CONTENTS

NB Some spellings of medical terms may vary - words are sometimes used in their internationally accepted format.

By Harry Jivenmukta

THE DIGESTIVE SYSTEM

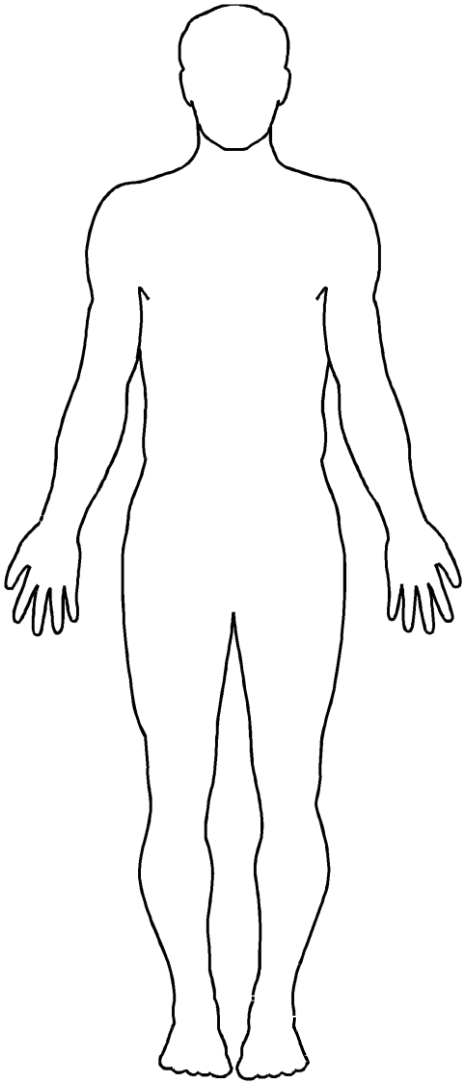
The digestive system is responsible for:

- processing food,
- breaking it down into proteins, carbohydrates, minerals, fats, etc.,
- introducing these into the bloodstream so that they can be used by the body.

The digestive process begins in the mouth, where the teeth and tongue start to break down the food we eat. The process is helped by saliva which is secreted by the salivary glands. The chewed food, combined with saliva, is then swallowed, and it is carried down the oesophagus to the stomach. In the stomach, the food mixes with hydrochloric acid which further assists in breaking it down. When the food is properly digested, the fluid remaining, called chyme, is passed into the small intestine and large intestines. Within the long intestinal canals, the nutrients are absorbed from the chyme into the bloodstream, leaving the unusable residue. This residue passes through the colon. It is squeezed as it passes through and the water in it is largely removed and passed into the bloodstream to be used by the body. The rest goes into the rectum where it is stored until it is excreted. This solid waste, called faeces, passes through the anal canal and the anus.

Other organs release enzymes to help digestion as the chyme passes through. These are the:

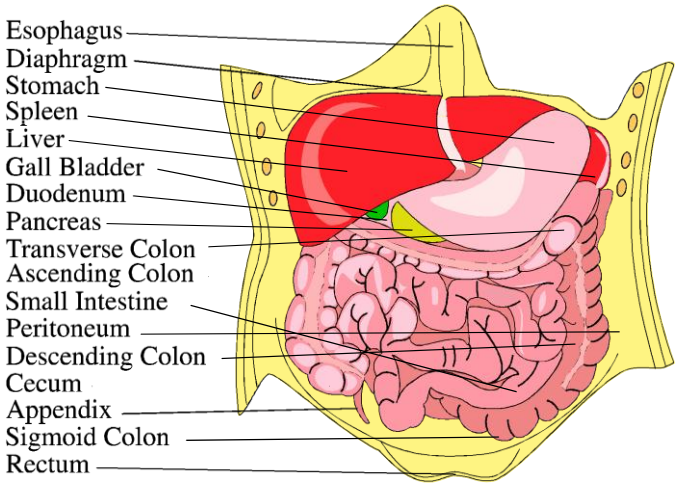
- pancreas,
- spleen,
- liver,
- gall bladder.



Draw the digestive system into the body illustration above. Try to draw in the correct proportions, and label the parts in the empty space on the right hand side of the picture.

THE DIGESTIVE SYSTEM

Abdominal Digestive Organs



Questions...

1. Write a short description of what the digestive system is and how it works.
2. Study the illustration above. Find out more about three of the listed organs.
3. Select one important part of the digestive process and write about how it links with the processes of other organs.
4. Draw a simple diagram showing how the digestive system works. It has been started for you.

Food is placed in the mouth → Food is chewed by the teeth ↓

↓

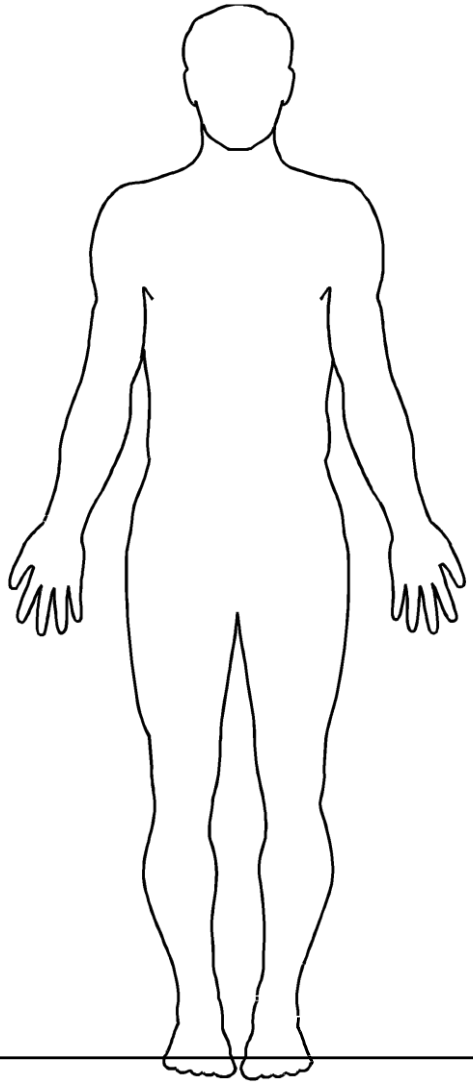
THE RESPIRATORY SYSTEM

The respiratory system is responsible for:

- supplying oxygen to the blood,
- expelling waste gases, (mainly carbon dioxide), from the body.

A good way to understand the respiratory system is to imagine it as an upside down tree. The main trunk, (trachea or windpipe) branches off into the right and left lung. The lungs contain smaller passages, (bronchioles), which then split themselves into smaller and smaller passageways. There are thousands of tiny alveolar chambers at the ends of the tiny branches where the oxygen is transferred to the blood cells. The remaining unwanted gases are passed back and out of the mouth when we breathe out. Below is a traditional technical description of the process.

The larynx, or voicebox, is located at the head of the trachea, or windpipe. The trachea extends down to the bronchi which branch off at the tracheal bifurcation to enter the hilus of the left or right lung. The lungs contain the narrower passageways, or bronchioles, which carry air to the functional unit of the lungs, the alveoli. There, in the thousands of tiny alveolar chambers, oxygen is transferred through the membrane of the alveolar walls to the blood cells in the capillaries within. Likewise, waste gases diffuse out of the blood cells into the air in the alveoli, to be expelled upon exhalation. The Diaphragm, a large, thin muscle below the lungs, and the intercostal and abdominal muscles are responsible for contracting and expanding the thoracic cavity to effect respiration. The ribs serve as a structural support for the whole thoracic arrangement, and pleural membranes help provide lubrication for the respiratory organs so that they are not chafed during respiration.



Draw the respiratory system into the body illustration above. Try to draw in the correct proportions, and label the parts in the empty space on the right hand side of the picture.

THE RESPIRATORY SYSTEM

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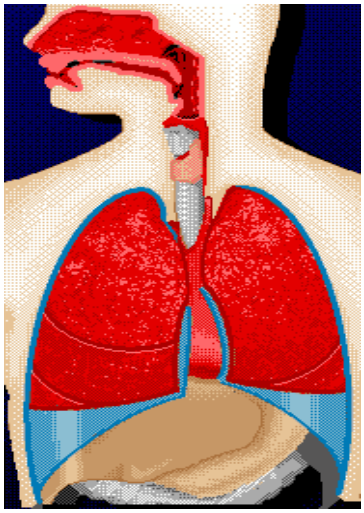


Questions...

1. What is the respiratory system?
2. How does it work?
3. Find out and write about how the division occurs which separates the food intake process with the air intake process.
4. Draw an illustration showing how the lung splits into smaller and smaller passageways and eventually feeds oxygen into the bloodstream.

THE CIRCULATORY SYSTEM

The circulatory system is a process which ensures that essential food and oxygen are efficiently passed around the body and supplied in the required amounts. The driving force of the circulatory system is the heart which pumps blood around the body. The supply has to be sufficient to meet every need. Sometimes, for instance when a person is participating in active sport, the needs are greater and the heart will work harder to supply more essential energy. The other job of the circulatory system is to remove unwanted gases and some types of waste. Below is a more technical explanation:

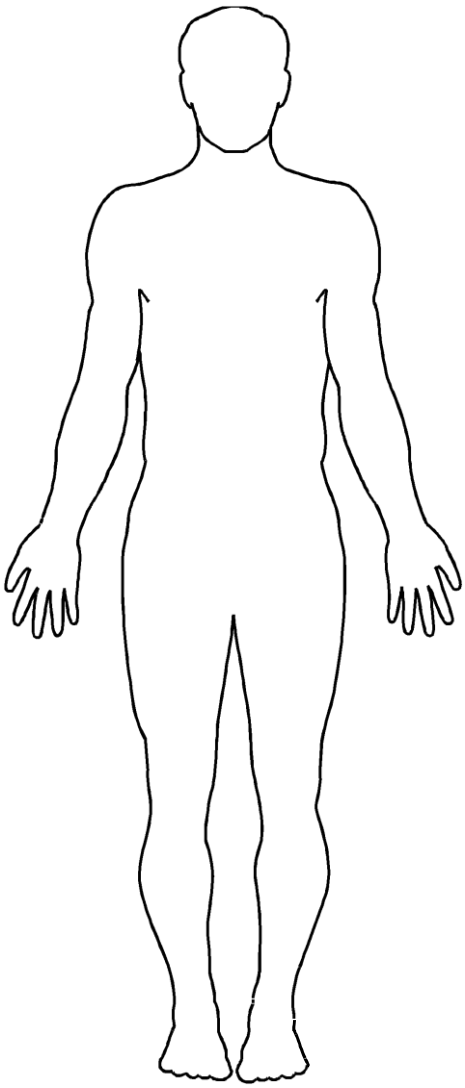
In order for the body to stay alive, each of its cells must receive a continuous supply of:

- *food,*
- *oxygen.*

The primary circulatory system consists of the heart and blood vessels, which together maintain a continuous flow of blood through the body delivering oxygen and nutrients to and removing carbon dioxide and waste products from peripheral tissues.

A subsystem of the circulatory system, the lymphatic system, collects interstitial fluid and returns it to the blood. The heart pumps oxygen-rich blood from the lungs to all parts of the body through a network of arteries, and smaller branches called arterioles. Blood returns to the heart via small venules, which lead to the larger veins. Arterioles and venules are linked to even smaller vessels called metarterioles. Capillaries, blood vessels a single cell thick, branch off from the metarterioles and then rejoin them. The network of tiny capillaries is where the exchange of oxygen and carbon dioxide between blood and body cells takes place.

The average adult has over 60,000 miles of blood vessels in their body.



Draw the heart and main arteries into the body illustration above. Try to draw in the correct proportions, and label the parts in the empty space on the right hand side of the picture.

THE CIRCULATORY SYSTEM

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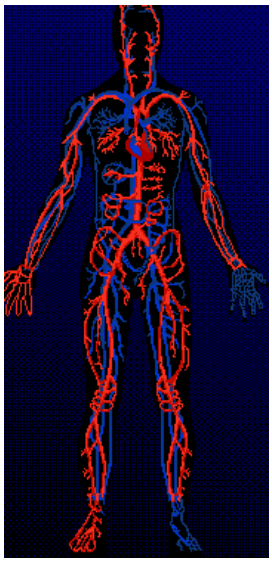


Questions...

1. What are the main functions of the circulatory system?
2. What is the difference between arteries and veins?
3. What might happen if the circulatory system became blocked? Give examples.
4. Draw a representative illustration, (not a human body), showing how the circulatory system operates. An example might be to compare it to the road and rail system which keeps a nation supplied and functioning, (but do not use this example as your illustration).

MUSCLES

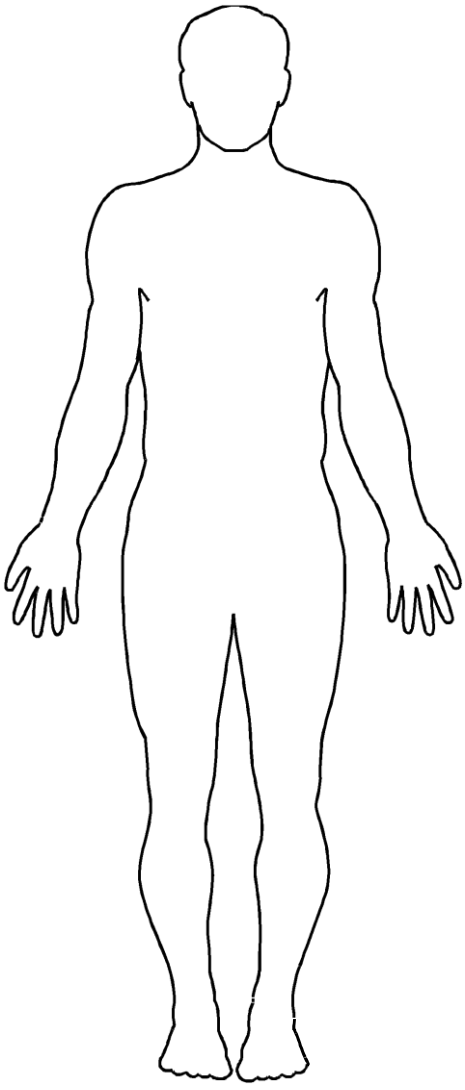
The human body contains more than 650 muscles joined to the skeleton. The function of the muscles is to give you power so that you can move around. Muscles make up about 40% of a person's total body weight. Without muscles we would be unable to do the smallest task.

The muscle's points of attachment to bones or other muscles are called the point of origin or insertion. The point of origin is the point of attachment to the bone to which the muscle is anchored. The point of insertion is the point of attachment to the bone the muscle moves. Usually, the muscles are attached by tough fibrous structures called tendons. These attachments bridge one or more joints and the result of muscle contraction is movement of these joints. The body is moved mainly by groups of muscles rather than by individual muscles. These groups of muscles power all actions ranging from turning on a light switch to the lifting of heavy weights.

In humans, the muscle systems are classified by appearance and location of cells. The three types of muscles are;

- *striated (or skeletal),*
- *cardiac,*
- *smooth (or nonstriated).*

Striated muscle is almost exclusively attached to the skeleton and constitutes the bulk of the body's muscle tissue. The fibres are under the control of the somatic nervous system and cause movement by forces exerted on the skeleton similar to levers and pulleys. The rhythmic contraction of cardiac muscle is regulated by the sinoatrial node, the heart's pacemaker. Smooth muscle lines the viscera, blood vessels, and dermis, and, like cardiac muscle, its movements are operated by the autonomic nervous system and are not under voluntary control.



Draw the main muscle groups into one arm or leg of the body illustration above. Try to draw in the correct proportion, and label the parts in the empty space on the right hand side of the picture.

MUSCLES

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Questions...

1. What are the functions of muscles?
2. Explain why muscles usually work together rather than functioning alone.
3. How are muscles joined to the skeleton?
4. Draw an illustration showing how a muscle works.

THE SKELETON

The skeleton is the framework which supports the body and protects its internal organs. Two hundred and six bones compose the skeleton, about half of which are in the hands and feet. Most of the bones are connected to other bones at flexible joints, which allow the frame- work a high degree of flexibility. Only one bone, the hyoid, is not directly connected to another bone. It anchors the tongue and is attached to the skull by ligament.

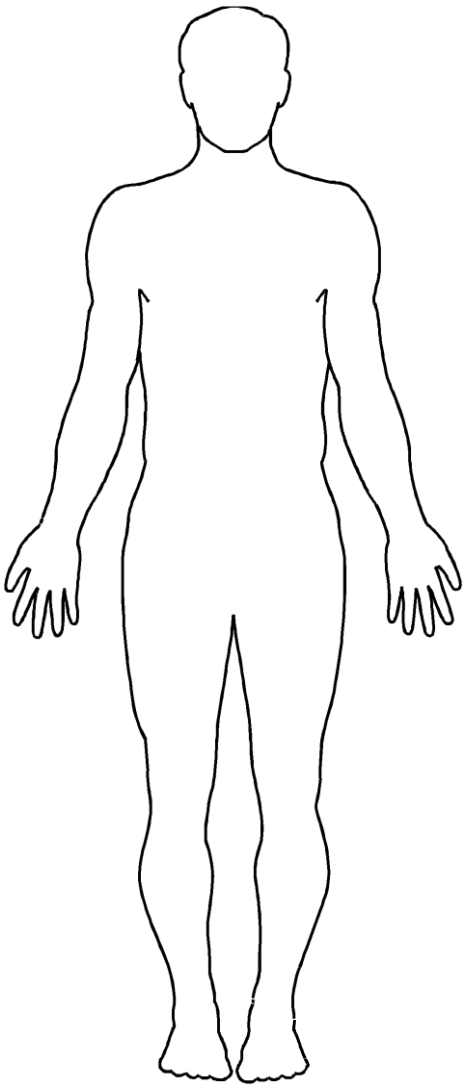
The skeletons of male and female bodies are almost the same, with the only noticeable exceptions being that female bones are usually lighter and thinner than male bones, and the female pelvis is shallower and wider than the male's. This difference makes childbirth easier.

The human skeleton, like that of other vertebrates consists of three subdivisions, each with origins distinct from the others and each showing certain individual features. These are:

- *the **axial**, comprising the vertebral column, the spine, and much of the skull,*
- *the **visceral**, comprising the lower jaw, some elements of the upper jaw, and the branchial arches, including the hyoid bone, (around the throat and head),*
- *the **appendicular**, to which the hip and shoulder girdles and the bones and cartilages of the limbs belong.*

The bones of the skeleton are connected to each other and to the rest of the body by one or more of a variety of 'connectors', including:

- *cartilage,*
- *ligaments,*
- *tendons.*



Draw the bones of one arm or leg into the body illustration above. Try to draw in the correct proportion, and label the parts in the empty space on the right hand side of the picture.

THE SKELETON

Questions...

1. What is the function of the skeleton?
2. How is the skeleton of a male and female body different? Why is this so?
3. How are bones joined to each other?
4. Draw a detailed picture of the human hand or foot.

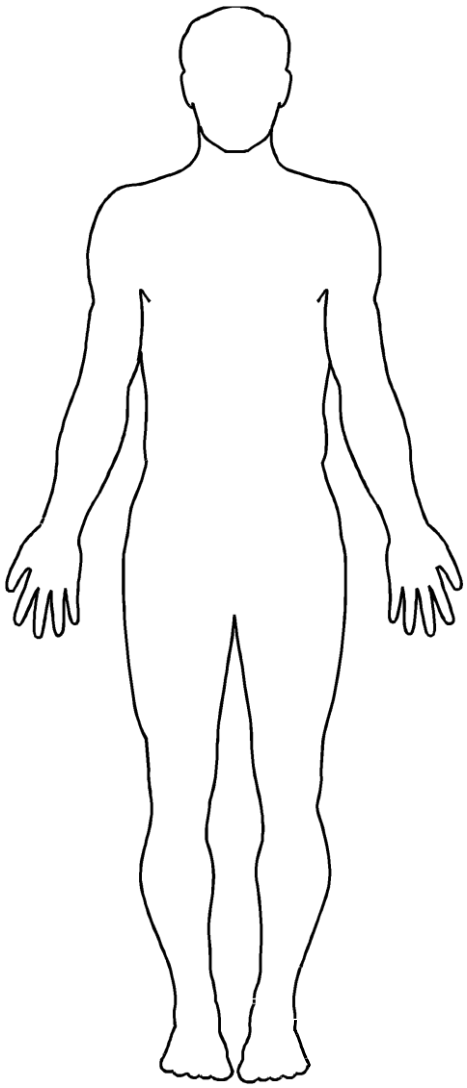
THE NERVOUS SYSTEM

The nervous system of the human anatomy is responsible for sending, receiving, and processing nerve impulses. All of the body's muscles and organs rely upon these nerve impulses to function. Three systems work together to carry out the mission of the nervous system: the central, the peripheral, and the autonomic nervous systems.

- The **central nervous system** is responsible for sending nerve impulses and analysing sensory data, and includes the brain and spinal cord.
- The **peripheral nervous system** is responsible for carrying nerve impulses to and from the body's many structures, and includes the many craniospinal nerves which branch off of the brain and spinal cord.
- The **autonomic nervous system** is composed of the sympathetic and parasympathetic systems and is responsible for regulating and coordinating the functions of vital structures in the body.

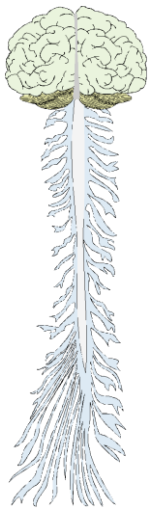
The brain is the primary component of the nervous system, occupying the cranial cavity. Without its outermost protective membrane, the brain weighs an average of about 1.4 kilograms, comprising about 97% of the entire central nervous system. The brain is connected to the upper end of the spinal cord and is responsible for issuing nerve impulses, processing nerve impulse data, and engaging in the higher order thought processes. The brain is divided into three parts:

- the large cerebrum,
- the smaller cerebellum,
- the brainstem leading to the spinal cord. The brainstem is also divided into the medulla oblongata, the midbrain, and the pons.



Draw the main group of nerves from the brain to the base of the spine into the body illustration above. Show how the nerves spread out into the rest of the body.

THE NERVOUS SYSTEM



Questions...

1. What is the nervous system?
2. Why do we need a nervous system? Give examples.
3. What does the illustration above show us about the nervous system?
4. What part does the brain play in the nervous system?
5. Draw a picture showing how the nervous system spreads throughout the body.

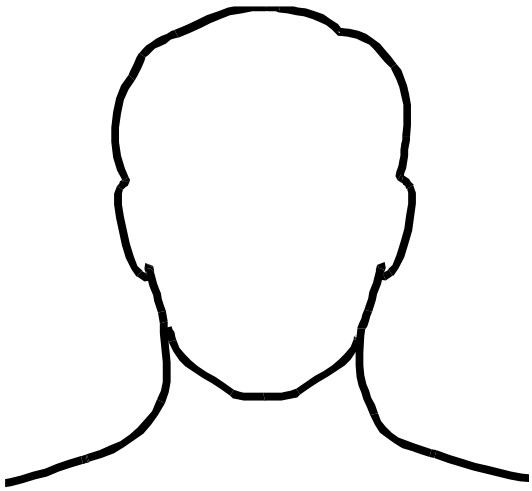
The sensory organs are:

- the eyes,
- the nose,
- the ears,
- the mouth and tongue,
- feeling through the skin, especially the fingers and hands.

The description and function of the eye.

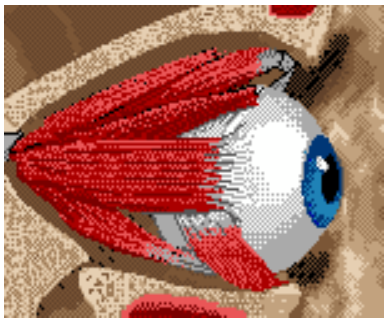
The eyeball lies nestled in fat within the orbital cavities of the skull, where it is situated above and lateral to the centre. Of all the senses, eyesight is often considered most important. According to some estimates, almost four-fifths of everything we know reaches the brain through our eyes. The eyes transmit images to the brain by electrical signals. The eyes receive information from light rays. The light rays are either absorbed or reflected. Objects that absorb all of the light rays appear black, whereas those that reflect all the light rays appear white. Coloured objects absorb certain parts of the light spectrum and reflect others. When you look at something, the light rays reflected from the object enter the eye. The light is refracted by the cornea and passes through the pupil to the lens. The iris controls the amount of light entering the eye. Then the lens focuses the light onto the retina, forming an image in reverse and upside down. Light-sensitive cells in the retina transmit the image to the brain by electrical signals. The brain "sees" the image the right way up.

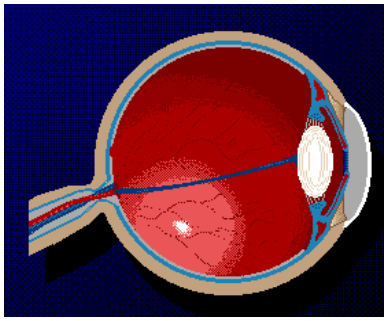
On the following page you will find exercises which ask you to find out about the other senses.



Draw the sensory organs of the human face into the body illustration above. Try to draw in the correct proportions, and label the parts in the empty space on the right hand side of the picture.

THE SENSORY ORGANS





Questions...

1. What are sensory organs?
2. How does the eye work?
3. Select one other of the sensory organs and write a short paragraph on how it works.
4. Draw a picture to illustrate your description and aid understanding of the workings of the organ.

FEMALE REPRODUCTIVE SYSTEM

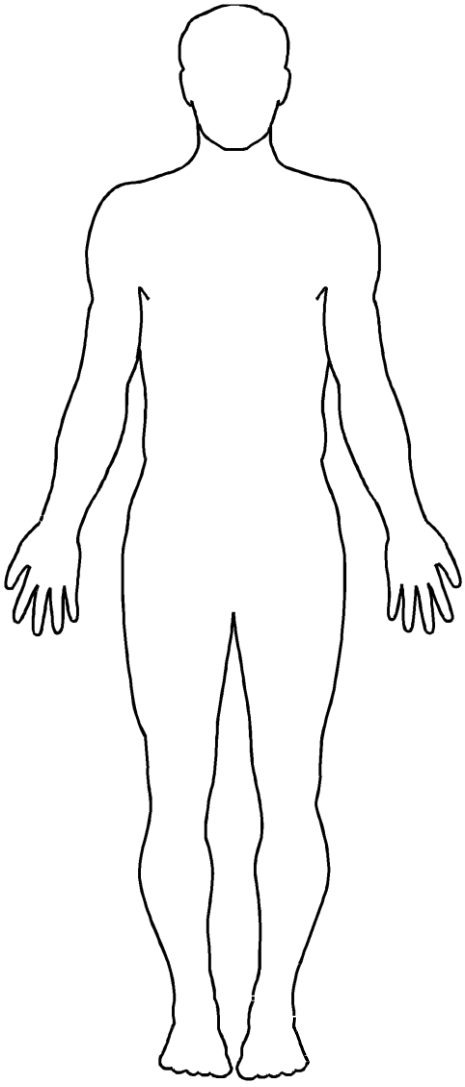
The female reproductive system is responsible for generating the ovum, or egg, for storing the fertilized ovum, and nourishing the gestating embryo and foetus. The chief organs include;

- the ovaries,
- the uterus,
- the vagina,
- the fallopian tubes.

External (vulvar) organs include;

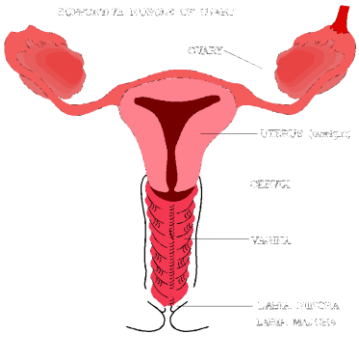
- the labia majora,
- the labia minora,
- the mons pubis,
- the clitoris,
- the vestibule,
- the greater vestibular cleft.

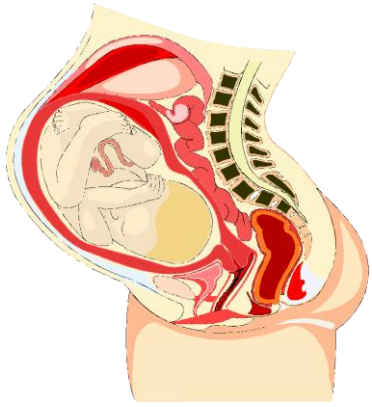
The ovum, or egg, contains the female's contribution to the genetic make-up of the new child, and is generated in the ovaries. The newly generated ovum is passed into the fallopian tube and there is fertilized by a sperm cell. During sexual arousal, a fluid created by the male's seminal vesicles and the prostate gland combines with the sperm cells to create semen, which is carried through the urethra and out of the opening in the end of the erect penis. When the semen is deposited in the female vagina, the spermatozoa swims through the uterus to the fallopian tube, where it fertilizes the ovum, or egg. The fertilized egg travels down the fallopian tube within the next three days and becomes attached to the wall of the uterus (womb). There, during pregnancy, the fertilized egg will be nourished and will develop into the embryo and, later, the foetus. Once fully developed (after about 9 months), muscular contractions (labour) will push the foetus out of the womb.



Draw the female sex organs into the body illustration above. Try to draw in the correct proportions, and label the parts in the empty space on the right hand side of the picture.

FEMALE REPRODUCTIVE SYSTEM





Questions...

1. Why is it important to understand human reproduction?

2. Why does biology concentrate more on the female sex organ and not as much on the male sex organ?

3. Find out more about the reproduction processes in humans and write a paragraph about conception.

4. Write a diary of important stages in the growth of the foetus. What information do you think a pregnant woman would want to know during this period?

THE FOETUS DIARY

Today, more and more people are concerned with their health and fitness and this can be seen in:

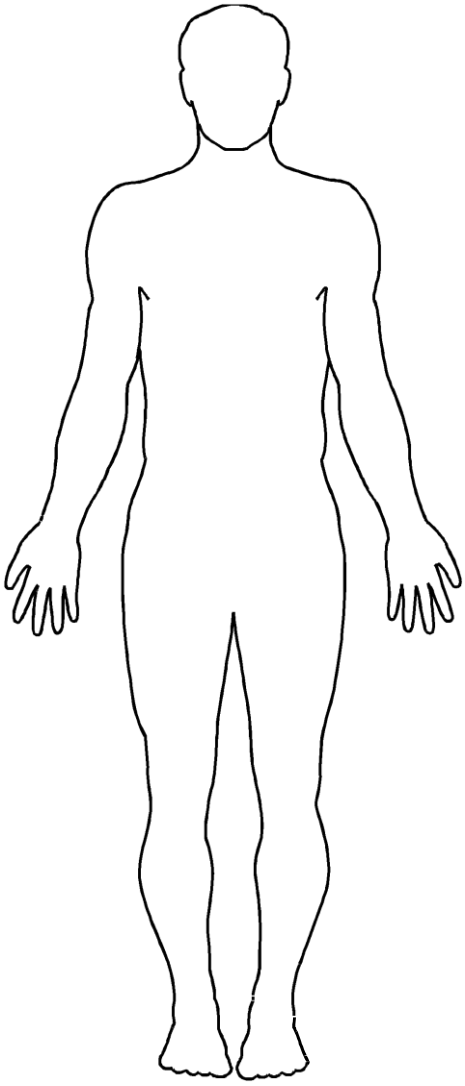
- participation in sports and exercises,
- concerns about diet and nutrition,
- considerations of household products used to maintain health.

One of the reasons why people are so much more aware of fitness and health is because of the way we live today. Machines do most of the hard and heavy work and so people do not tend to get much exercise through work. The amount and type of food available today also means that people tend to become overweight very easily. This combination of little hard physical work and lots of food availability means that people can become unfit very easily.

The growth of fitness and health centres, books and videos about health, and diets, is clear evidence of the growing problem.

There are other factors related to age groups which are also important to consider:

- **young people** tend to be less fit today than young people in the past because their leisure activities are less physically active; computer games, television, videos, etc.,
- **older people** are living longer and need to be more conscious of their health if they are to keep active and fit in their old age,
- more **young women** smoke today than ever before. One reason is that it is easier for smokers to stay slim because cigarettes suppress appetite. But there are obvious dangers for their babies and the health of the women themselves.



Highlight aspects of a healthy body in the body illustration above.

Questions...

1. What does healthy mean?
2. Why is keeping healthy important?
3. Does keeping healthy always mean exercising? What other factors affect good health?
4. What does being healthy mean to you? Write a paragraph to explain your opinions.
5. Write a list of things which we should do in order to improve and maintain our health.

TIPS FOR A HEALTHY LIFE

COMMON CHARACTERSITICS OF LIVING THINGS

All living things have certain things in common. It is useful to remember these when studying biology because it reminds us of the similarities and essential functions of a living thing, whether it be a plant or a person. In very simple terms living things can be studied by learning about the following common traits:

- **NUTRITION** - All living things need food. Nutrients in the food give energy for other functions to take place.
- **GROWTH** - All living things grow. This is usually to become larger, and the growth also usually produces a more complicated and advanced structure.
- **MOVEMENT** - Animals and humans move their whole bodies whilst other living things may be capable of moving only certain parts of their structure. Obvious movement in animals can be compared to more subtle movement in plants and small organisms.
- **RESPIRATION** - All living things need to extract energy from the food they consume. Part of this process usually involves taking in oxygen and expelling carbon dioxide.
- **EXCRETION** - All living things need to remove waste during the living process. Waste is often not only surplus to requirement but potentially dangerous if not excreted because it may become poisonous, (think of the acids in human digestion etc.).
- **REPRODUCTION** - The fundamental and basic instinct of all living things is to reproduce. Lifespans for some organisms can be as little as a few minutes and all their energy is spent on reproduction. On the other hand, humans may live for about 100 years, and reproduction, whilst being very important, is not the only activity of advanced living things.
- **SENSITIVITY** - All living things need to know about their surroundings and know how to maximise the food and nutrient intake among other things. Sensitivity in plants, for instance, can be seen in the movement of a plant towards the sun.

Questions...

1. Taking each of the listed points above compare human behaviour to that of plants.