The *somatic system* is associated with the voluntary control of body movements. This can be done via the use of the skeletal muscles. It consists of two parts:

  - **Spinal nerves**

    Spinal nerves receive the sensory information from the receptors to and away from the spinal cord. There are 31 pairs of spinal nerves that are divided into different categories:

8 cervical nerves (C1-C8)	12 thoracic nerves (T1-T12)	5 lumbar nerves (L1-L5)	5 sacral nerves (S1-S5)	1 coccygeal nerve

  - **Cranial nerves**

    These are the 12 pairs of nerves at the back of your brain. *Cranial nerves* send electrical signals between your face, neck, torso, and brain that help you taste, hear, smell, and feel sensations. They also help with facial movements like blinking and moving your tongue.

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- **Automatic nervous system**

  Unlike the somatic nervous system, the *automatic nervous system* controls the body's involuntary functions. It allows these functions to happen without thinking about it. An example of this are heartbeat and blood flow. This system is divided into two branches:

  - **Sympathetic system**

    This system is related to the body's rapid involuntary response when it enters dangerous or stressful situations. It releases hormones that activate the flight-or-fight reaction from someone.

  - **Parasympathetic system**

    After undergoing a rapid response to a threat, this system will return the body's functions to their normal resting state. It will lower the heart rate, reduce blood flow, and slow breathing.

There are different types of neurons (nerve cells), and these include the following:

- **Sensory neurons***,* e.g. neurons in the skin that detect temperature, pain and pressure
- **Motor neurons** stimulate the muscles
- **Interneurons** connect all neurons

To help you understand how the brain receives and interprets information, take note of the following terminologies and functions of the different parts of the nervous system.

A nerve cell is composed of the following parts:

- **Dendrite** – The structure that looks like a branch found at the ends of the neuron that receives signals or information from other neurons
- **Soma** – The body of the cell where the nucleus lies and that controls the cells
- **Nucleus** – The part of the cell that stores DNA, which helps with and controls a cell's function, growth and reproduction
- **Axon** – The long extension structure from the soma; it works to transmit the information it receives down its body to the dendrites at the end of the neuron
- **Myeline sheath** – The protective sleeve that covers the axon of neurons

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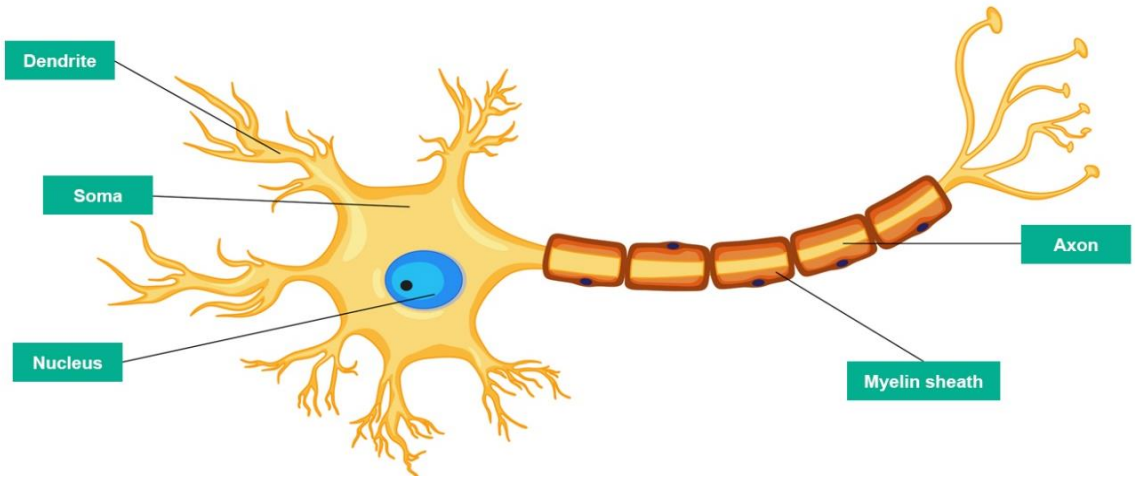
There are billions of neurons (refer to the diagram below) that carry information from one part of the body to another. The information or messages are transported along the neurons by an electrical current. As it reaches the end of the neuron, a message will jump across to the next neuron via neurotransmitters. This occurs at lightning speed. An example of this process is when your sensory neuron activates when you touch something hot. A message will go to your central nervous system (where information is processed) and to the motor neurons, stimulating your arm muscles to remove your hand.

The *somatic system* (or voluntary nervous system) sends sensory information (e.g. touch, hearing, vision and smell) to the central nervous system. Then a message is sent to motor nerve fibres (e.g. to move muscles).

The *autonomic system* is responsible for involuntary actions like breathing and heart rate.

For example, our breathing rate is determined by central chemoreceptors located in the medulla (brain). The chemoreceptors detect pH levels in the blood. Increased carbon dioxide increases the pH of the blood. The response sends nervous impulses to the diaphragm and intercostal muscles to increase breathing.



Nervous System Problems

It is crucial to understand the signs and symptoms of neurological disorders. The nervous system contains some of the body's most vital organs. Early detection can aid in the identification of the correct diagnosis and treatment.

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Remember that every person may experience different signs and symptoms. However, the following are the most common ones:

- Seizures
- Loss of feeling
- Slurred speech
- Lack of coordination
- Persistent headache
- Loss of muscle strength
- Double vision or loss of sight

The following are some of the common nervous system conditions:

Alzheimer's disease

- A neurodegenerative disease that destroys memory and thinking skills

Bell's palsy

- A condition where there is an inability to control facial muscles

Epilepsy

- A neurological disorder that causes recurring seizures

Meningitis

- Inflammation of the protective tissues of the brain

Motor neurone disease (MND)

- A degenerative disease where the motor neurons of the brain and spinal cord lose their function

Multiple sclerosis

- A chronic autoimmune disorder affecting the central nervous system

Parkinson's disease

- A degenerative disease affecting the motor system
- Characterised by shaking of body parts or tremors

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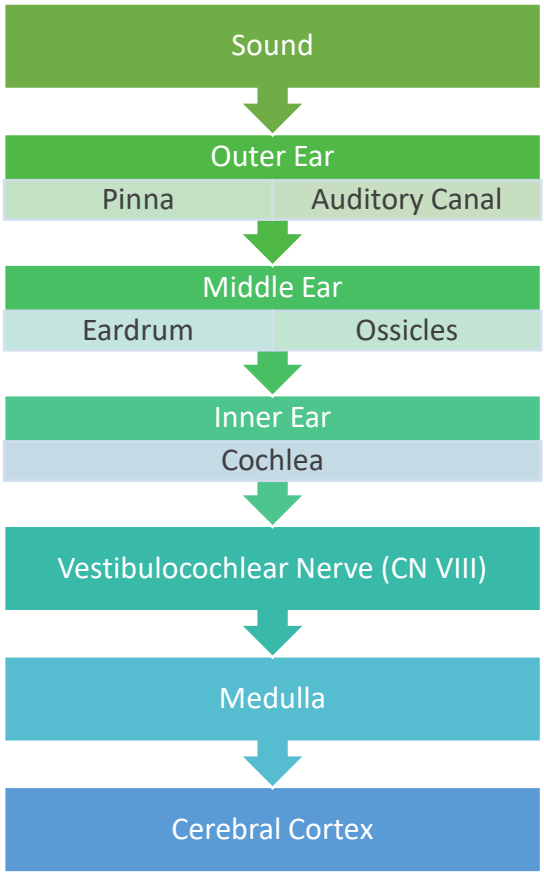
The Sensory Nervous System

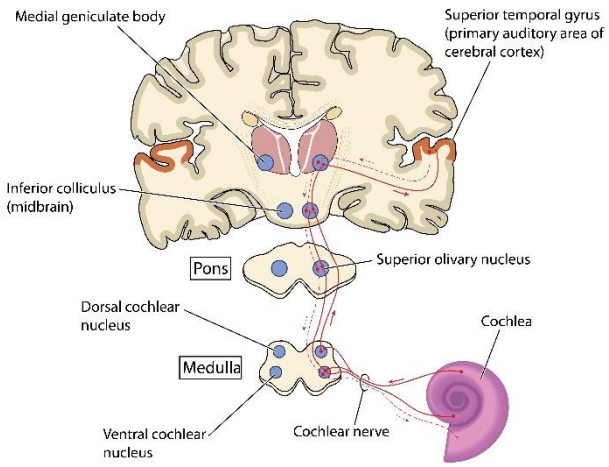
The *sensory nervous system* is part of the nervous system, specifically the PNS. It is a complex network of neural pathways that detect internal and external stimuli. They send the signals to the brain. The nervous system picks up the signals, interprets them and translates them to what you know as *senses*.

The main function of the sensory system is to allow you to interact with your environment. You can protect yourself from harm or any form of pain because of the sensory organs. Two of the most important senses are hearing and sight.

The next section will detail the parts of the ears and eyes and the other special senses. However, the following diagrams will give you the big picture of the pathway of sound waves and light to the nervous system.

Auditory Pathway





When the cochlea in the inner ear receives the compressed sound wave, the vestibulocochlear nerve transmits it to the medulla. From the medulla, the electrical signals will be transmitted to the auditory cortex. The *auditory cortex* is the part of the brain that interprets the signals and enables you to understand the sound. It is in the temporal lobes of the cerebral cortex.

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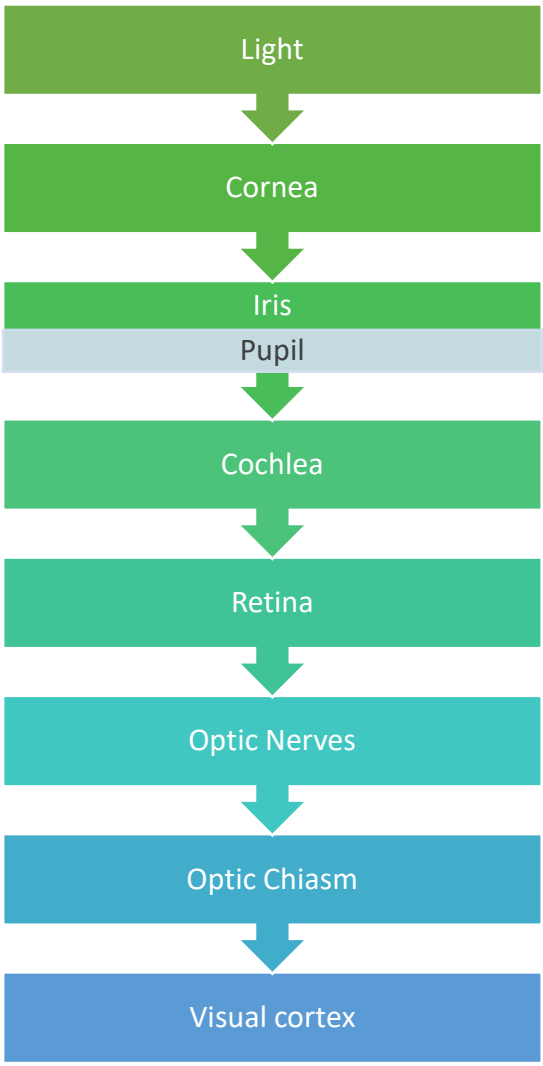
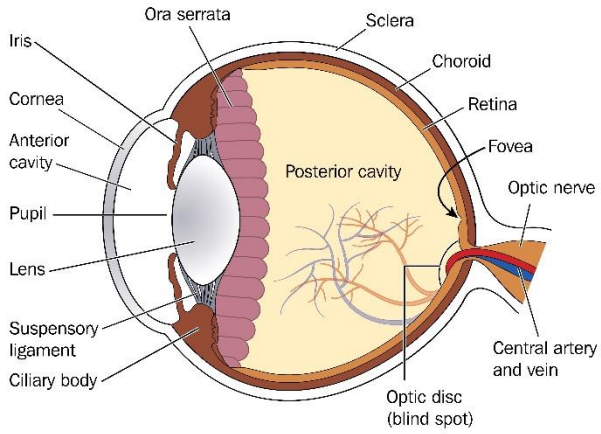
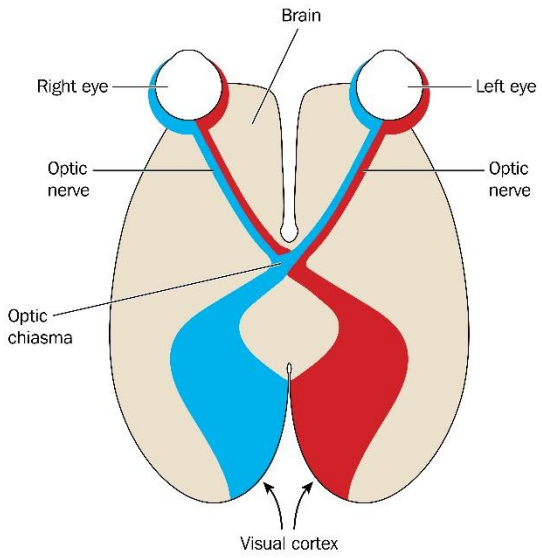
The ears send sounds to the brain by the following process:

Sound waves enter the inner ear and then into the cochlea. The fluid contained in the cochlea moves in response to the vibration from the oval window. These vibrations are transformed into electrical impulses and then sent to the brain via the auditory nerve.

Visual Pathway







You will learn in the next section the specific functions of the parts of the eye up to the retina. When the light signal reaches the retina, it converts the light into electric signals. The visual information will then be transmitted to the brain via the optic nerves.

The eyes send images to the brain by the following process:

Light rays enter the eyes. When it reaches the light-sensitive nerve cells (rods and cones) in the retina, light energy is processed into electrical activity or impulses. Electrical impulses are communicated to the visual cortex of the brain by the optic nerve.

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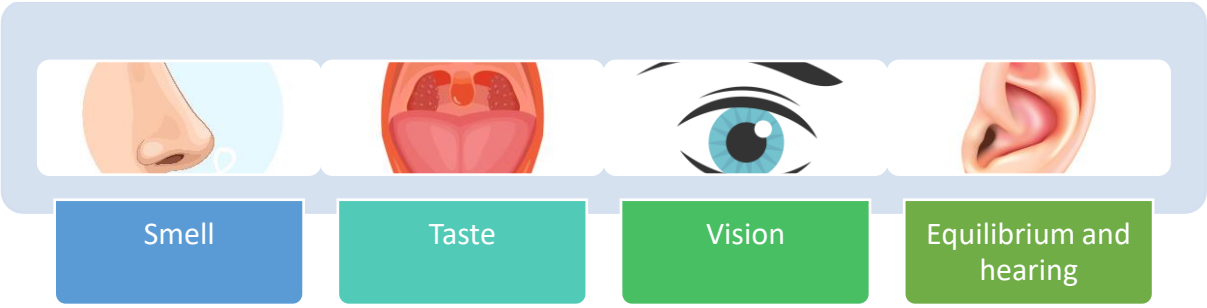
The optic nerves from the left and right eye will form an intersection called the *optic chiasm.* In this region, the nerves cross over, and the visual cortex gets information from both eyes. The optic chiasm processes the information by sorting it and breaking it into parts.

The left field of vision processes the visual information from the right. The right does the same process as the left. When the processing is done, the visual information will be organised again and sent to the *visual cortex*. This region of the brain will interpret and recognise the image you see.

1.1.12 The Special Senses – Smell, Taste, Vision, Equilibrium and Hearing

Special senses are the senses with specific organs that receive external stimuli and transmit them to the brain. They allow you to receive information from the environment. The special senses connect you to the world. The five special senses are smell, taste, vision, equilibrium and hearing. The diagram below shows the specialised organs for the special senses.



Smell

The *sense of smell* or olfaction has the nose as the olfactory organ. The nose allows air to enter the body while filtering debris such as dust and is the primary organ for smell.

As we smell, signals are sent from the olfactory bulb to other parts of the brain to be interpreted as a smell that we may recognise, e.g. perfume, freshly baked bread, etc.

The sense of smell is also considered one of the two chemical senses because it has chemoreceptors. It means that the nose has receptors that respond to chemicals.

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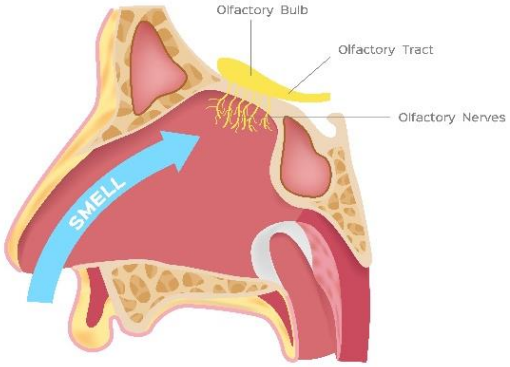
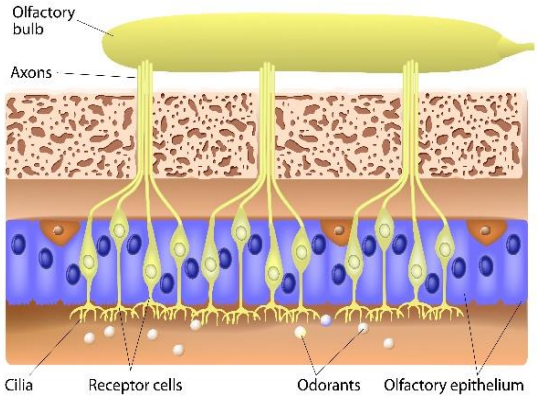




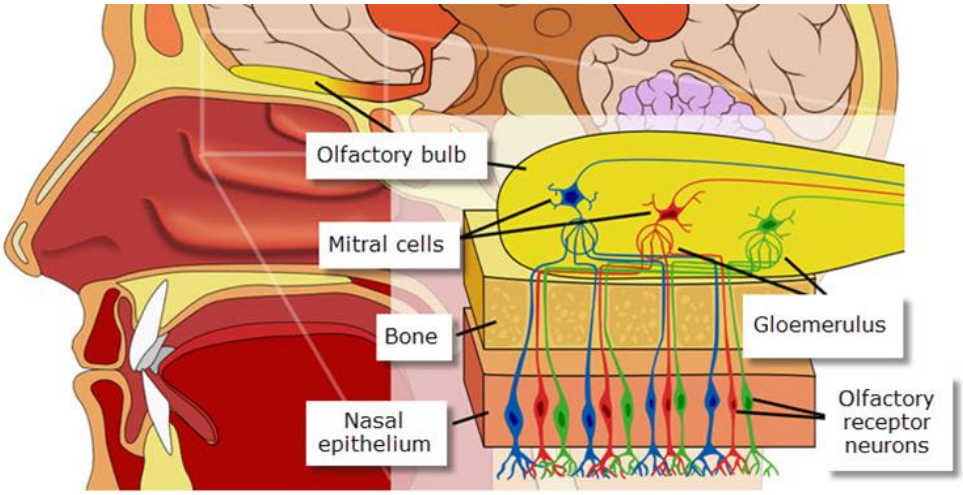
Examples of chemicals that the chemoreceptors detect are hazardous gases, pheromones and food. These chemical stimuli can also be called *odorants*. The sense of smell happens when the odorants bind to the olfactory receptors in the nasal cavity. So, when you breathe in, the air enters your nose into the nasal cavity. Thousands of chemoreceptors are lined up at the top of your nasal cavity to receive the stimuli.

In the above right image, you can see the *olfactory epithelium*. This epithelium is made up of at least six different kinds of cells. One of them is the olfactory receptor cell. If you carefully examine the image above, you will notice that the receptor cells have long cilia protruding from the epithelium.

When you breathe in the odorants, the receptor cells in the cilia will capture the odorants. When they bind, the cilia will be stimulated. It will transmit signals to the olfactory bulb (See the left image on the previous page). To reach the olfactory bulb, the signals will go through the *olfactory nerve*. This nerve connects the receptor cells and the olfactory bulb.

The *olfactory bulb* is the extension of the brain in your nasal cavity. It is a nervous structure that processes the olfactory information from what you breathe in. It helps you distinguish different smells. The olfactory bulb also interacts with the other parts of the brain, making a certain odour associated with a memory or an emotion.

The other parts of the nose can be found in the photo below.



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Taste

The *sense of taste* or gustaoception is the other chemical sense in the special senses. It works together with the sense of smell. When you cannot smell your food, you can expect that you cannot taste it either.

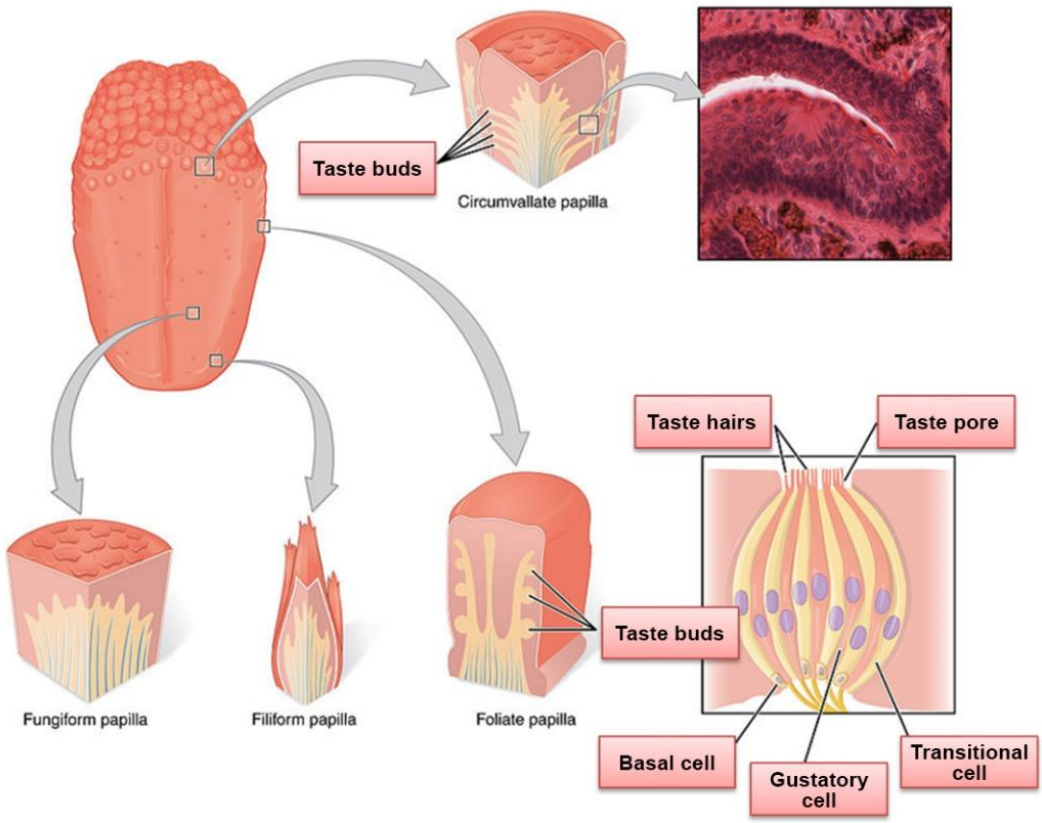
The *tongue* is its main organ. The tongue helps us in tasting, chewing, swallowing food, and speech. It also has chemoreceptors, but the tongue has four distinct types, unlike the nose. The parts of the tongue include:

- Taste buds
- Taste hair
- Taste pore
- Basal cell
- Gustatory cell
- Transitional cell

The receptors are called *taste buds*. These taste buds are widely scattered in the oral cavity, but the majority are in the tongue.

The taste buds in the tongue react to sweet, sour, salty, bitter and savoury. The taste buds send messages to the areas in the cortex responsible for processing taste.

To understand better taste buds, examine the image below.



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Try to look at your tongue in the mirror. You will notice it is covered with thousands of small bumps. These small bumps are called *lingual papillae*. The primary function of the papillae is to increase the friction between the food and the tongue. This friction improves the chewing of the food in the mouth. There are four types of lingual papillae, as presented in the table below.

Types of Lingual Papillae	Description
Foliate	▪ Are found on the tongue's lateral aspect ▪ Taste buds in foliate papillae degenerate in childhood and do not get replaced
Circumvallate	▪ Are arranged in a V-shape pattern toward the base of the tongue ▪ Contain more than 100 taste buds each
Fungiform	▪ Are found all over the dorsal aspect of the tongue ▪ Contain only about five taste buds each
Filiform	▪ Are found all over the tongue ▪ Do not contain taste buds

Based on LAB 5: SPECIAL SENSES, used under CC BY 4.0. © Mavs Open Press

Taste buds contain taste receptor cells. When you chew your food, the chemical properties of the food will dissolve in the saliva. This chemical signal will be picked up by the taste receptor cells. The signal will be transmitted to the brain. It will be interpreted as the sense of taste.

The five basics sensations of taste are:

- Sweet
- Sour
- Bitter
- Umami or savoury
- Salty

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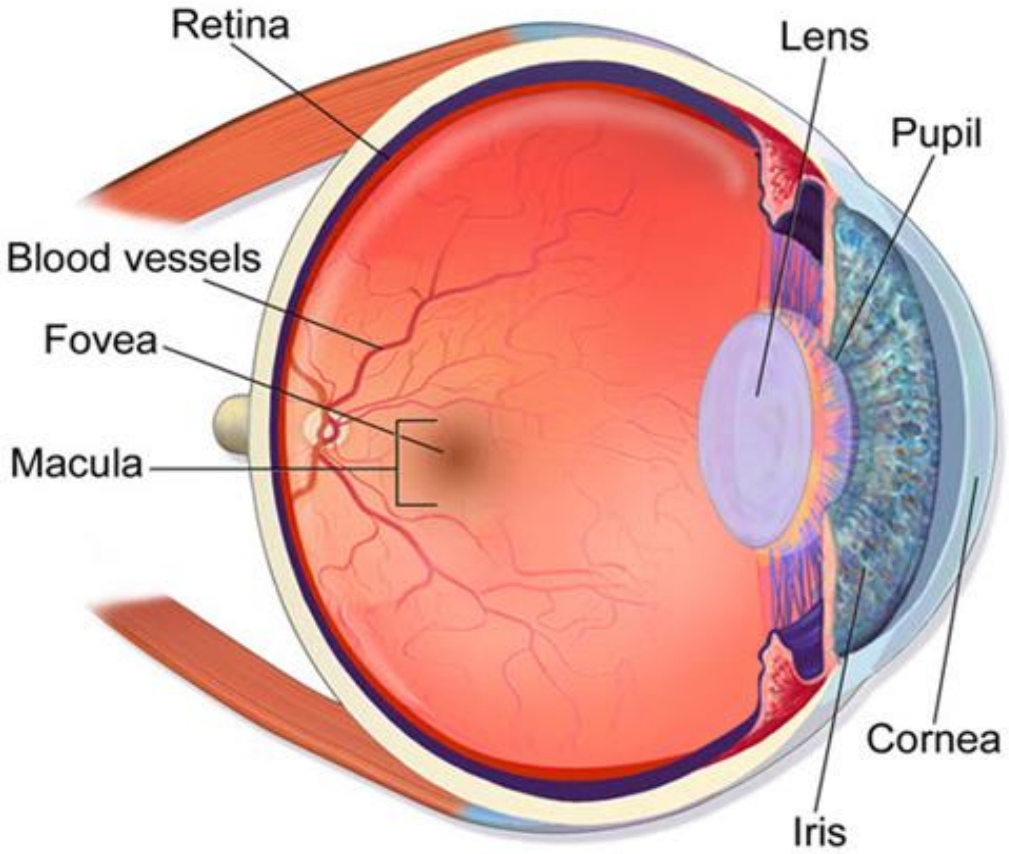
Some people have different conditions relating to their ability to taste:

- *Hypogeusia* – This is the decreased ability to taste.
- *Ageusia* – The person is unable to detect any taste. This is a rare case as a person would most likely lose their sense of smell rather than the sense of taste.

Vision



The sensory organs for vision or sight are the *eyes*. They receive, focus, and transmit light that helps us see.

The eyes can focus and detect images of visible light through their sensory receptors. These receptors are called *photoreceptors* and are in the retina. The eyes have 70% of all the sensory receptors in the human body. It has external and internal accessory structures working together to give rise to vision.

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- **External structures and accessories**

  The external structures and accessories of the eyes are:

  - **Eyelids and eyelashes**

    The *upper and lower eyelids are* skin folds from the medial to lateral corners of the eyes. They are external parts responsible for eye protection. They have short, curved hairs projecting from their borders called *eyelashes*. The eyelashes are a barrier to prevent dust or any irritants from entering the eyes.

  - **Tarsal glands**

    Tarsal glands are sebaceous glands in the eyelids that produce oil secretions to lubricate the eyes.

  - **Conjunctiva**

    The *conjunctiva* covers the sclera or the white of the eye. It is also the tissue that lines the inner part of the eyelid. It lubricates the eye by producing mucus and tears.

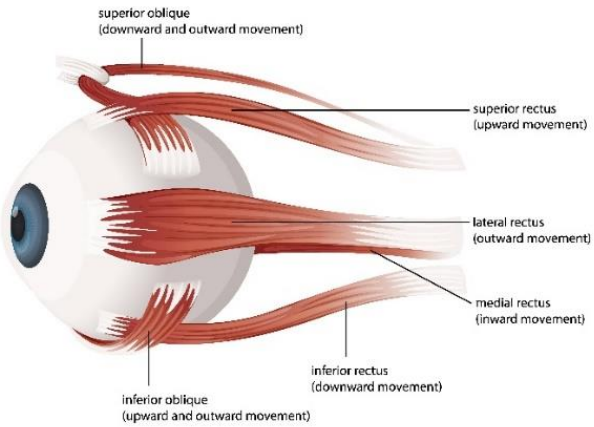
  - **Lacrimal glands**

    Lacrimal glands are located underneath the upper eyelid towards the corner of each eye. It is made up of multiple lobules, which have many acini. *Acini* are small sac-like cavities at the end of the ducts of lacrimal glands. They contain serous cells that produce serous secretion or lacrimal fluid or what you know as tears.

  - **Extrinsic eye muscles**

    There are six external eye muscles that allow the eyes to move and follow a moving object. They are the following:

    - Lateral rectus
    - Medial rectus
    - Superior rectus
    - Inferior rectus
    - Inferior oblique
    - Superior oblique



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- **Internal structures and accessories**

  The *eyeball*, which is the eye itself, is a hollow sphere made up of a three-layer wall. The eye's interior is filled with fluid that helps maintain its shape. The eyeball's three layers are:

The fibrous tunic	• Outermost layer • Comprises the sclera and cornea
The vascular tunic	• Middle layer of the eyeball • Forms the iris, ciliary body, and choroid
The nervous tunic	• Also known as the retina • Contains millions of photoreceptor cells

  The internal structures and accessories of the eyes are:

  - **Sclera**

    The *sclera* is most commonly known as the white of the eye. It is a glistening white connective tissue that covers more than 80% of the eyeball. It helps provide structure and ensures that the eye attaches properly.

  - **Cornea**

    The *cornea* is the dome-shaped front of the eye with several layers to provide additional protection to the inner parts. This clear outer part is where the light enters.

  - **Iris**

    The *iris* is the coloured part of the eye and is also located at the front. It is unique to every individual. It regulates the light that enters the eye by controlling the size of the pupil. This regulation is called the *pupillary reflex*.

  - **Pupil**

    The *pupil* is the black dot at the centre of the iris. It is where the light passes, and it allows the eye to focus on the object in front of it.

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- **Ciliary body**

  The *ciliary body* is a ring-shaped tissue located behind the iris. It regulates the movement of the lens and maintains its shape.

- **Choroid**

  The *choroid* is located between the sclera and retina. It supplies blood to the eye to provide nutrition to its different parts.

- **Retina**

  The *retina* is the tissue at the back of the eye that is sensitive to light. It converts light into electrical impulses and sends them to the brain. It was mentioned earlier that the retina contains photoreceptor cells arranged in layers. *Photoreceptor cells* are cells that respond to light. There are two types:

Rods

- Detect black and white
- Are responsible for monochromatic vision and night vision

Cones

- Detect colours
- Responsible for central vision

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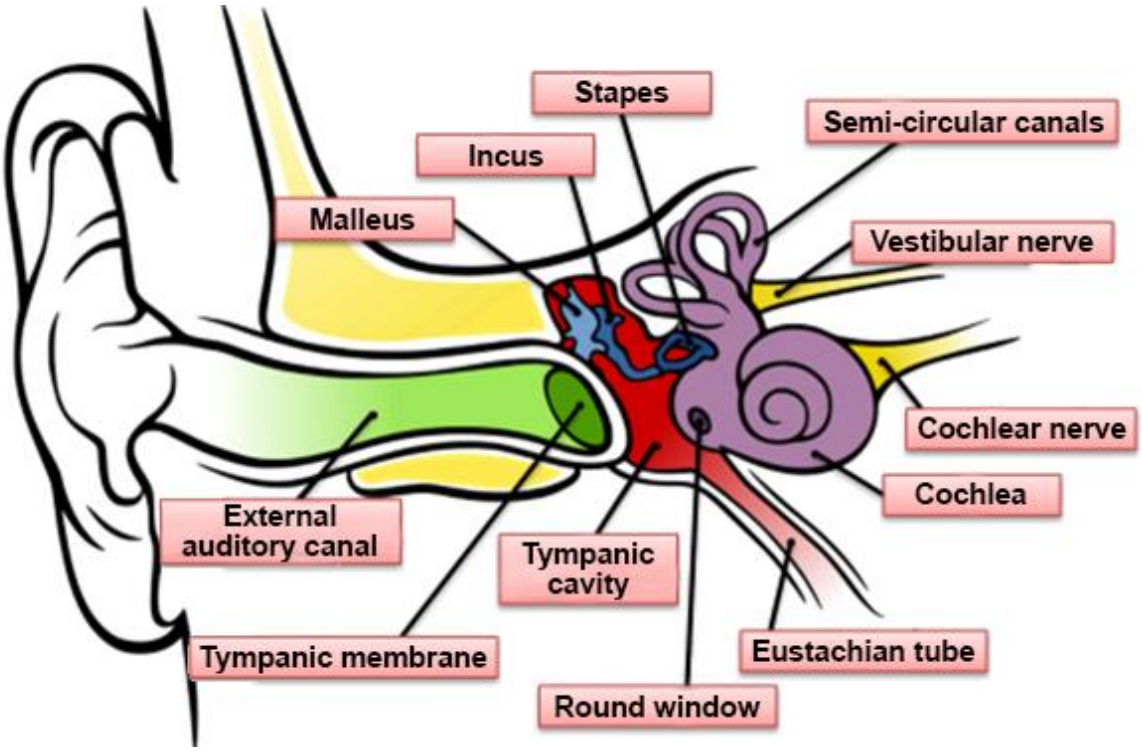
Equilibrium and Hearing

Hearing or auditory perception is the ability of the human body to detect vibrations and interpret them as sounds. *Equilibrium* provides input about the position of the head and body in space. It is also known as the vestibular sense or sense of balance. The sensory organ for hearing and balance is the *ear*. It has the following functions:

- It receives sound waves from the environment to help us hear (hearing)
- It also helps us maintain balance (equilibrium)



The ear has three parts – the external ear, the middle ear and the inner ear.

- **External ear**

  The *external ear,* or the Auris externa, is made up of the auricle and the external auditory canal. It is the part of the ear that receives the sound energy and directs the sound to the eardrum. The following are the parts of the external ear:

  - **Auricle**

    The *auricle* is the ear flap or the visible part of the ear, also known as the pinna. It collects sound and transmits it inward.

  - **Ear canal**

    The *ear canal* is also known as the auditory canal or meatus. From the auricle, it extends inward to help the sound enter the middle ear. The ear canal has the cells that produce ear wax. This secretion protects the middle ear by entrapping debris and irritants.

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- **Middle ear**

  The *middle ear* is made up of tissues and bones. It is the part of the ear where the sound waves are translated into mechanical energy so they can travel to the inner ear. It has the following parts:

  - **Eardrum**

    The ear canal ends at the *eardrum* or the tympanic membrane. This part is a thin tissue that stretches at the junction of the external and middle ear. It receives the sound waves entering the auricle and ear canal. When the sound wave hits the tympanic membrane, it vibrates like a drum. It helps in translating sound waves from the external ear.

  - **Ossicles**

    The *auditory ossicles* are the three tiny bones in the middle ear. Their main purpose is to amplify the sound waves passing through them so that the inner ear can translate them clearly. The three bones are named for their shape.

    Malleus or hammer

    - The *malleus* is attached to the eardrum, so when the sound wave hits the eardrum, it also vibrates.

    Incus or anvil

    - The *incus* is located at the top of the malleus. It bridges the malleus and stapes. Thus, its function is to help transfer the sound from the malleus to the stapes.

    Stapes or stirrup

    - The *stapes* is located below the incus. It is the smallest bone in the body and the final collecting bone in the middle ear. When the sound reaches the stapes, it will compress the waves. It needs to compress the sound waves to pass them to the inner ear.

  - **Cavity**

    The *tympanic cavity* is a small cavity where you can find the ossicles. It is filled with air and helps amplify sound and equalise pressure.

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- **Inner ear**

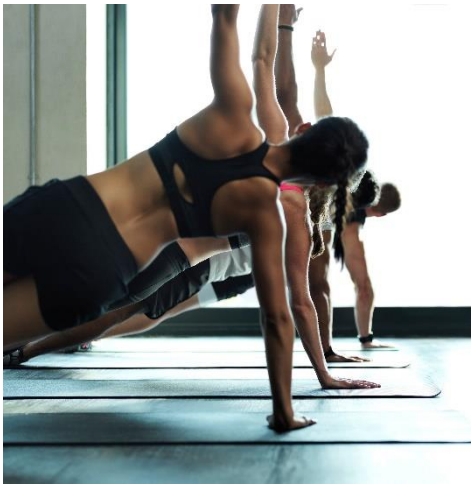
  The *inner ear* is responsible for the translation of sound waves. It sends it to the brain for interpretation. It is composed of fluid-filled canals that are interconnected like a maze. The inner ear has two main structures:

  - **Cochlea**

    The *cochlea* is a snail-shaped or spiral-shaped canal. It is considered the auditory centre of the ear because it is the organ that translates the vibration into signals that the brain understands. It is the main structure of the inner ear responsible for hearing.

  - **Semicircular canals**

    Semicircular canals are the other main structure of the inner ear. They are responsible for maintaining your balance. These canals make up the vestibular system, and they are filled with fluid and attached to the cochlea and nerves. When the head moves into different rotations, it sends information about the balance and head position to the brain.



Multimedia

Learn more about the vestibular system and the sense of balance in the following video published by Khan Academy Health and Medicine in 2015.

The vestibular system, balance, and dizziness | Processing the Environment | MCAT | Khan Academy

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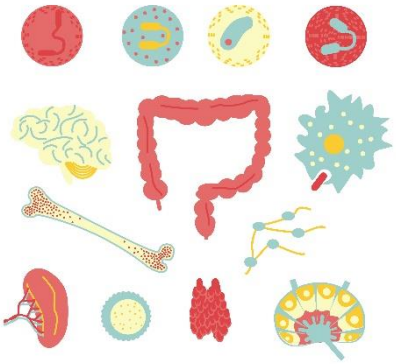
1.1.13 Immune System



The *immune system* protects you against disease as the defence system. It provides the body protection from infections/diseases. This complex collection of cells and organs destroys causative agents like bacteria or viruses. The immune response is how one's body defends and acknowledges itself against invading foreign bodies.

The table below shows the different parts of the immune system.

Parts of the Immune System	Description and Function
White Blood Cells	The *white blood cells* are immune cells that protect the body from bacteria, viruses, endotoxins, and other invading foreign bodies. They also remove dead or already damaged cells in the body.
The Complement System	The *complement system* helps eliminate infectious microorganisms. It is a system of more than 30 proteins circulating in the blood.
Lymph Nodes	The *lymph nodes* are part of the lymphatic system and aid in destroying and filtering germs before they spread to other body parts.
Spleen	The *spleen* stores white blood cells that protect the body from foreign bodies. It is attached to the lateral border of the stomach.
Thymus	The *thymus* is a soft organ that can be found in your upper chest behind the breastbone. It secretes thymosin that helps produce the T cells, an essential part of the immune system.
Marrow	The spongy tissue in the centre of most bones is called the *marrow*. They produce billions of red blood cells, platelets, white blood cells, and other immune cells daily.

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Humans have three types of immunity:

- **Adaptive immunity**

  Adaptive immunity is gained after the body's exposure to an antigen. An *antigen* is any toxin or substance that can induce an immune response. It can come from a pathogen or a vaccination. It is also called acquired immunity and is 'acquired' during one's lifetime. Unlike innate immunity, it can take days or even weeks for the system to develop immunity.

- **Innate immunity**

  Innate immunity is a type of immunity with which you are born. It defends you against all antigens and prevents these harmful organisms from entering the body. It is the first line of defence. Examples of innate immunity are skin, eyelashes, sweat, and cough reflexes.

- **Passive immunity**

  Passive immunity happens when a person receives antibodies for a disease instead of producing them through their immune system. For example, breast milk contains antibodies called immunoglobulins that are passed to the baby. Pregnant women exposed to antigens develop antibodies that they can transfer to their child through breast milk. It is a kind of protection that is a crucial support to the child's still underdeveloped immune system.

Immune System Problems

The immune system defends the body against invading bacteria, viruses, and germs. It accomplishes this by producing molecules known as antibodies, which bind to invaders such as foreign cells or viruses. Antibodies instruct other parts of the immune system on what to attack and destroy. It is better to watch out for these symptoms to see if you are having problems with your immune system:

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The following are some of the common immune system conditions:

Acquired immunodeficiency syndrome (AIDS)

- A life-threatening condition caused by the human immunodeficiency virus

Autoimmune disorders

- Conditions caused by an abnormal immune response against body parts

Celiac disease

- An immune disorder that damages the small intestine by making it gluten intolerant

Food allergies

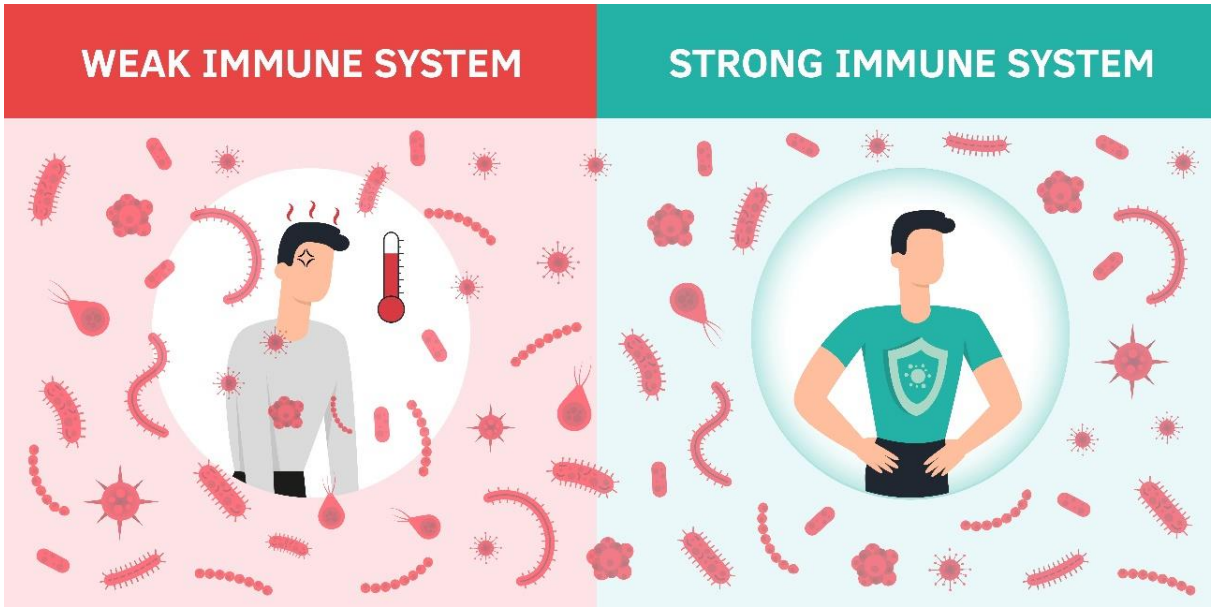
- Abnormal immune responses to a harmless food protein

Myasthenia gravis

- A neuromuscular disease that causes weakness in the skeletal muscles

Rheumatoid arthritis

- An autoimmune disorder affecting joints



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1.1.14 Use and Interpret Health Terminology About the Body Systems

As a worker, the use and interpretation of specific vocabulary relevant to health and the body are part of your standard service delivery. In the following discussions, you will learn how to use and interpret information about the body systems.

Use Health Terminology

When you speak to your clients, you use health terminologies to explain different body-related facts. You also interpret medical advice from professionals to your clients whenever needed.

Using health terminologies and abbreviations relevant to body systems will help you perform tasks in your work role, such as:

- Interpreting medical advice to the client given by the doctor
- Recognising changes in the physical, psychological and mental condition of the client
- Reporting indicators of body system issues
- Interpreting content to implement in clients' individualised plans
- Taking note of clients' health conditions accurately

Interpret Health Terminology

The common documents containing health-related terminologies and abbreviations that you will be interpreting may include the following:

- Doctor's prescriptions
- Client's individualised care plans
- Client's medical records with information on:
    - Previous hospitalisations
    - Previous surgeries
    - Allergies
    - Medications
    - Client's medical history
    - Client's family history of illnesses

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You will need to access other documents to properly interpret the clients' needs. What is important is that you have a thorough knowledge of the common terminologies and abbreviations used in your field of practice. Consider the following scenario.

Medical Report

A co-worker who is handling a client received an emergency and had to leave work immediately. He did not have enough time to walk you through the client's information. Instead, you were handed the client's medical report. The following are the details included in that report:

Client's Name: Liam Hartman

Age: 57

Sex: Male

Hx: The client had a prior consultation because of the following complaints: heartburn, palpitations, shortness of breath, chest pain and dizziness.

Fhx: His grandfather died of an aneurysm, and his mother has CHD.

Physical examination: The client's BP is 150/110. Resting HR is irregular and less than 60 bpm. (Obs: Upon physical examination, the client is suffering from mild chest pain.)

Based on the above information, what is your impression about the client's condition and what will be your plan of action?

In the above case study, you can use your knowledge about health terminologies to make a correct interpretation of the medical report. Your knowledge about the cardiovascular system tells you that your client is showing signs and symptoms of a cardiovascular problem. You can understand the medical abbreviations your co-worker used in the medical report. You also understand the diseases mentioned in the family history of the client.

Using your knowledge of health terminology and the body's anatomy and physiology, you are able to conclude the following:

Impression	Plan
• Because of the low and irregular heart rate and other symptoms, the client is suspected to suffer from bradycardia. The client needs to undergo more tests to confirm diagnosis.	• You recommended for the admission of the patient for proper monitoring. You also requested for complete laboratory tests, including ECG.

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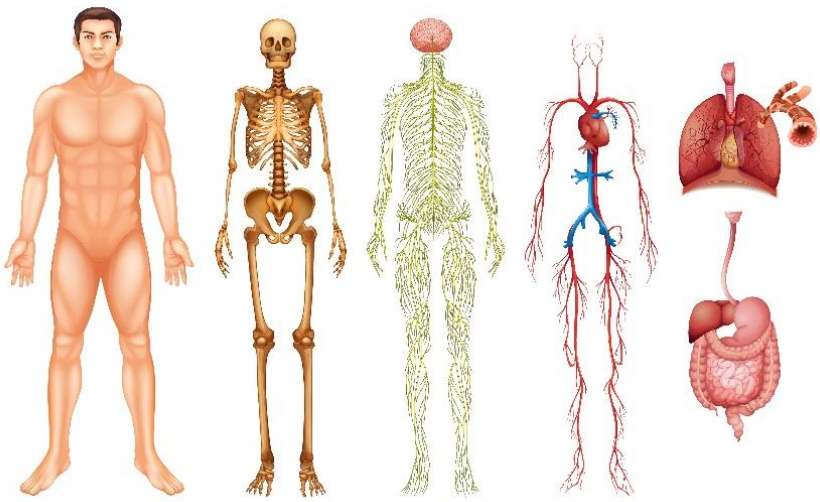
Checkpoint! Let's Review

1. The level of organisation in the body comprises cells, tissues, organs, and body/organ systems.
2. There are 11 body systems:
    - Musculoskeletal system
    - Gastrointestinal system
    - Integumentary system
    - Cardiovascular system
    - Reproductive system
    - Respiratory system
    - Endocrine system
    - Lymphatic system
    - Immune system
    - Nervous system
    - Urinary system
3. Using health terminologies and abbreviations relevant to body systems will help you perform tasks in your work role.
4. The common documents containing health-related terminologies and abbreviations need correct interpretation.



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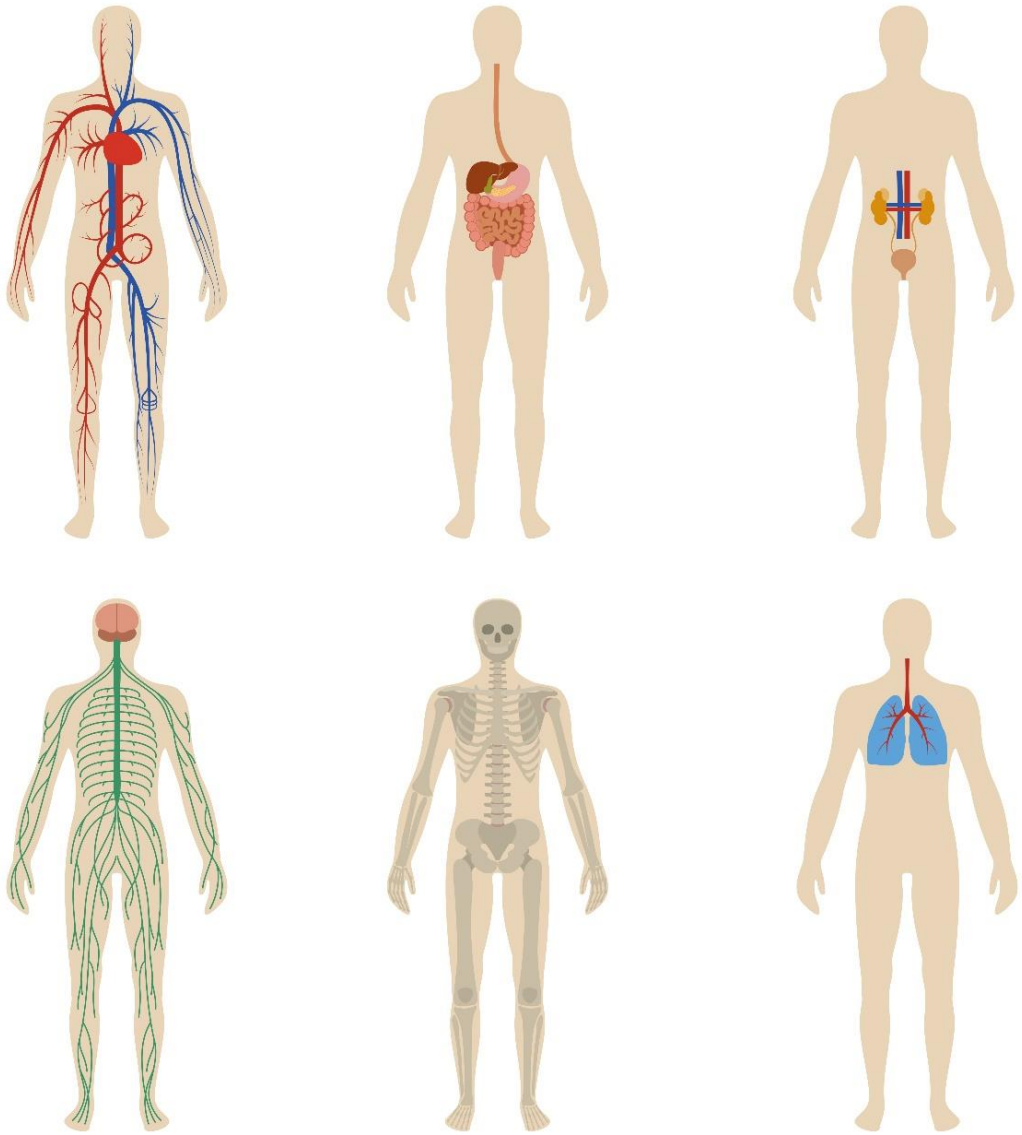
1.2 Use and Interpret Information About the Interrelationships Between Major Body Systems



The human body has many parts with specific functions. If you look at it as a whole, it can be overwhelming as everything works simultaneously. Fortunately, it is divided into organ systems so people can study and focus on one system at a time. However, the organ systems must work together to complete a certain job for a body to function properly.

Communication is vital to keep the body functioning. These body systems are interlinked and reliant on one another to operate appropriately. Most involuntary tasks happen from the automatic nervous system (ANS), which serves as the body's communication centre. You can not tell your heart to beat faster or slower; the ANS does it for you. It sends signals between the nervous system and other body systems through neurotransmitters.

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1.2.1 Interrelationships Between Major Body Systems

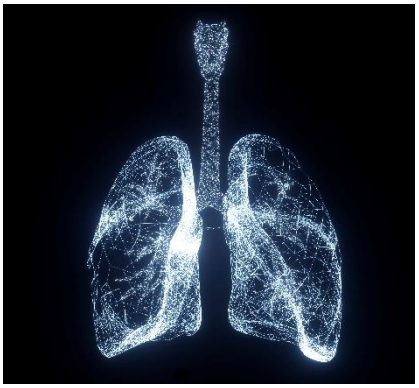
There are different ways the organ systems interact and work with one another. Here are some examples:

- **Digesting food**

  The digestive system works with several other body systems to ensure the proper digestion of food. Once the food enters the body, it sends signals to the nervous system. In response, the brain will send a message to the cardiovascular system to increase the heart rate to support the digestive system. The food will pass through the organs of the digestive system, guided by the contractions made by the smooth muscles within its walls. After the food is digested, nutrients will be absorbed into the blood and delivered to different body parts. The large intestines will excrete all the remaining waste.

- **Breathing**

  You breathe because you take in oxygen and expire carbon dioxide. The respiratory system works with the cardiovascular system. Together, they ensure the delivery of oxygenated blood to other body parts. Aside from that, these two systems need to guarantee that the waste material, carbon dioxide, will be removed from the system.



Even the organ systems that do not seem connected also work together, such as the urinary system and the skeletal system. The bone cells in the skeletal system also produce wastes and need the urinary system to remove them from the body. On the other side, the urinary system also needs skeletal structures to protect its member organs.

The organ systems are dependent on the functions of one another. The circulatory and respiratory systems work together to circulate blood and oxygen throughout the body. And the bones are responsible for producing blood cells. In the same way, the circulatory system supplies oxygen to the brain. The brain is responsible for the regulation of the heart. Air moves in and out of the lungs through the trachea, bronchi, and bronchioles. Blood moves in and out of the lungs through the pulmonary arteries and veins that connect to the heart. The circulatory or cardiovascular system distribute the nutrients absorbed in the digestive system.

The heart pumps the blood filled with oxygen through all the parts of our body including the kidneys. The kidneys clean the blood, removing waste products and extra water.

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Kidneys support the blood through the following ways:

- Clean the blood of waste products and extra water
- Help control blood pressures
- Help make red blood cells
- Keep the balance of minerals in your blood (e.g. sodium, phosphorous, and potassium)

The lymphatic system is a part of the immune system. It produces and releases white blood cells and other immune cells that monitor and then destroy foreign invaders, e.g. bacteria, viruses, parasites and fungi, which may enter the body.

The bone marrow found in the interior walls of bones is crucial for the proper development of the immune system. It also houses stem cells, which are used in the maintenance of the immune system.

To appreciate this cooperative network of the body systems more, examine the following scenario.

It is the usual Thursday morning, and you are driving to work. You took your normal route. You are very familiar with the road. You already memorised where all the crossroads are and where you are supposed to stop. Your body seems to know how fast you should drive. It is effortless. You know you are driving within the required speed limit.

While you are mindful of driving, the car in front of you suddenly stops. You slam the brakes so hard that you are able to stop your car quickly enough to avoid the collision. Your hands are trembling, and you can feel your heart beating quickly. You manage to get outside the car to check for any damages. It is a relief that you could stop your vehicle on time. Nobody got hurt.

When you stepped on the pedal brake, that response was so fast that you did not have the time to think or decide if you would step on it or not. You just did, and that saved you from getting into a car accident.

The situation above demonstrates the 'fight-or-flight' response of the body. The *fight-or-flight response* is an innate body reaction to danger. Your body systems create a rapid chain reaction to protect you from harm.

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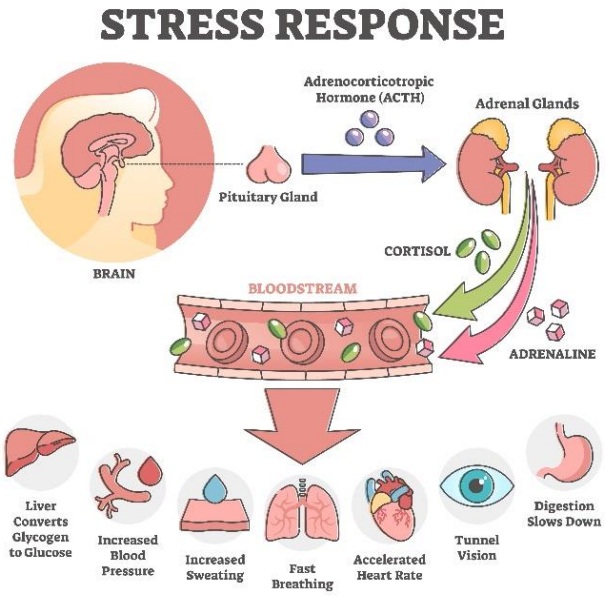
How Did Your Body Systems Work Together?

The hypothalamus is responsible for controlling human behaviour, including emotional and stress responses. It is also responsible for basic drives such as sleep, hunger, thirst and libido.

The nervous system controls the voluntary muscle movements of your body. The integumentary system gathers information from the nervous system by the following process:

The skin has different types of sensory receptors that receive different sensations from the environment, e.g. pain, pressure, heat and cold. These sensations are sent to and processed by the nervous system.

When you realise that you are about to crash into the car in front of you, your eyes and ears send the information to your amygdala. The chain reaction starts here. The *amygdala* is the part of the brain that responds to fear.



The amygdala recognises your fear and sends signals to the hypothalamus. The hypothalamus stimulates the autonomic nervous system (ANS), and the ANS alerts your endocrine system.

The adrenal gland receives the distress signal and produces the stress hormones. The stress hormones are *adrenaline* and *cortisol*.

The stress hormones quickly release into the bloodstream and affect the other body organs. Some of the effects are the following:

It makes the heart beat faster to pump more oxygen to the muscles.

It opens the small airways in your lungs so you can also breathe faster and deliver more oxygen to the blood.

It binds to the liver cells to break down glycogen into glucose and give the muscles an energy boost.

It increases your peripheral vision and dilates your pupils so you can see clearer.

It increases the clotting factors in your blood to prepare for possible injury.

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These changes happen rapidly. The body's communication system is unparalleled. You are able to step on the brake and prevent the crash before you get the chance to even think about it.

This teamwork among the body systems also has its downside. Because the systems do not work in isolation, the other systems also get affected when one malfunctions. There are instances when a certain organ in the process fails to do its part.

Take, for example, the pancreas in the endocrine system. The pancreas is a long, soft organ near the stomach that produces insulin and glucagon hormones. If the pancreas stops, it will cause the blood glucose level to rise. It will result in a disease called *Type I diabetes mellitus*. This disease is more common in people under 30 years old.

Diabetes will affect the other systems like the digestive, circulatory and immune systems. It can prevent the digestive system from functioning properly. The body can experience digestive problems like diarrhea and constipation. Moreover, untreated diabetes can make the blood vessels thicken. The blood circulation to the vital organs will be affected. It can lead to heart problems, kidney failure, coma and death.

People with this condition must intake insulin since their pancreas cannot make enough. The only way they can get insulin in their body is through needle injection or insulin pump.

Endocrine glands in the reproductive system produce sex hormones that are responsible for secondary sex characteristics in men and women.

Sex hormones also contribute to the production of sex cells or gametes.

Female sex hormones regulate pregnancy, ovulation, and menstruation or menstrual cycle.

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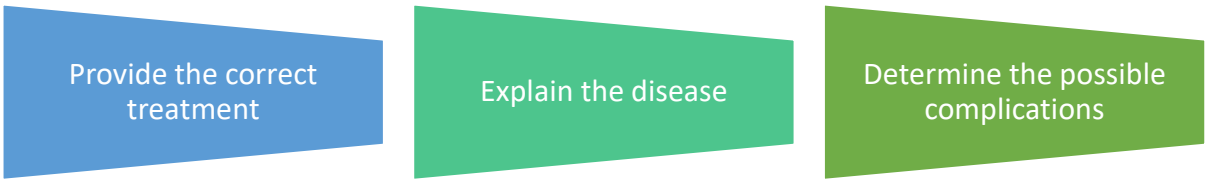
1.2.2 Use Information About the Interrelationships of the Body Systems

How can you use the knowledge about how body systems work together? As a worker, your detailed knowledge is crucial in checking the health status of your clients. It is especially true when there is a need to provide treatments and interventions.

Here are ways you can use the knowledge about the interrelationships between the body systems:



- **Provide the correct treatment**

  Suppose you do not understand how the body functions when it is healthy. You will not know how to treat it. You can have a person under your care who has a problem with a particular organ. You need to know how that organ functions normally and how it functions relative to other organ systems. If not, you may not be able to provide the correct health intervention or treatment.

  For example, the endocrine and nervous systems are linked through the hypothalamus. This organ is responsible for controlling human behaviour, including emotional and stress responses. It is also responsible for basic drives such as sleep, hunger, thirst and libido. The endocrine and nervous systems are involved intimately in maintaining homeostasis. Endocrine issues may manifest in various neurologic problems, such as headache, myopathy, and acute encephalopathy, including coma.

  In the above example, the client will have signs and symptoms of a neurological problem. However, the actual health condition roots in the malfunction of the endocrine system. The treatment plan of the client must address not only the neurologic symptoms. It should also cover the endocrine system problems.

- **Explain the disease**

  Typically, clients would want to know what is wrong with them. When you understand how the body systems work, you will be able to explain it to the clients in a simple way. The clients will also be confident in your ability because you can discuss why you are doing what you are doing.

  You can use your understanding of the body systems' interrelationships in explaining the health condition. Your clients may not be able to understand the connection between their symptoms and treatment. In the previous example, you can use your knowledge to explain how a headache can be a symptom of pancreatic failure.

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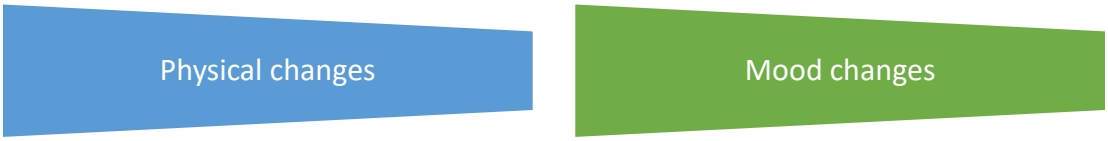
- **Determine the possible complications**

  You may see symptoms in the digestive system, but the underlying issue is in the immune system. To fully understand the disease, you must be able to see the interconnection between the body systems.

  You will be able to use your familiarity with the structures, functions and interactions of the organ systems in the human body to recognise any changes in your client's health actively.

  Recognising could mean making rounds to check on your client and following a routine schedule to observe and monitor your client's condition actively. This could also involve reviewing your client's individualised support or care plan to check the person's current physical conditions and symptoms. Recognising indicators could also mean consulting with the person's family or carer to inquire about changes to the client's physical health and conditions.

  Monitoring your client's health is one of the responsibilities you might have in your work role. There are two areas of your client's health that you can monitor as you apply what you have learned about body systems in the previous subchapter. You will be closely monitoring there:



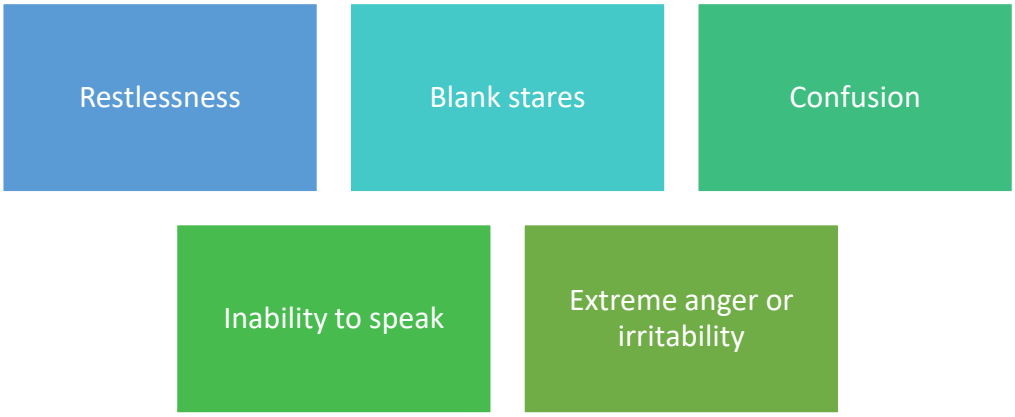
  Monitoring the abovementioned means paying attention to the following:

  - **Indicators of changes in the client's physical condition**

    This is normally checked through constant monitoring and observation. You can pay attention to any changes in their outward appearance or what they say they feel or experience in specific areas of their body.

  - **Indicators of changes in the client's psychological/mental health condition**

    Some examples of observable mood changes are:



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1.2.3 Interpret Information About the Interrelationships of the Body Systems

In checking the health status of your clients, it is essential that you can also interpret the information correctly. The following are the common measures to determine the body's health status.

Body temperature	Pulse rate	Respiration rate	Blood pressure	Blood glucose level

- **Body temperature**

  The normal body temperature is around 37°C (or 98.6 °F), measured by a thermometer. The client's body temperature depends on several factors. Examples are developmental age, cognitive functioning, level of consciousness, or state of health. The methods of measurement include oral, axillary, tympanic, and rectal. The range of normal temperature differs depending on the method you have used.

  The table below shows the normal temperature range based on the method of measurement.

Method	Location	Range
Axillary	Under the arm	34.8 to 36.3°C
Oral	Mouth	35.8 to 37.3°C
Rectal	Rectum	36.8 to 38.2°C
Tympanic	Inside the ear canal	36.1 to 37.9°C

- **Pulse rate**

  The *pulse rate* measures the frequency with which the heart beats per minute. It can also tell you about your heart's rhythm and pulse strength. The pulse rate of a normal adult is 60 to 100 beats per minute. However, it can be affected by the activities done before the checking.

  You can use your finger, a Doppler device, or a pulse oximeter to check your pulse rate.

- **Respiration rate**

  Respiration rate is the breaths you take in a minute. Typically, an average adult takes 12 to 25 breaths per minute while resting. However, some conditions, such as asthma and anxiety, can change the normal respiration rate.

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- **Blood pressure**

  Blood pressure is the measurement of the force or pressure of blood against the walls of the arteries. When your heart beats, your blood pressure is at its highest. It is referred to as *systolic pressure*. Blood pressure falls when the heart is resting, and this is your *diastolic blood pressure*.

  Systolic and diastolic blood pressures are used to measure how high or low your blood pressure is. It is usually reported in mm Hg, which is read as a millimetre of mercury. The systolic pressure is the numerator, and the diastolic pressure is the denominator. The normal blood pressure for most adults is 120 for systolic pressure and 80 for diastolic pressure (120/80 mm Hg) or lower.

  However, there are different normal ranges for blood pressure per age level. Check the table below:

Age Range	Systolic Pressure	Diastolic Pressure
Newborn to six months	45 to 90	30 to 65
Six months to two years	80 to 100	40 to 70
Children (2 to 13 years)	80 to120	40 to 80
Adolescent (14 to 18 years)	90 to 120	50 to 80
Adult (19 to 40 years)	95 to 135	60 to 80
Adult (41 to 60 years)	110 to 145	70 to 90
Elderly (61 years and older)	95 to 145	70 to 90

  You can categorise it into four:

  - **Low blood pressure**

    Low blood pressure is called *hypotension*. It has a systolic blood pressure lower than 90 or a diastolic blood pressure lower than 60. You may feel light-headed, dizzy, or even faint if you have low blood pressure.

  - **Normal blood pressure**

    Normal blood pressure is having a systolic blood pressure of 120 or lower and a diastolic blood pressure of 80 or lower.

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- **Elevated blood pressure**

  Elevated blood pressure is systolic blood pressure between 120 to 129 and diastolic pressure less than 80.

- **High blood pressure**

  High blood pressure happens when the systolic blood pressure is 130 or higher and 80 or higher for diastolic blood pressure.

- **Blood glucose level**

  The blood glucose level is another thing to keep in check for a healthy body. Keeping your blood glucose level within the prescribed range is critical. It helps you avoid long-term health problems.

  You can use an electronic blood glucose meter to measure the blood glucose level. You must apply a drop of blood to a chemically treated, disposable test strip, which will be inserted into the glucose meter.

Multimedia

Watch the video published by the University College London Hospitals to learn how to do a blood glucose test.

How to do a blood glucose test

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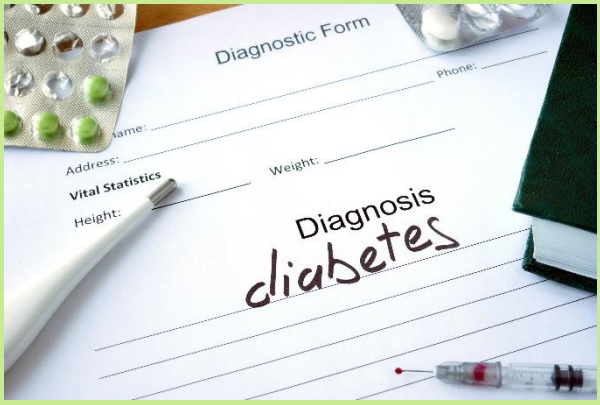
Examine the following case study.

The Underlying Condition



Lyndsay, a 53-year-old businesswoman, is looking for medical assistance. She claims that something is wrong with her head because she always feels dizzy and has frequent headaches. Lyndsay also noticed that her vision had gotten blurry. She wanted to have an MRI scan.

You interviewed her to know more about the symptoms and her medical history. She said she is handling multiple businesses that make her feel tired all the time. You can observe that her weight is more than ideal. However, she mentioned that she had already lost weight. She is actually wondering how she is losing weight when she eats frequently.

When you took her blood pressure and glucose level, both were way beyond the normal range. You asked if any of her family members had been diagnosed with diabetes. She said she remembers that her father has diabetes. You also asked her if she experiences frequent urination and feels very thirsty. She confirmed having those symptoms.

You told her that her symptoms are pointing to diabetes mellitus Type 2. The initial issues she complained about were complications caused by diabetes. You then proceeded to tell her the ways to manage her condition.

In the above case study, you could interpret the information relevant to the interrelationship of the pancreas and the sensory organ, the eyes. Instead of treating upfront Lyndsay's blurry vision and headache complaints, you were able to connect those symptoms to the actual health problem.

The correct interpretation can provide a better course of action for your client's medical condition. Can you imagine if you do not understand the body systems' interrelationships? In the case of Lyndsay, you may be able to provide intervention to her initial complaints. However, if you do not understand how the symptoms connect to other body systems, you cannot address the real cause of those symptoms. Most likely, Lyndsay will come back with new and worse health complaints.

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Diabetes mellitus Type 2 can bring long-term complications to the body. Diabetes increases the risk of high blood pressure. Over time, this condition strains the heart. It then results in cardiovascular diseases like arrhythmia and cardiomyopathy.

Blurry vision is one of the first indicators of diabetes. This condition can damage the retina and surrounding blood vessels. If diabetes is left unchecked, it can progress to total blindness.

The malfunction in the pancreas can branch out and affect not only individual organs but an entire organ system. You need to know how each of the body's organ systems is interrelated to maximise any plans of improving and supporting your client's overall health. Not knowing how basic organ systems interconnect with each other can lead to grave consequences, including:

- Confusion with interpretation
- Injuries
- Expensive mistakes
- Medical malpractice
- Loss of life

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Checkpoint! Let's Review

1. Each of our body systems is interconnected and dependent on each other. It will be beneficial to remember that any issues affecting one organ system may also affect the other components of the body.
2. You can use and interpret health information correctly when you understand how the systems work together and how the organs normally function.

Learning Activity for Chapter 1

Well done completing this chapter. You may now proceed to your **Learning Activity Booklet** (provided along with this Learner Guide) and complete the learning activities associated with this chapter.

Please coordinate with your trainer/training organisation for additional instructions and guidance in completing these practical activities.

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II. Recognise and Promote Ways to Support Healthy Functioning of the Body

In the previous chapter, you learnt about the different organs and systems that work together to keep the body functioning. A *healthy functioning body* means that all the organs, along with their associated muscles and nerves, perform well every day.

More often than not, people only seek medical attention when one of the organs or body systems fails or malfunctions. People only care about their health when they are sick and ill. However, health professionals agree with the saying, 'prevention is better than cure'. In any circumstance, you will always find it easier to maintain a healthy body than to cure failing organs due to sickness or disease.

In this chapter, you will learn how to:

- Review factors contributing to a healthy body
- Evaluate relationship between body systems and healthy functioning
- Enhance quality of work by utilising information about healthy body functioning

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2.1 Review Factors Contributing to a Healthy Body

A healthy body does not only mean it is free of illness or disease. It also focuses on an individual's overall well-being. It includes physical, mental, emotional, and social well-being. It is important to develop strategies to promote and maintain your clients' health and well-being. However, before promoting and maintaining your clients' health, you must first review the factors that affect their overall health and well-being.

There are a lot of factors that can contribute to maintaining a healthy body. This subchapter will discuss four factors that have significant impacts. To decrease the risk of developing health conditions, you must consider the following factors:

Well-Balanced Diet

Proper nutrition and a healthy diet are at the top of the list in maintaining a healthy body. The diet you take determines the nutrients you supply to your body organs. The energy and nutrients supply should be sufficient for tissue maintenance, repair and growth. The National Health and Medical Research Council developed the Australian Dietary Guidelines in 2013. The guidelines recommend the following for adults, adolescents and children:

1. Be physically active and choose amounts of nutritious food and drinks to meet energy needs.
2. Drink plenty of water and enjoy a wide variety of nutritious foods from the five food groups every day:
    - Plenty of vegetables, including different types and colours, and legumes/beans
    - Fruit
    - Grain (cereal) foods, mostly wholegrain and/or high fibre varieties, such as breads, cereals, rice, pasta, noodles, polenta, couscous, oats, quinoa and barley
    - Lean meats and poultry, fish, eggs, tofu, nuts and seeds, and legumes/beans
    - Milk, yoghurt, cheese and/or their alternatives, mostly reduced fat (reduced fat milks are not suitable for children under the age of 2 years).
3. Limit intake of foods containing saturated fat, added salt, added sugars and alcohol.
4. Encourage, support and promote breastfeeding.
5. Care for your food; prepare and store it safely.

Source: Australian Institute of Health and Welfare. Risk Factors to Health, used under CC BY 4.0

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Insufficient or even excessive amounts of nutrients can make the body ill. The body conditions affected by diet include the following:

Coronary heart disease

- A type of heart disease where the coronary arteries become narrowed, causing reduced blood supply to the heart

Stroke

- A life-threatening condition where there is poor blood supply to the brain, causing death to some brain cells

High blood pressure

- A common condition where the blood flow in the blood vessels is higher than normal

Type 2 diabetes

- A condition that results from the impairment of glucose use in the body, causing the blood sugar to be too high

Other related health conditions are:

- Dental caries
- All bladder disease
- Some forms of cancer
- Nutritional anaemias

Diet requirements will vary depending on several factors. For example, the dietary needs of a client with an acute medical condition will be different from a client who is generally healthy. Pregnant women may have a particular food diet. You may also handle individuals with food allergies and other limitations. It is always best to evaluate the nutritional needs of the client under your care for optimal health interventions. Good hygiene is essential when it comes to preparing food. It ensures that food is clean and safe for consumption. Poor hygiene when handling or eating food can lead to the spread of germs and food-borne diseases, such as diarrhoea.

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Regular Exercise

A healthy diet should always be partnered with regular exercise. Those two are the foundation of a healthy and happy lifestyle. The benefits of exercise seem to be an unending list. Even the World Health Organisation confirms that it plays a critical role in maintaining a healthy body. Some of the impacts of exercise are:

- Increased self-esteem
- Increased strength and energy
- Healthy body weight
- Improved mood
- Improved sleep
- Healthier state of mind
- Increased longevity

The table below shows the impacts of exercise on the body systems.

Body System	Exercise Benefits
Cardiovascular system	Exercise increases cardiac output because your muscles need more oxygen. The increased blood flow in the body results in: ▪ Stronger heart ▪ Better blood circulation ▪ Decreased risks of heart disease
Respiratory system	Exercise makes the lungs work harder, like the heart, to supply the oxygen demand. This results in: ▪ More efficient lungs ▪ Stronger respiratory muscles
Musculo-skeletal system	Exercise requires the muscles to use oxygen, fats, and protein effectively. This results in: ▪ Stronger muscles ▪ Stronger bones and better bone formation ▪ Reduced inflammation

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Body System	Exercise Benefits
Endocrine system	Exercise helps the endocrine system release hormones better, resulting in: ▪ Increased metabolism and healthier weight ▪ Normal blood glucose level ▪ Improved mood
Digestive system	Exercise helps the digestive systems by: ▪ Boosting healthy microbiota ▪ Improving gut mobility that increases digestion ▪ Reducing constipation
Reproductive system	Exercise helps regulate metabolism and hormones in the reproductive system by: ▪ Improving hormonal balance ▪ Improving function
Integumentary system	Exercise improves blood flow to the skin. It also helps remove chemicals through sweating, resulting in: ▪ Improved skin structure making it look younger ▪ Regulated body temperature ▪ Improved detoxification
Nervous system	Exercise improves communication between the brain and the different parts of the body. It helps in: ▪ Releasing feel-good chemicals (also called *endorphins*) that improve mental health ▪ Improving sleep ▪ Improving brain function
Immune system	Exercise helps the immune system by: ▪ Increasing white blood cells ▪ Increasing function

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The Department of Health and Aged Care developed a physical activity guideline for different age groups. It recommends the amount and intensity of activity by age. The table below summarises the physical activity guidelines for the age group 15-17 and 18-64.

Behaviour Guideline	15 to 17 Years Old	18 to 64 Years Old
Physical activity	▪ Accumulate at least 60 minutes of moderate to vigorous activity per day, involving mainly aerobic activities at least three days per week. ▪ Achieve several hours of light physical activities. ▪ Incorporate vigorous activities at least three days per week.	▪ Accumulate 150 to 300 minutes of moderate-intensity physical activity or 75 to 150 minutes of vigorous-intensity physical activity, or an equivalent combination of both moderate and vigorous activities each week. ▪ Be active on most, preferably all, days every week.
Sedentary or recreational screen-based activity	▪ Have no more than 120 minutes of recreational screen use per day. ▪ Break up long periods of sitting as often as possible.	▪ Minimise the amount of time spent in prolonged sitting. ▪ Break up long periods of sitting as often as possible.
Strength	Have muscle and bone strengthening activities at least three times a week.	Have muscle strengthening activities at least two days a week.
Sleep	▪ Have uninterrupted sleep of 8 to 10 hours per night. ▪ Follow consistent bed and wake-up times.	There are no specific guidelines.

Based on Australian Institute of Health and Welfare material. Australia's youth: Physical Activity, used under CC BY 4.0

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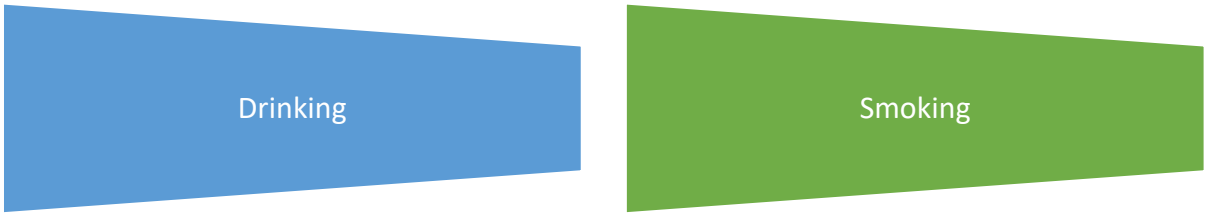
Further Reading

You can read more about the physical activity and exercise guidelines on the Department of Health and Aged Care website.

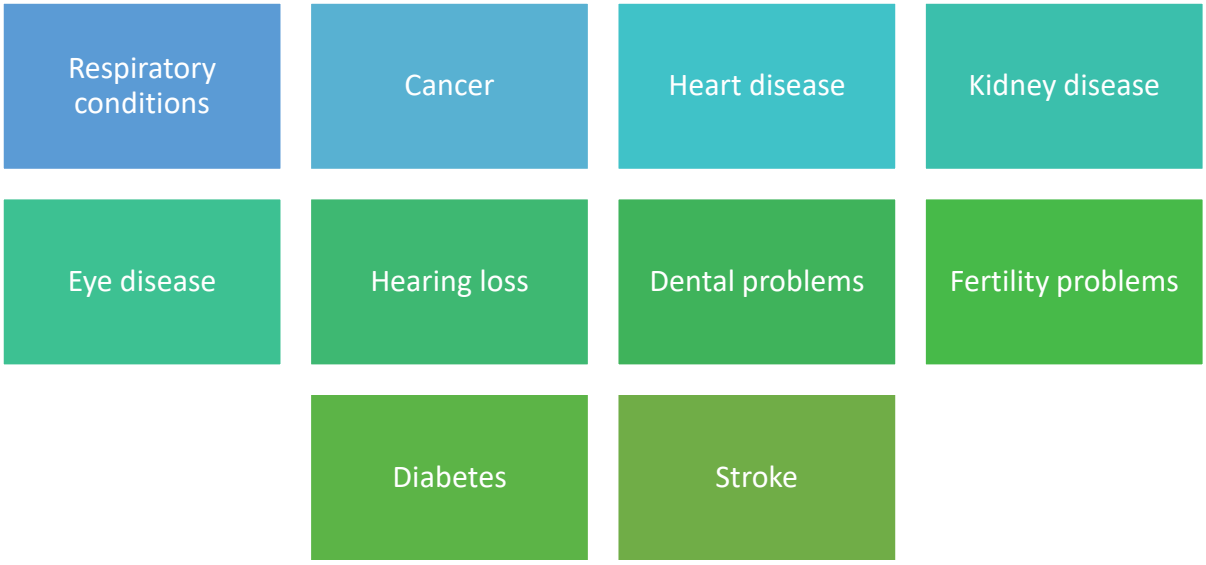
Physical activity and exercise guidelines for all Australians

Better Habits

A *habit* is a behaviour or a practice that you routinely do and often unconsciously. It is an activity you regularly repeat that becomes part of your lifestyle. Sadly, you can develop habits that are not good for your health. And usually, you do not realise that you already have it. There are two common bad habits that some individuals struggle to break:



The Australian Institute of Health and Welfare (AIHW) claims that tobacco smoking is Australia's most important preventable cause of ill health and death. It is associated with several health issues:



Unlike smoking, which has no safe levels, you can take alcohol in moderation. Alcohol intake can be hard to avoid, especially during special celebrations. It becomes a problem when the individual has no limits and abuses their consumption.

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The Australian Guidelines to Reduce Health Risks from Drinking Alcohol advise that:

- To reduce the risk of harm from alcohol-related disease or injury, healthy men and women should drink no more than 10 standard drinks a week and no more than 4 standard drinks on any one day. The less you drink, the lower your risk of harm from alcohol.
- To reduce the risk of injury and other harms to health, children and people under 18 years of age should not drink alcohol.
- To prevent harm from alcohol to their unborn child, women who are pregnant or planning a pregnancy should not drink alcohol. For women who are breastfeeding, not drinking alcohol is safest for their babies.

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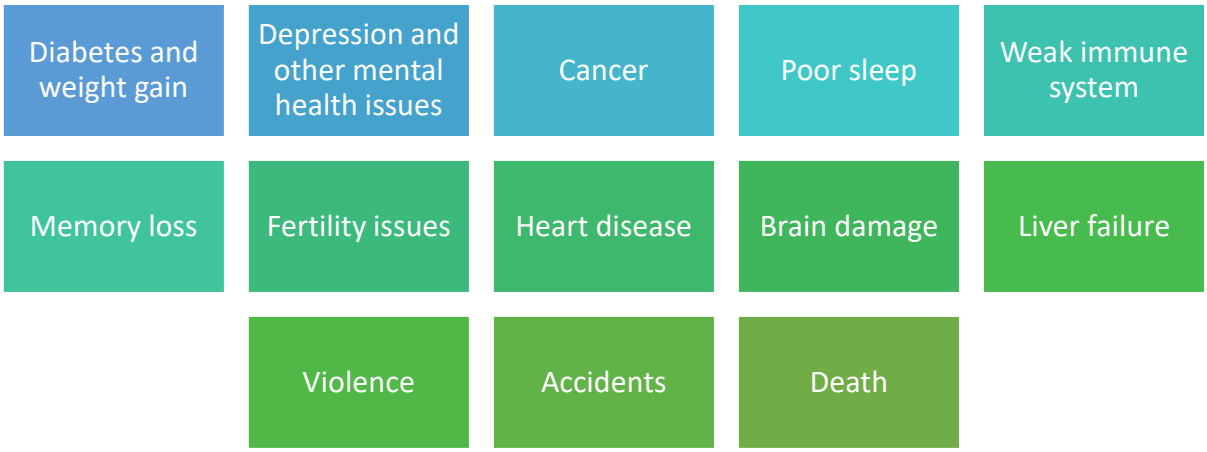
Alcohol abuse also has its associated health risks and other problems:



Several methods and strategies are available to help individuals break free from these bad habits. In severe cases, clients will need professional guidance to help the body adjust properly.

Poor oral health can lead to impaired oral health, e.g. missing teeth (due to tooth decay, dental caries) and gum diseases. Impaired oral health can affect our ability to chew or swallow food, and this can negatively impact our nutritional intake. We may tend to consume fewer meals or meals with lower nutritional value, and this can lead to poor nutritional status and an increased risk of malnutrition.

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One of the most practical ways is to develop new and better habits. There are endless options depending on the person's interests and skills. The following are some alternative activities that can help maintain a healthy body.

Exercise and meditation	Sports like hiking, biking, swimming	Crafty habits like painting, sewing, baking	Healthy sleeping habits
Work-life balance	Stress management	Spending more time with family and friends	Travelling

Regular Health Checks

Maintaining health is a proactive commitment. The body grows and changes. It is continually affected by internal and external factors. How can you be assured that the changing body is still healthy?

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People would only like to visit doctors and have check-ups when they feel sick. However, if you are committed to protecting health, you will find it more advantageous to do health checks regularly. The benefits of regular health checks are:

- **Awareness about the body condition** – Individuals who are more informed about their health status care more for their bodies. When you know that you are healthy, you will likely maintain it and avoid the factors that can put your health at risk.
- **Early detection of health issues** –Not all sicknesses will show immediate signs and symptoms. Some health problems only manifest when they are already complicated. A regular health check can provide timely intervention to prevent further health damage.
- **Reduced healthcare costs** – You may think that a regular check-up is costly. The fact is that medical treatment at the early stage of sickness is way lower than when treating it in an acute phase. Management of health diseases in the early stages can help you save money.

There are several ways of maintaining a healthy body in the areas of nutrition, hydration, skin integrity, movement and social interaction. These can be seen in the following table:

Area	One way of promoting and maintaining a healthy body
Nutrition	▪ Follow healthy eating habits, e.g. minimising salt, saturated fats, and trans fats ▪ Take vitamins and minerals as recommended by the doctor or dietitian ▪ Eat a wide variety of foods from the five food groups
Hydration	▪ Aim to drink at least six times a day (more during warmer weather or after exercising) ▪ Avoid drinking caffeinated drinks and alcohol, as they can dehydrate ▪ Eat water-rich foods, e.g. cucumber, tomato, spinach, etc
Skin integrity	▪ Ensuring skin is cleansed, dried thoroughly, and moisturised daily ▪ Using non-soap cleansers with a pH close to 5.5 to prevent the skin from drying out

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Area	One way of promoting and maintaining a healthy body
Movement	▪ Encourage incidental activities or physical activities that occur as part of the person's regular daily activities, e.g. walking to the toilet, dressing, eating meals out of bed, etc. ▪ Follow an exercise program recommended by the doctor that includes strength, balance, and aerobic exercises.
Social interaction	▪ Incorporate social interaction into activities, e.g. running group exercise activities. ▪ Join communities, hobby or interest groups, e.g. book club, volunteering at an animal shelter, etc.

Some of the common health problems that regular health checks can detect and address are the following:

Blood pressure	Heath problems	Diabetes	Cancer	Visual and hearing impairments

The table below shows examples of the health checks done to identify health problems.

Health Problem	Health Check-Up
Heart problems	▪ Blood test ▪ Cholesterol level ▪ Electrocardiogram ▪ Body mass index
Diabetes	▪ Family history ▪ Blood glucose level ▪ Obesity ▪ Blood pressure

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Checkpoint! Let's Review

1. A healthy body does not only mean it is free of illness or disease. It also focuses on an individual's overall well-being.
2. The factors that can help maintain a healthy body are:
    - Well-balanced diet
    - Regular exercise
    - Better habits
    - Regular health checks

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2.2 Evaluate Relationship Between Body Systems and Healthy Functioning

As a worker, it is your job to maintain your client's health. However, apart from you, there is one that works twice as hard in keeping your client's body healthy and functioning. This is none other than their body itself. In addition to the amazing structure and function of the human body's organ systems, the body can also regulate itself to maintain a stable internal environment despite the changes it experiences in the external environment. This state or condition is called *homeostasis*. Homeostasis is the process of maintaining a state of balance in the body. It is the job of the cells, tissues, organs, and organ system to maintain this balance and ensure that everything will be within its set point.

For example, the body must maintain an ideal temperature to prevent proteins and cells from dying. The set point for the human body temperature is 37°C or 98.6 °F. If it is too hot, humans sweat to keep the body temperature within that number. Homeostasis helps control the heat released to keep it at the ideal level.

The body has a different set point for various states like hunger, sleep, temperature, thirst, and weight. If any of these set points are off, homeostasis will correct it. There are four components involved in maintaining homeostasis:

- **Stimulus**

  A *stimulus* is something that is moved away from the set point or the balance level.

- **Sensor**

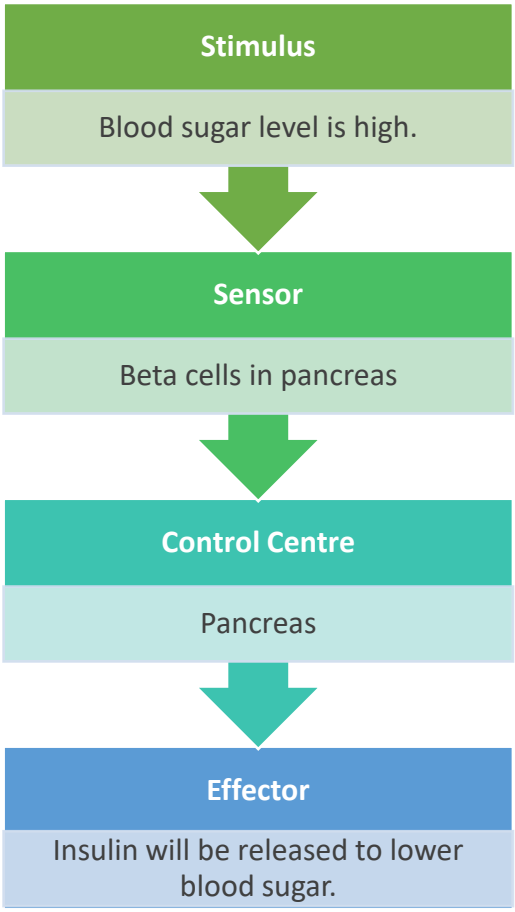
  A *sensor*, or a receptor, reacts to the change happening in the body. It sends these data to the control centre.

- **Control centre**

  The *control centre* will evaluate the data received from the receptors. If data is not within the normal level, the control centre will signal to bring everything back into balance.

- **Effector**

  Once the signal is released, the *effector* will act. It will follow the information provided by the control centre to return the body's state to normal.



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Homeostatic Imbalance and Diseases

The body must maintain stable conditions through homeostasis. If the normal level gets disrupted, homeostatic imbalance may happen. If the homeostasis is not restored, it might result in disease or even death. It must be controlled immediately to avoid further harm.

You must evaluate how the body is maintaining homeostasis and healthy functioning. This way, you will be able to determine if something is wrong with the body processes and how the systems interact with each other. You can provide early health intervention.

Diabetes is an example of a disease caused by homeostatic imbalance. It can cause significant health complications if left unchecked and uncontrolled. A regular health evaluation is needed for proper medical intervention.

Different factors can affect homeostasis, such as:

- **Internal influence**

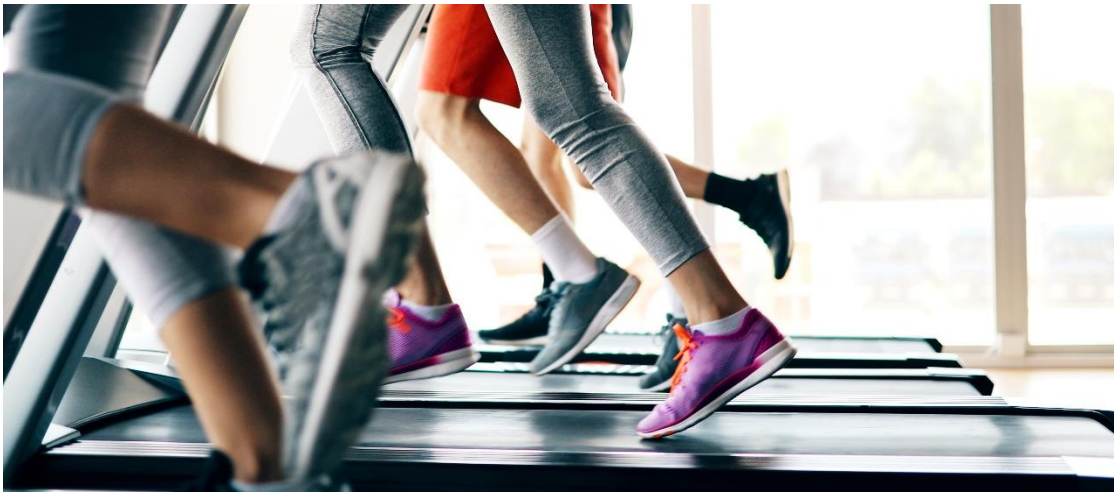
  Internal influence, like heredity, can be a significant factor in the disruption of balance in the body. Disorders like diabetes and cancer can be inherited.

- **Nutrition**

  For the cells in the body to function, it needs nutrients like vitamins and minerals. These can be obtained through diet. An imbalanced diet might result in disease.

- **Physical activity**

  Being physically active is a vital factor in keeping a body healthy. Lack of this might result in being overweight or obese and can be a huge factor in developing heart disease, diabetes, and certain forms of cancer.



- **Mental health**

  Mental health will always be partnered with your physical health. Emotions can cause chemical changes inside the body and can affect one’s health badly.

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Multimedia

Watch the video below and learn from Mike Todorovic (PhD). He is a Senior Lecturer and Medical Researcher at Griffith University Australia. In this video, he talks about homeostasis and its positive and negative feedback.

Homeostasis

The body needs certain processes and conditions to maintain homeostasis. It needs the following support in its healthy functioning:

Body regulation

- Maintenance of a normal body temperature
- Fluid and electrolyte balance
- Elimination of wastes
- Maintenance of normal blood pressure levels

Protection from infection

Active and passive physical activities

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2.2.1 Body Regulation

Knowing the body processes that maintain homeostasis can help you evaluate how the relationships between different body systems affect and support healthy functioning. The following discussions will give you knowledge on how you can evaluate if something is not okay with the body systems.

- **Maintenance of a normal body temperature**

When the body's internal temperature is within a certain range, it performs better. The normal body temperature ranges from 36.5 to 37.5 °C (97.7 to 99.5 °F). If it deviates, the body will initiate a series of processes to correct it. The process of regulating one's body temperature is known as *thermoregulation*. The hypothalamus is the processing centre in the brain that controls body temperature. It does this by triggering changes to effectors, such as sweat glands and muscles controlling body hair.

Below are some of the responses of the body to changes in temperature. You can use these to check if your client is feeling too hot or too cold:

  - Skin hairs trap more warm air if they are standing up and less if they lie flat. Tiny muscles in the hair follicles pull these hairs upright to reduce heat loss or lay them down flat to increase heat loss.
  - When exposed to hot conditions, sweating is one of the body’s primary methods of maintaining its temperature. The sweat glands under the skin push out sweat if the body is too hot. As the sweat evaporates from the skin, the heat leaves the body. Sweating then stops when body temperature returns close to 37°C. Use a thermometer to measure a client’s temperature.
  - Blood vessels supplying blood to the skin's capillaries can widen, decreasing blood pressure. This can cause more heat to be carried by the blood to the skin, where it can be lost to the air. During this process, the client's skin may appear red.
  - Blood vessels can narrow or constrict, which increases blood pressure. This reduces heat loss through the skin. The person's skin appears pale.

Normally, the body will have an increased temperature when it is fighting an infection. If the body has no infection and yet the body’s temperature is deviating from the normal range, it will mean a malfunction in the body systems regulating it.

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Anhidrosis is the inability to sweat normally. It occurs when our sweat glands do not function properly.

There are several conditions that may cause anhidrosis. These are the following:

Congenital conditions affect the development of sweat glands

e.g. certain congenital dysplasia

Inherited conditions that affect your metabolic system

e.g. Fabry's disease.

Connective tissue diseases

e.g. Sjogren's syndrome, which causes dry eyes and mout

Skin damage

e.g. from burns or radiation therapy

Diseases that clog your pores (poral occlusion)

e.g. psoriasis

Conditions that cause nerve damage (neuropathy)

e.g. diabetes, alcoholism and Guillain-Barre syndrome

- **Fluid and electrolyte balance**

The kidneys are a pair of bean-shaped organs. They are essential for regulating the fluid and electrolyte composition of the body. The kidneys are responsible for maintaining fluid and electrolyte balance. They go hand in hand, which is why failing to keep them at their ideal state would lead to various body systems failing to function at their normal capacity.

Electrolytes are bodily substances with a natural positive and negative electrical charge. Electrolytes include calcium, chlorine, phosphate, potassium, and sodium. They aid the body in maintaining fluid balance inside and outside of cells.

Fluid balance is the equal input and output of bodily fluids. It enables the body to function normally. The majority of the fluid in the body is obtained through food absorption or digestion. It is eliminated through excretion or respiration. Several mechanisms in the body can assist in maintaining fluid balance. One way is through thirst. When the water levels in the body are low, the brain receives a signal that causes this sensation.

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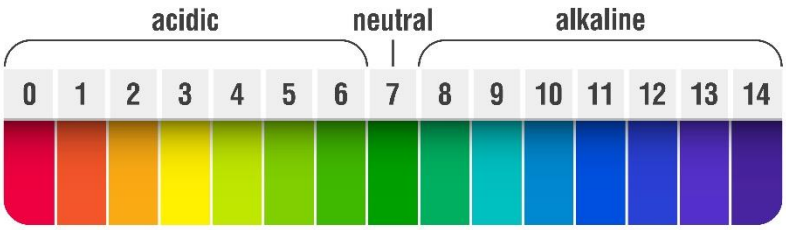
A lot of factors will affect how much water you need. The general recommendation is about 2.7 litres a day for women and 3.7 litres for men. It includes fluids from water, other beverages like tea or juice, and the food you eat. The amount of water you lose must equal the amount you take in. However, if something disturbs this balance, you experience dehydration or overhydration. If it keeps happening for a long time, it can cause serious illnesses or disorders.

Several biochemical processes in the body require acid production. Because of this, the body also needs to regulate the balance between the levels of acidity and alkalinity. The body's acid-base balance or *pH balance* is essential for all its structures. pH stands for the power of hydrogen. It measures the acidity or alkalinity of substances. The scale is from 0 to 14. The closer to 0 the pH level, the more acidic. pH levels closer to 14 are more alkaline. pH 7 is neutral. The following image illustrates a pH scale.



The pH levels in the different parts of the body vary. For example, the pH in the lower parts of the stomach is highly acidic. This acidic pH is essential in breaking down proteins. It helps activate the enzyme pepsin, which is responsible for breaking down food. On the other hand, pancreatic fluid maintains an average pH of 8.8. While it also helps break down nutrients, it must be alkaline to neutralise stomach acid.

The pH of urine is healthy at 4.6-8.0. Overall, the body maintains a neutral pH of 7.4. The normal blood pH level is around 7.35 – 7.45.

Three body mechanisms work together to regulate this pH level. They are:

- **Buffer system**

  The buffer system consists of several proteins that regulate the body's pH level. There are naturally occurring weak acids and bases in the body that help adjust sudden changes in acidity or alkalinity. Bicarbonate (HCO3) is an example of an important chemical buffer.

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- **Lung control**

  Respiration is an essential process in the acid-base balance. It provides a quick but short fix in regulating carbon dioxide in the blood. An increased respiration rate can decrease the build of up of carbon dioxide circulating in the blood.

- **Renal control**

  The kidneys provide long-term function in maintaining pH levels. They secrete and absorb either acids or bases depending on the need. If the fluid's acidity passing through it is high, they secrete H+ ions to buffer it. They have a slow but effective process in keeping the body's homeostasis.

  The kidney maintains pH (acid-base) balance in the body through the following ways:

  The kidneys' cells reabsorb bicarbonate HCO3 – from the urine back to the blood, and they secrete hydrogen H+ ions into the urine.

  By adjusting the amounts reabsorbed and secreted, they balance the bloodstream's pH.

Abnormality in the pH levels is often a good indicator of the body's health status. The body works hard to regulate pH balance. If the blood and urine pH of your client is off the normal range, it would mean an organ or organ system is malfunctioning. You may require additional tests to evaluate the client's health condition.

One example of a condition is respiratory acidosis. This condition is caused by the lungs' inability to remove enough carbon when the individual exhales. It results in too much carbon dioxide in the body, which means the pH level will be highly acidic.

- **Elimination of wastes**

  It is important to remove all the toxic wastes in the body. Failure to do so will result in serious consequences in the long run. The *excretory system* is a passive biological system that removes excess and unnecessary materials from the body to help maintain *homeostasis* and prevent damage.

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Excretion is the process of eliminating wastes and excess fluid from the body. Although the kidneys are the main organs for this, other organs also excrete waste. The main organs involved in waste management are the skin, lungs, liver, kidneys, and digestive organs. You can see it in the list below with their respective functions:

Organ	Function
Skin	Eliminates excess toxins and fluid via sweat It has sweat glands that secret a fluid waste called perspiration or sweat.
Liver	Breaks down excess substances such as amino acids and toxins in the blood It is a vital organ with a wide range of functions including: ▪ detoxification ▪ protein synthesis ▪ production of biochemicals necessary for digestion
Lungs	Removes carbon dioxide from the body It diffuses gaseous wastes, such as carbon dioxide from the bloodstream as a normal part of respiration.
Kidneys	Eliminates salts, urea, and excess water
Digestive organs	The final step in digestion is the elimination of undigested food content and waste products. After food passes through the small intestine, the undigested food material enters the colon, where most of the water is absorbed. These digestive organs excrete solid waste and some water in the form of faeces.

When your body cannot remove all the wastes that it needs, waste accumulates and spreads to other body parts. It causes sickness and various ailments, such as skin disorders, constipation, bad breath, and fatigue.

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- **Maintenance of normal blood pressure levels**

  The force of the blood when it is pushed against the artery walls is the *blood pressure*. It is the result of the heart's activity every time it pumps blood into the arteries.

  There are two types of pressure. These are the following:

Pressure	Definition
Systolic	The pressure of the blood during the heart contraction (systole).
Diastolic	The pressure of the blood when the heart is at rest between heartbeats (diastole).

  Several body organs work together to maintain normal blood pressure levels. Blood vessels have receptors on its wall that detect changes in blood pressure. A change in the blood pressure, whether rise or fall, will send a signal to the brain. The brain will respond by producing chemicals called neurotransmitters. *Neurotransmitters* are the brain's chemical messengers. The brain will send this to the target organ to affect its function and in turn, regulate the body's homeostasis. Our body tries to maintain stable blood pressure through the process of homeostasis.

  For example, the brain receives the signal that the blood pressure is falling too low. It will produce a neurotransmitter called *catecholamines*. This chemical signal will direct the heart to beat faster and more forcefully. The quicker and more forceful pump will tighten the blood vessel and in turn, increase the blood pressure.

  Another organ that can regulate blood pressure is the kidneys. Low blood pressure can also result from dehydration and excess or heavy bleeding. The loss of fluid in the body causes a drop in blood pressure. The kidneys will absorb the sodium and fluid from the urine to compensate for the fluid loss and raise the blood pressure.

  Section 1.2.3 has a table showing the different normal ranges for blood pressure per age level. If your client has a higher or lower blood pressure level (compared to the normal range), it will mean that the body cannot maintain homeostasis. One of the organs or organ systems is not functioning well.

  Maintaining a normal blood pressure level is important. Prolonged high blood pressure may lead to heart complications. The doctors use an instrument called a sphygmomanometer to measure blood pressure. However, digital blood pressure monitors can help you check your blood pressure alone.

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There are different factors that can affect blood pressure:

- Cardiac output
- Peripheral resistance
- Blood viscosity (or changes to the blood viscosity)

You can maintain normal blood pressure by changing your daily habits. Sometimes, you will need additional medications. However, lifestyle change alone can help prevent high blood pressure. To do so, you should:

- Exercise
- Lessen stress
- Cut down salt
- Get enough sleep
- Eat a heart-healthy diet
- Maintain a healthy weight
- Avoid smoking and drinking alcohol

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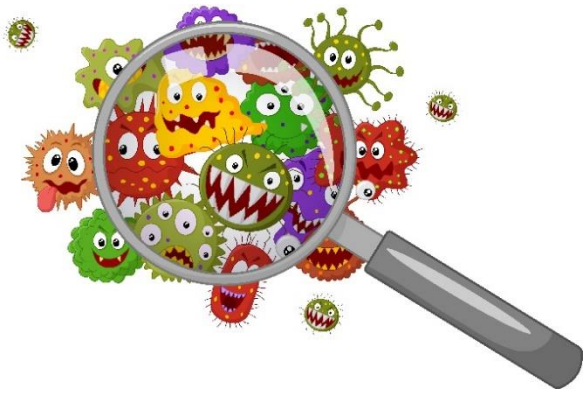
2.2.2 Protection From Infection

Infection means unwanted microorganisms enter the body and disturb how cells, tissues and organs normally function. Examples of these microorganisms are bacteria, viruses, protozoa and fungi. Microorganisms that can cause disease are called *pathogens*. To provide better bodily protection, you must first understand how these pathogens spread. Examine the table below.



Entry	Contamination	Transmission
Microorganisms can enter through the openings in the body: ▪ Mouth ▪ Respiratory tract ▪ Eyes ▪ Genitals ▪ Broken skin	Microorganisms can spread through: ▪ Air droplets via sneezing, coughing or rubbing the eyes ▪ Food contamination from improper food handling ▪ Contact with the broken skin or other mucous membranes ▪ Body fluids like urine, saliva, genital secretions	Microorganisms' transmission can be: ▪ Direct (from an infected person to another person) ▪ Indirect (from an infected person to the environment)

There are several ways that your body naturally protects you from infection. *Keratin,* a protein inside skin cells, makes up the skin cells and, along with other proteins, sticks together to form the *epidermis.* The epidermis keeps bacteria ang germs from entering the body and causing infections. White blood cells attach to germs, absorbing them or destroying them. They produce antibodies that latch onto these germs. Having fever is also an immune system response. A rise in temperature can kill some microbes within the body.

Many diseases are highly infectious and contagious. However, there are also ways to protect yourself from infection. You can consider the following measures:

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- **Good personal hygiene**

  Good personal hygiene can prevent infection and diseases. It is easy and simple, and thus it is also often overlooked. It involves keeping the body parts clean and healthy. Personal hygiene includes good grooming habits like:

  - Bathing or washing the body regularly
  - Washing hands regularly and adequately
  - Brushing and flossing teeth after meals
  - Trimming nails in hands and toes
  - Getting enough hours of sleep

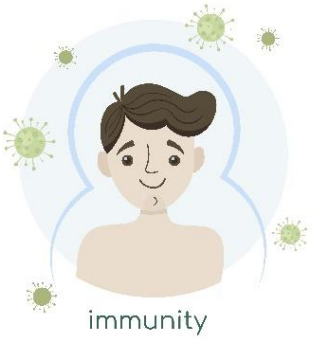
- **Proper food handling**

  Food-borne pathogens cause some illnesses. A good practice is to always wash your hands before and after food preparation. This simple act can prevent food contamination and transmission of unwanted organisms from raw food. Cooking food properly is also part of good food handling. Ensure to use the right temperature when cooking. Another good practice is proper food storage. Microbes proliferate in food at room temperature. Store food in the fridge or at a cold temperature to prevent its growth.

- **Immune system boost**

  Your immune system is a natural protection against microbe invasion. You can help your body systems fight disease-causing organisms by keeping them healthy. Some of the natural ways to boost your immune response are:

  - Healthy diet and nutrition
  - Regular exercise
  - Adequate rest and sleep
  - Controlled intake of alcohol
  - No smoking habits
  - Avoid or minimise stress



- **Vaccinations**

  Sometimes, there are diseases that are beyond the capacity of your natural immune system. To have protection against possible infection, your body needs to have immunisation. *Vaccination* introduces a weakened form of the pathogen to help the body produce defensive cells. Always check if your vaccination and immunisation are up to date.

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2.2.3 Physical Activity

Physical activity is any body movement that will require your body to use energy. The activities can range from simple everyday motions to rigorous exercises. The World Health Organization (WHO) confirms that physical activity improves health. According to the WHO, it helps prevent and manage non-communicable diseases. Not only that, but it is also instrumental in improving mental health and general well-being. In this regard, physical activity can be defined as any movement that can help in keeping the body healthy.

There are two types of physical activity:

Passive	Active
• Passive exercise is an exercise performed without volitional control. • These are activities or exercises that do not require effort from your muscles. These kinds of activities can be done independently but are often assisted by another person.	• Active exercise in an exercise performed with volitional control. • Activities or exercises that require effort from your muscles. These kinds of activities do not need any assistance.

Passive Physical Activity

In passive activity, the movement is done to the body, which is why it needs assistance from trained personnel. Stroke clients usually need this kind of exercise. In most cases, passive exercises are part of the rehabilitation process. It aims to prevent the muscle from stiffening because the person cannot voluntarily move their body. Examples are the following:

- **Passive range of motion** – The trained person moves or stretches the body parts of the person exercising; examples are the arms and legs.
- **Ice or heat therapy** – Body parts that are swelling or in need of pain relief are applied with ice or warm packs. Ice packs can help reduce swelling, and warm packs assist blood circulation.
- **Massage therapy** – This can help relax and loosen muscles.
- **Functional neuromuscular stimulation (FNS)**
- **Facilitated electrical stimulated (FES) exercise**
- **Technician- assisted exercise**
- **Use of leg extension or leg-cycling equipment**

There are specific individuals who might benefit from this type of exercise. Some of them are stroke survivors with mild to severe paraesthesia, also known as paresis.

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Active Physical Activity

Active exercises mean the person exercising is actively performing the activities on their own. Active exercise is recommended for clients who have the physical capability to perform active exercises. These kinds of exercises increase communication between the body and brain. Examples are:

- Muscle-strengthening and bone-strengthening activities, such as running, walking, jumping, lifting weights, etc.
- Flexibility activities, such as side stretches, yoga exercises, touching your toes, etc.

The following are the recommended number of physical activities according to the World Health Organization (WHO).

- In a day, infants who are not yet mobile must be put in prone position for at least 30 minutes spread throughout the day while awake.
- Infants 0-3 months of age must have 14-17 hours of good quality sleep, including naps.

- Children 1-2 years of age should spend at least 180 minutes in a variety of physical activities in a day.
- Children 1-2 years of age must have 11-14 hours of good quality sleep, including naps, with regular sleep and wake-up times.
- Children 3-4 years of age should spend at least 180 minutes in a variety of physical activities in a day. At least 60 minutes must be moderate- to vigorous-intensity physical activities.
- Children 3-4 years of age must have 10-13 hours of good quality sleep, including naps, with regular sleep and wake-up times.
- Children and adolescents aged 5-17 years must do at least an average of 60 minutes of moderate- to vigorous-intensity physical activities in a week. They must limit the amount of time being spent being sedentary.

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- Adults aged 18-64 years must do at least 150-300 minutes of moderate-intensity aerobic physical activity. They must replace the amount of time being sedentary with physical activity of any intensity.
- As part of their weekly physical activity, adults aged 65 years and above must do varied multicomponent physical activity that emphasises functional balance.

Multimedia

The Panorama Orthopedics and Spine Center published a video in 2019 showing some of the passive range of motion exercises for clients who had a hip surgery.

Using a Partner for Assisted Passive Range of Motion Exercises

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Checkpoint! Let's Review

1. The factors that can contribute to the maintenance of a healthy body are:
    - Body regulation
    - Protection from infection
    - Physical activity
    - Regulating the body includes:
    - Maintenance of a normal body temperature
    - Fluid and electrolyte balance
    - Elimination of wastes
    - Maintenance of normal blood pressure levels

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2.3 Enhance Quality of Work by Utilising Information About Healthy Body Functioning

Healthcare work is challenging but rewarding work. The quality of work you will provide can significantly impact the health of your clients. You will be handling clients with different needs and health conditions. You must continuously improve your work activities to ensure that you will and can provide the best possible health care.

Work activities are the specific tasks included in your work role. You can review the unit introduction for examples of work activities. Some examples were also provided at the end of Section 1.1.13.

You can use your knowledge about how a healthy body works in a lot of ways to help your clients. It can help you judge their health conditions. Because you can recognise the symptoms, you will be able to provide the proper care for each client. You can also help them by communicating your knowledge about a healthy body.

This subchapter will help you add value not only to your work but also to every person who will be under your care by:

- Using information about a healthy body
- Sharing information about a healthy body

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2.3.1 Enhance Quality of Work Activities by Using Information About Healthy Functioning of the Body

You are a critical player in the health industry. You will also have a diverse work role as you deal with different clients. Here are some of the areas you can improve using your knowledge about a healthy functioning body:

- **Assist clients in having better habits to maintain their bodies' health.**

  You can teach your clients how they can take care of their bodies by sharing what you learnt from Subchapter 2.1. The factors contributing to maintaining a healthy body are helpful for the clients. You can assess their need for proper nutrition depending on their current health condition. Determine the appropriate physical activities they need. Help them build new habits and encourage them to monitor their health regularly.

- **Collect and interpret the client's medical health status accurately.**

  You know what a healthy functioning body system looks like. You can have a proper observation of the client's signs and symptoms. Section 1.2.3 taught you how to take vital signs and recognise if there is an imbalance in the body's homeostasis.

- **Administer medication correctly.**

  Having detailed knowledge about the body parts will greatly help you administer medications. You may also be in situations where you must teach your clients how to administer the medicines themselves.

- **Explain the client's health status.**

  As discussed in Section 1.2.2, you can use your knowledge to help the clients understand their condition. It enables the clients to stay calm and not overthink when they know what is happening to them.

- **Provide excellent assistance to health care professionals and specialists.**

  You will be able to assist health care professionals effectively. You can talk to them in the same language because you also have the knowledge of what a healthy body is. You can connect the client to the correct specialist/ professional or facility.

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2.3.2 Enhance Quality of Work Activities by Sharing Information About Healthy Functioning of the Body

Many clients suffer from illnesses and several diseases because they just do not know how to care for their bodies. One of the ways you can provide premium healthcare is to share the knowledge and information on how to keep the body healthy. You can educate your clients. You can invite them to participate in their care and wellness actively. When more people are well-informed about how the body works, you will find that you can deal with your work role more efficiently.

The following are some of the ways you can share information about a healthy functioning body:

- Client education
- Visual posters and brochures
- Trainings and seminars

Client Education

Health communication is central to health care. When you can share the information in a way your client understands, it can impact their health decisions and actions. You will be dealing with two kinds of clients – clients with many questions and clients who do not know what to ask.

Take advantage of all the times you are with your client. Directly share with them information about a healthy body. For example, if your client is dealing with a heart condition, you can talk them through the importance of the heart in all body processes. You can share with them how it works and how it becomes affected by their habits and activities. Like you, when the client understands how it works, they will also understand how the treatment will work. They will be more cooperative in doing the health interventions they need.

Here are some of the guidelines you can consider when sharing information directly with your clients:

- Explain the concepts without using medical jargon.
- Try to ask the client to explain the concept in their own words.
- Clarify any misunderstanding.
- Repeat the explanation if needed.
- If the health condition is complicated, break down the information into pieces.
- Use a caring tone.

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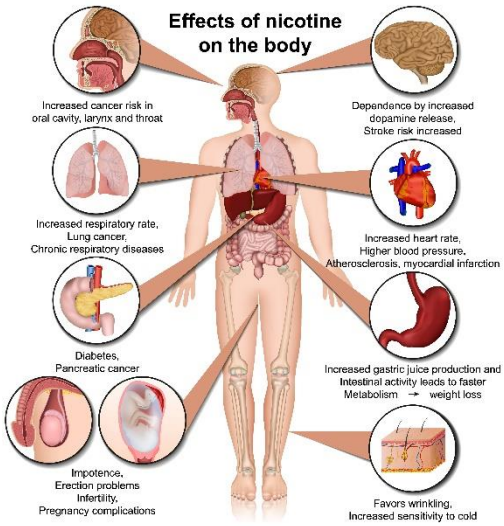
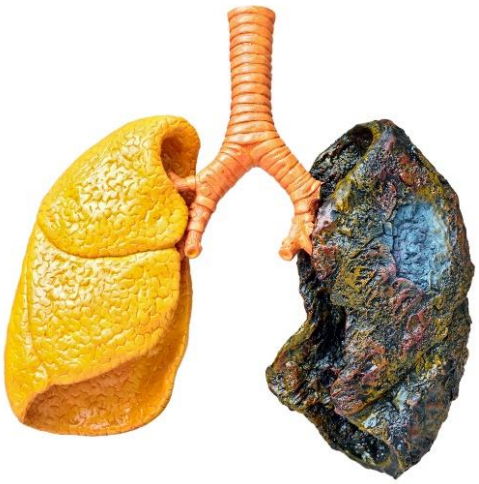
Visual Posters and Brochures

Do you remember a clinic or hospital you visited and seeing posters on almost all walls of the facility? A typical example is a visual poster about the effects of smoking on the body. Take a look at the following images.

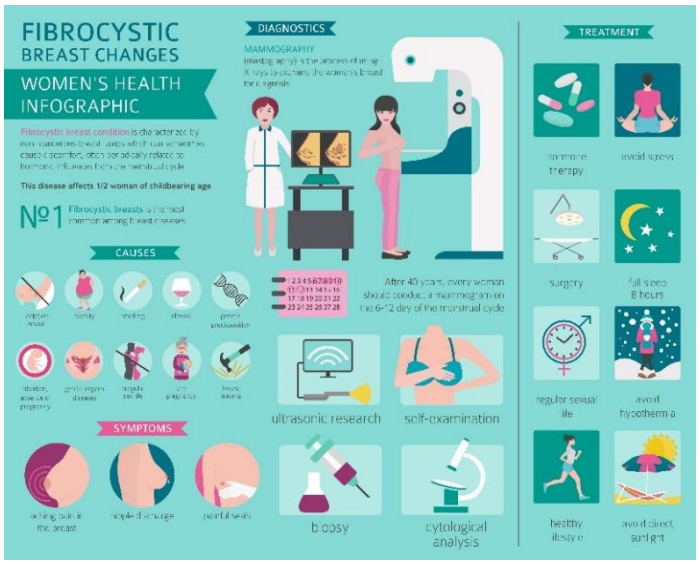




Can you remember seeing a similar image posted in your workplace? A *visual poster* is a form of communication where the text and images are placed on a large, printed sheet. Visual posters are great tools for information dissemination. They are creative, concise and often easier to remember.

Post visual aids and provide short readings about health in strategic areas in the workplace. For example, in the waiting area, the clients will have time to read. Display posters about the importance of a healthy body or the effect of bad habits on the body.

You can also provide *brochures*. These documents are like mini magazines that contain important information about health diseases and the signs and symptoms they should be looking for. Sometimes, you will be too busy to provide one-on-one client education. A ready brochure containing information about the condition and treatment can also help the clients. You can simplify the concepts and provide illustrations to help them understand them better.



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Training and Seminars

Clients are not the only ones who should be well-informed and educated. Your colleagues and the other people you work with should also have the same information to provide quality care. You can give a training or seminar to inform colleagues about the healthy functioning of the body. Activities like this are important to refresh knowledge. It can also update everyone with the currently available treatments.

Checkpoint! Let's Review

1. You can add value not only to your work but also to every person who will be under your care by:
    - Using information about a healthy body
    - Sharing information about a healthy body
2. You can share information about a healthy functioning body through:
    - Client education
    - Visual posters and brochures
    - Training and seminars

Learning Activity for Chapter 2

Well done completing this chapter. You may now proceed to your **Learning Activity Booklet** (provided along with this Learner Guide) and complete the learning activities associated with this chapter.

Please coordinate with your trainer/training organisation for additional instructions and guidance in completing these practical activities.

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References

Australian Institute of Health and Welfare. (2017, August 7). *Risk factors to health*. https://www.aihw.gov.au/reports/biomedical-risk-factors/risk-factors-to-health/contents/nutrition

Australian Institute of Health and Welfare. (2021, June 25). *Australia's youth: Physical activity*. https://www.aihw.gov.au/reports/children-youth/physical-activity

Australian Institute of Health and Welfare. (2022, August 29). *Smoking*. https://www.aihw.gov.au/reports-data/behaviours-risk-factors/smoking/overview

Chruścik, A., Kauter, K., Windus, L., & Whiteside, E. (2021). *Fundamentals of anatomy and physiology*. University of Southern Queensland. https://usq.pressbooks.pub/anatomy/

Commonwealth of Australia. (2018). *Alcohol*. National Health and Medical Research Council. https://www.nhmrc.gov.au/health-advice/alcohol

Commonwealth of Australia. (2021, May 7). *Physical activity and exercise guidelines for all Australians*. Department of Health and Aged Care. https://www.health.gov.au/health-topics/physical-activity-and-exercise/physical-activity-and-exercise-guidelines-for-all-australians

CrashCourse. (2015, December 1). *Lymphatic system: Crash course anatomy & physiology #44* [Video]. YouTube. https://www.youtube.com/watch?v=I7orwMgTQ5I&ab_channel=CrashCourse

Dr Matt and Dr Mike. (2022, March 1). *Homeostasis* [Video]. YouTube. https://www.youtube.com/watch?v=CMEre2VdSSc

Gordon Betts, J., Young, K. A., Wise, J. A., Johnson, E., Poe, B., Kruse, D. H., Korol, O., Johnson, J. E., Womble, M., & DeSaix, P. (2013a). 4.3 Connective tissue supports and protects. In *Anatomy and Physiology*. OpenStax. https://openstax.org/books/anatomy-and-physiology/pages/4-3-connective-tissue-supports-and-protects

Gordon Betts, J., Young, K. A., Wise, J. A., Johnson, E., Poe, B., Kruse, D. H., Korol, O., Johnson, J. E., Womble, M., & DeSaix, P. (2013b). 4.4 Muscle tissue and motion. In *Anatomy and Physiology*. OpenStax. https://openstax.org/books/anatomy-and-physiology/pages/4-4-muscle-tissue-and-motion

khanacademymedicine. (2015, January 23). *The vestibular system, balance, and dizziness | Processing the environment | MCAT | Khan Academy* [Video]. YouTube. https://www.youtube.com/watch?v=1AZnFszUroI

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OpenStax. (2020). *Book: Anatomy and physiology (OpenStax)*. LibreTexts MEDICINE. https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Book%3A_Anatomy_and_Physiology_(OpenStax)

Panorama Orthopedics & Spine Center. (2019, May 11). *Using a partner for assisted passive range of motion exercises* [Video]. YouTube. https://www.youtube.com/watch?v=VfKs2cUKJR0

University College London Hospitals NHS Foundation Trust. (2013, August 13). *How to do a blood glucose test* [Video]. YouTube. https://www.youtube.com/watch?v=GoV2p1y6flI

Whitmer, K. H. (2021). *A mixed course-based research approach to human physiology*. Iowa State University Digital Press. https://iastate.pressbooks.pub/curehumanphysiology/

Wilk-Blaszczak, M. (2018). Lab 5: Special senses. In *Human anatomy lab manual.* Mavs Open Press. https://uta.pressbooks.pub/anatomylab/chapter/lab-5-special-senses/

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