



keep it simple science

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Photocopy Master Sheets

Years 9-10

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Topics Available

Year 7-8 General Science

<u>Disk Filename</u>	<u>Topic Name</u>
01.Energy	Energy
02.Forces	Forces
03.Matter	Solids, Liquids & Gases
04.Mixtures	Separating Mixtures
05.Elements	Elements & Compounds
06.Cells	Living Cells
07.Life	Living Things
08.LifeSystems	Plant & Animal Systems
09.Astronomy	Astronomy
10.Earth	The Earth
11.Ecosystems	Ecosystems

Year 9-10 General Science

<u>Disk Filename</u>	<u>Topic Name</u>
12.Waves	Wave Energy (inc. Light)
13.Motion	Forces & Motion
14.Electricity	Electricity
15.Atoms	Atoms & Elements
16.Reactions	Compounds & Reactions
17.DNA	Cell Division & DNA
18.Evolution	Evolution of Life
19.Health	Health & Reproduction
20.Universe	The Universe
21.EarthScience	Earth Science
22.Resources	Resources & Technology

Year 11-12 Science Courses

Biology

Preliminary Core
Local Ecosystem
Patterns in Nature
Life on Earth
Evolution Aust. Biota
HSC Core
Maintain. a Balance
Blueprint of Life
Search for Better Health
Options
Communication
Genetics:Code Broken?

Chemistry

Preliminary Core
Chemical Earth
Metals
Water
Energy
HSC Core
Production of Materials
Acidic Environment
Chem.Monit.&Mngment
Options
Shipwrecks, Corrosion...
Industrial Chemistry

Earth & Envir. Science

Preliminary Core
Planet Earth...
Local Environment
Water Issues
Dynamic Earth
HSC Core
Tectonic Impacts
Environ's thru Time
Caring for the Country
Option
Introduced Species

Physics

Preliminary Core
World Communicates
Electrical Energy...
Moving About
Cosmic Engine
HSC Core
Space
Motors & Generators
Ideas to Implementation
Options
Quanta to Quarks
Astrophysics

All Topics Available as PHOTOCOPY MASTERS and/or KCiC

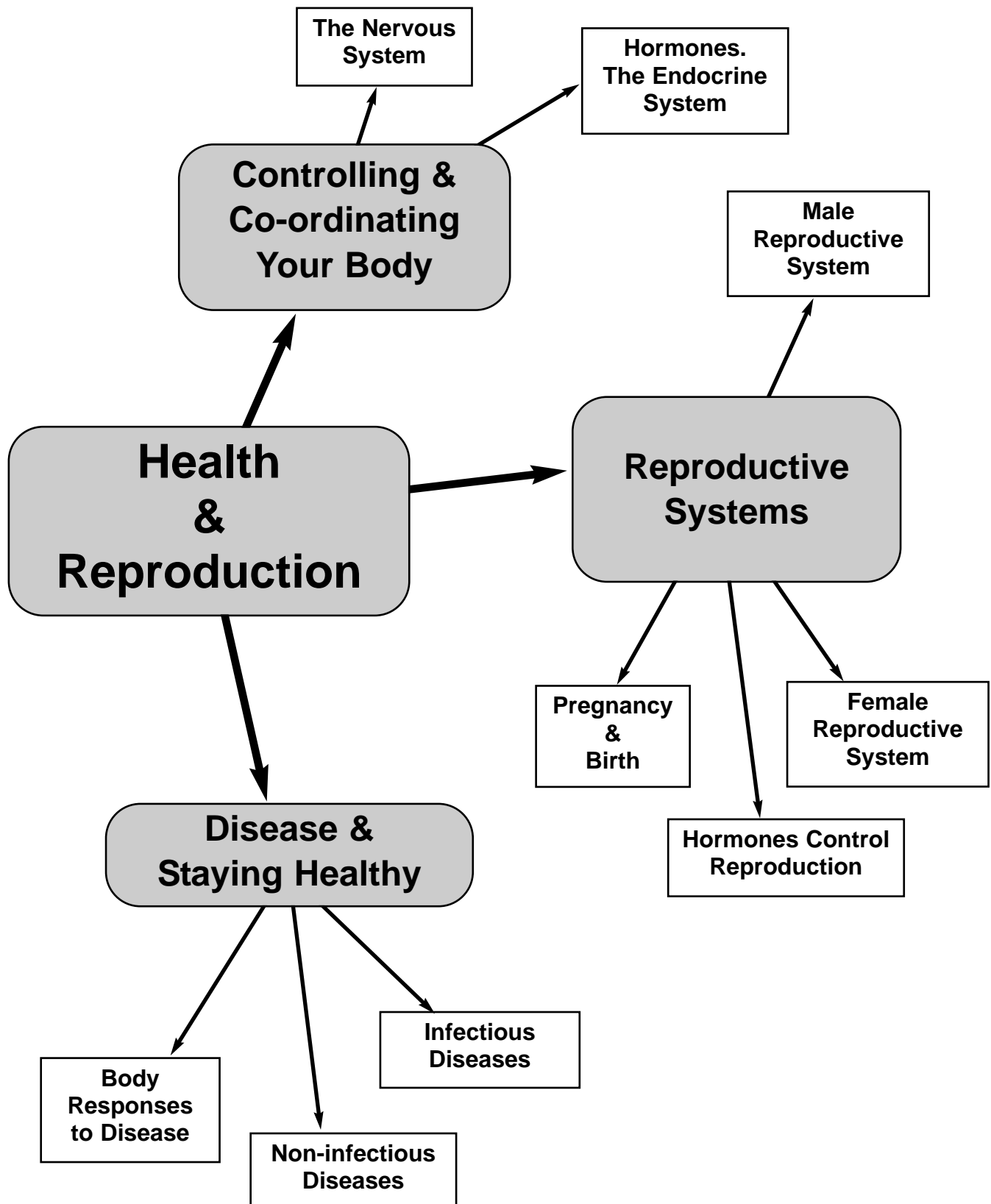
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for clear, economical photocopying.

KCiC = Key Concepts in Colour
Full colour, formatted for on-screen study
and data projection. PDF + Powerpoint®
Powerpoint is a trademark of Microsoft Corp.

“Mind-Map” Outline of Topic

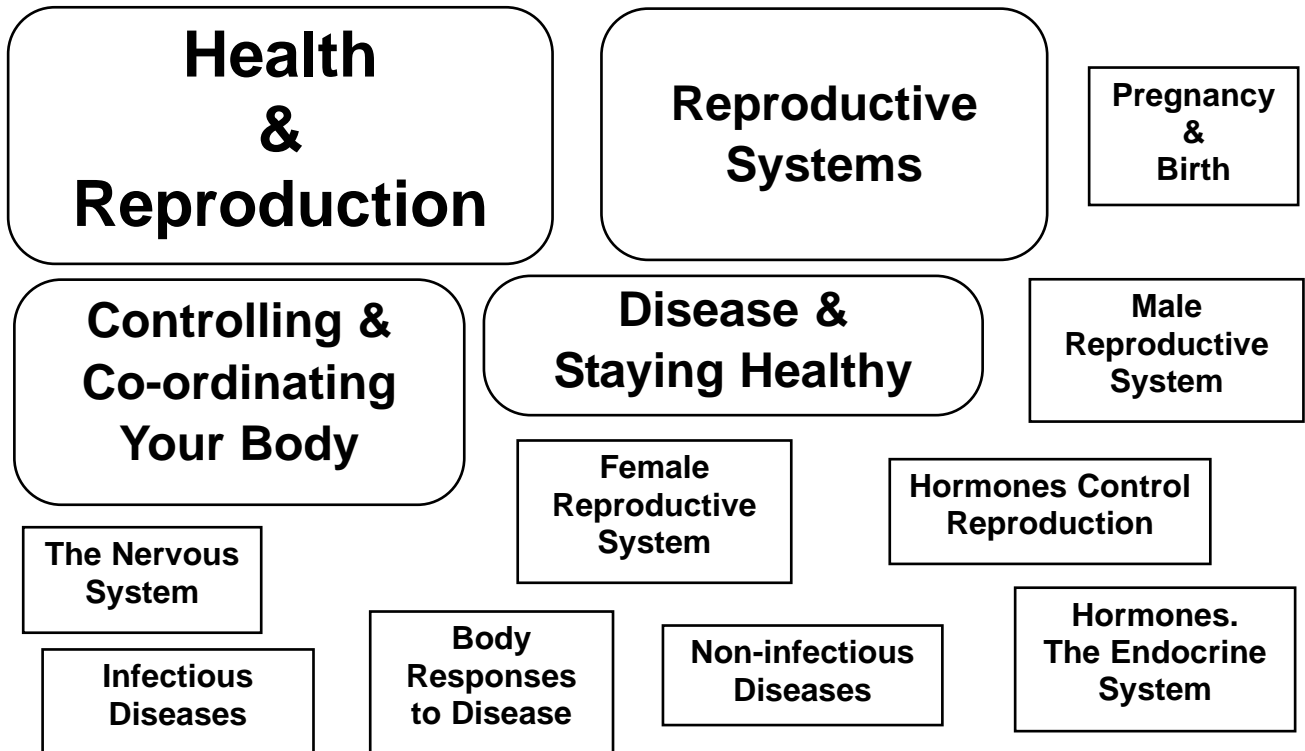
This topic belongs to the Biology branch of Science.

In this topic you will study some major body systems not previously covered, as well as learn about diseases and how your body fights back.



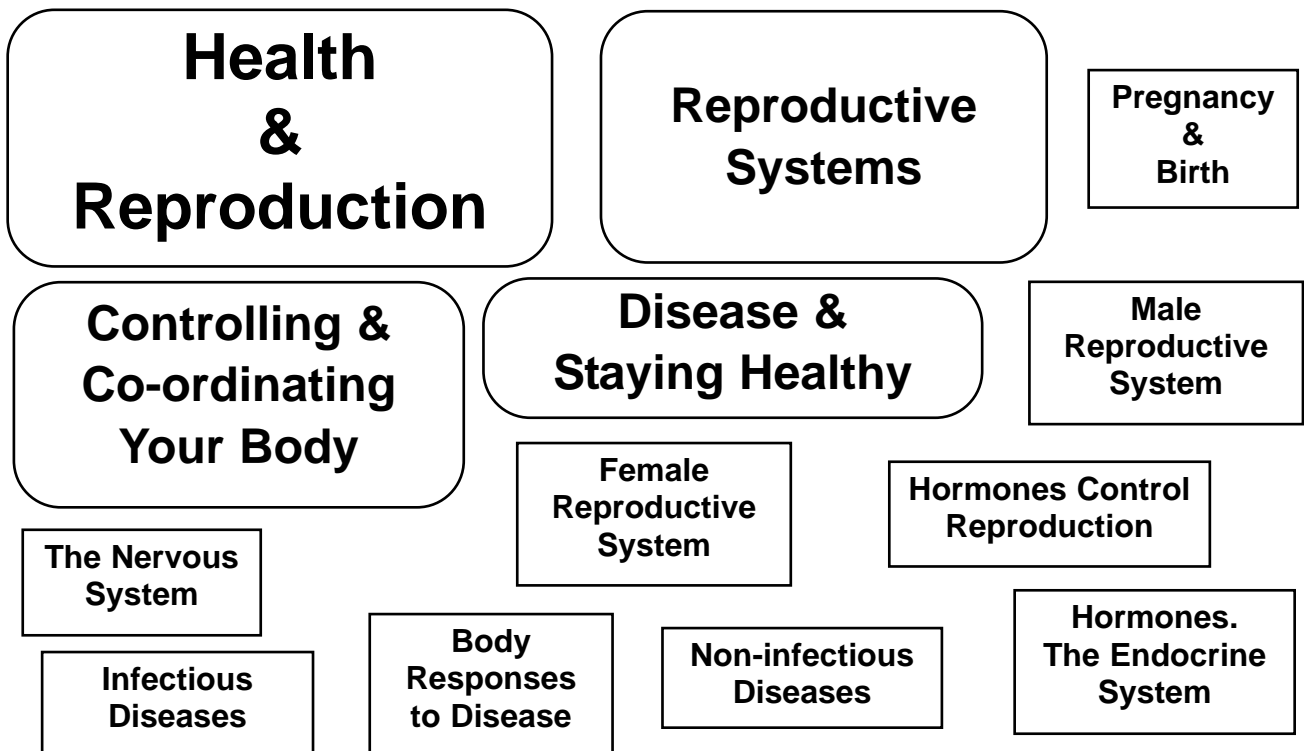
Make your own “Mind-Map” TITLE PAGE.

Cut out the boxes. Sort them into an appropriate lay-out on a page of your workbook, then glue them down. Add connecting arrows and colour in.



Make your own “Mind-Map” TITLE PAGE.

Cut out the boxes. Sort them into an appropriate lay-out on a page of your workbook, then glue them down. Add connecting arrows and colour in.



Human Body Systems

Your body is made up of many organ systems, each with its own special functions. Here is a quick revision of some important systems which you have studied previously. You need to be clear about their function, as well as the structures.

The Skeletal System

The skeleton is your system of bones. It has 3 main purposes:

- Protection of vital organs, such as the skull around the brain.
- To support the body, such as the backbone holding you upright.
- To allow movement. Your skeleton has many joints which allows your muscles to move your arms, legs, etc., for walking, swimming, and so on.

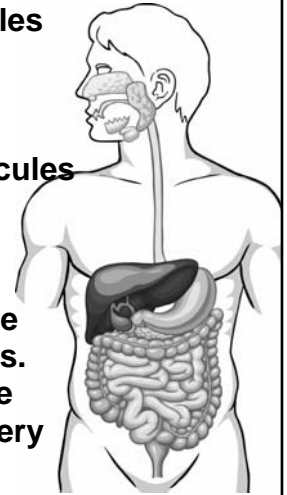


The Digestive System

As you know from studying living cells, every cell in your body needs food. The food chemicals must be able to enter each cell through the cell membrane, and this is only possible if the food molecules are very small.

However, most of the food we eat is made up of huge molecules which cannot enter a cell.

The purpose of the digestive system is to chemically break the food molecules into smaller parts. These are then absorbed into the blood stream to be carried to every part of the body.

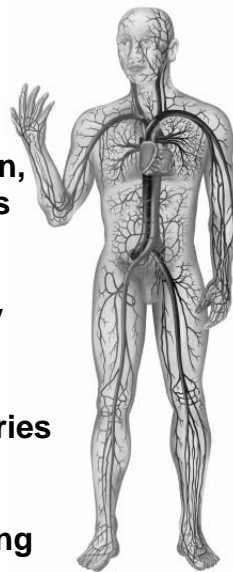


The Circulatory System

This is the system of blood circulation, including the heart, and many arteries and veins which carry the blood.

The purpose of the system is to carry food and oxygen to every cell in your body. The blood also collects waste chemicals (such as CO₂ gas) and carries it away from the cells for excretion.

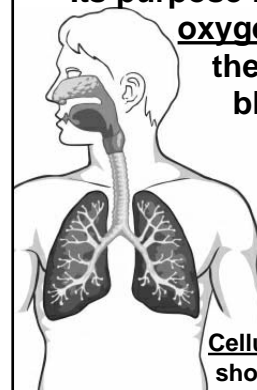
The blood is also involved in defending your body against disease.



Respiratory System

This is the lungs and associated air passages.

Its purpose is to absorb oxygen gas from the air into the blood, and to excrete the waste gas carbon dioxide.



The link to [Cellular Respiration](#) should be obvious.

The Excretory System (Urinary System)

“Excretion” means to remove waste materials from the body.

The left-over wastes from digestion are eliminated from your lower bowel. The waste gas CO₂ is excreted from your lungs. However, there are other wastes

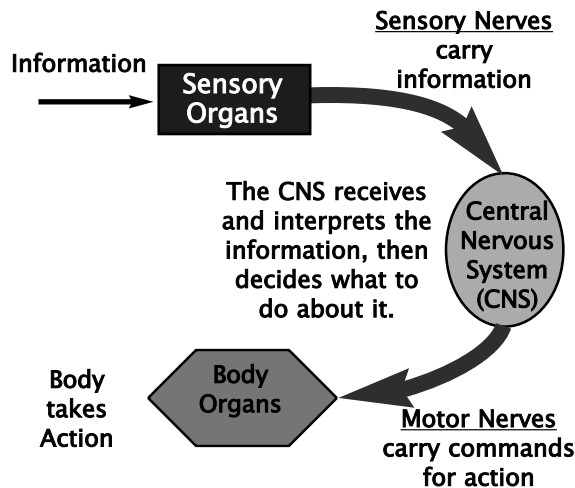
which accumulate in your blood stream and must be removed.

This is the job of your kidneys. They filter the blood and separate the wastes as urine, which is stored in the bladder until it is convenient to pass it.

Body Control & Co-ordination

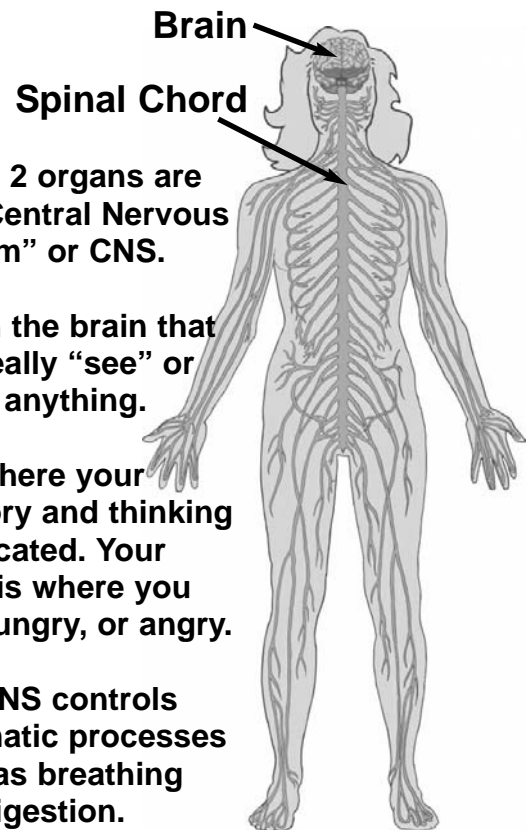
Your many body systems need to be controlled and co-ordinated so that you remain healthy, with everything working efficiently. You have 2 body systems which have the job of controlling and co-ordinating everything. The most important of these is the **Nervous System**

Schematic Diagram



The "Sensory Organs" are the eyes and ears, plus your senses of touch, taste and smell.

The main organs which "take action" when nerve commands arrive are the muscles.



The Brain



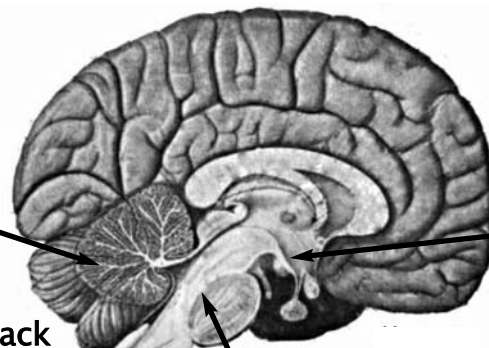
Position of the brain within the head.

The Cerebrum

This is the large, folded, top part of the brain. It has many different "areas", each with its own function. This is where you detect your senses, control body muscles for moving, keep your memories and do your thinking. It is divided into left & right sides which actually control the opposite side of the body.

The Cerebellum

This is the "hind-brain". Its job is to co-ordinate activities, so that (for example) you swing the bat or racquet into the right place at the exact instant to hit a moving ball.



Connects to Spinal Chord

Brain Stem
This controls the most basic functions, such as heartbeat and breathing.

Front

Hypothalamus

This brain area regulates body temperature, hunger and thirst. It also controls the Endocrine System. You will learn more about it later this topic.

The Spinal Chord

The Spinal Chord is the thick bundle of nerves which run down inside your backbone. This acts as a nerve “highway” connecting the brain to all parts of the body. It is considered part of the CNS because it also has a special control function...

Reflexes

What is a Reflex?

A reflex is an automatic body response to a sudden pain, or a possible threat, or even to a food smell.

Examples

Sudden movement near your eyes causes you to blink.

Sudden pain in your hand will cause your arm to jerk away.

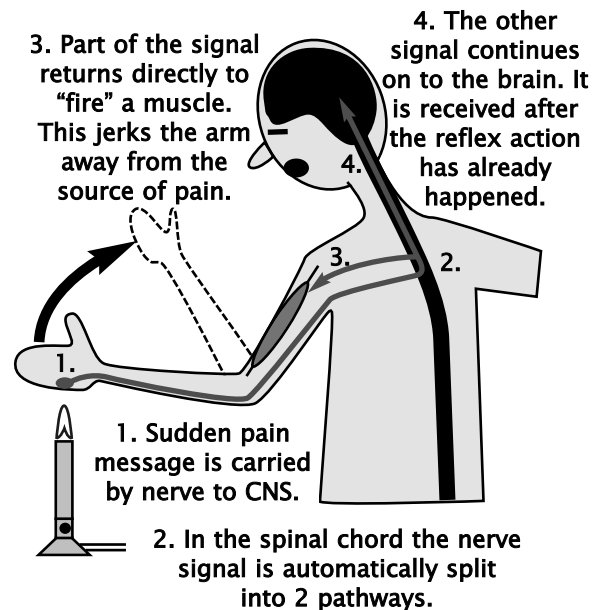
The smell of food can make your mouth “water”, when hungry.

Some reflexes protect you by automatically closing your eyes when something might hit them, or by removing your hand from something sharp or hot before too much damage is done.

Reflexes act before your brain is even aware of the pain, threat or other stimulus.

The Reflex Pathway

The spinal chord has special nerve connections to automatically set-off a reflex action whenever certain kinds of messages arrive from a sensory organ.



Nerve Cells or Neurons

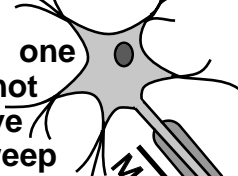
The cells of the nervous system are called “neurons”. To carry messages from one part of the body to another, neurons are very long and thin so they act a bit like electrical wires.

Nerve Signals

Neurons carry messages from one place to another. The signal is not electricity, but is carried by a wave of chemical changes which sweep rapidly along the length of the cell.

The message can only be carried one-way through the cell. That’s why there have to be sensory nerves to carry messages to the CNS, and a separate pathway of motor nerves to carry commands from the CNS to the muscles. It’s a one-way system.

Signals enter the cell at one of these connections



When the signal reaches the end of one neuron, it “jumps” into the next cell.

A “nerve” is a chain of neurons joined end-to-end in a long chain. In the brain, billions of neurons are interconnected in ways we do not yet understand.

Messages jump from this end into the next nerve cell.

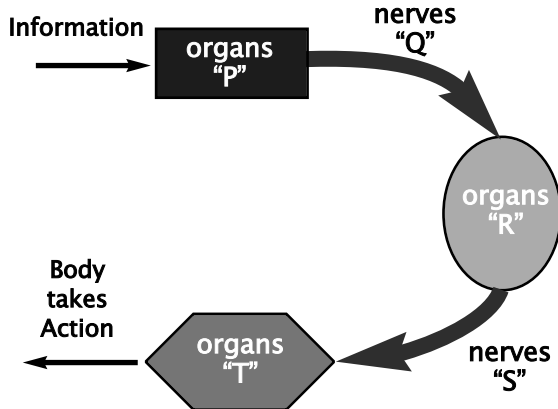
Worksheet 1 Nervous System

Student Name.....

1. What are the 2 functions of the Nervous System?

..... and

2. This diagram shows the operation of the nervous system schematically.



a) What are the organs at "P" called? Give one example of actual body organs.

b) What are the main type of body organs labelled "T"?

c) Give the name for nerves:

Q = S =

d) Which 2 organs are labelled "R"?
..... and

3.

a) What are nerve cells called?

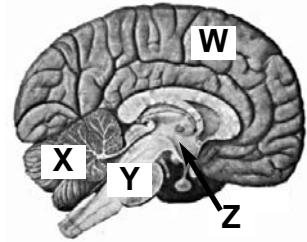
b) In terms of how nerve cells carry messages, why does the body need 2 sets of nerves? (Q & S in diag. above)

c) Nerve cells are sometimes compared to wires carrying electricity.

i) In what way do nerve cells resemble wires?

ii) In what way is this comparison not at all accurate?

4. The diagram shows the human brain.



a) Use the list to identify parts W, X, Y, Z.

List (not all will be used) brain stem, cerebellum, hypothalamus, cerebrum, hypothalamus.

W=..... X=.....

Y=..... Z=.....

b) (Answer by using the letters W,X,Y or Z.) In which part of the brain:

i) do you "see" and "hear", etc?

ii) is your memory & thinking?

iii) do you command your muscles for moving?

iv) is heartbeat & breathing controlled?

v) do you co-ordinate body movements?

5.

a) What is a "reflex action"?

b) Which part of the nervous system controls reflexes?

c) Here are the events involved in a reflex action all jumbled up. Write the letters P,Q,R, etc. in correct sequence.

P. signal to muscle along motor nerve.

Q. signal divides into 2 parts.

R. signal by sensory nerve to spinal chord.

S. muscle carries out reflex action.

T. message also sent to brain. Arrives after reflex.

U. sensory organ detects sudden pain or threat.

.....

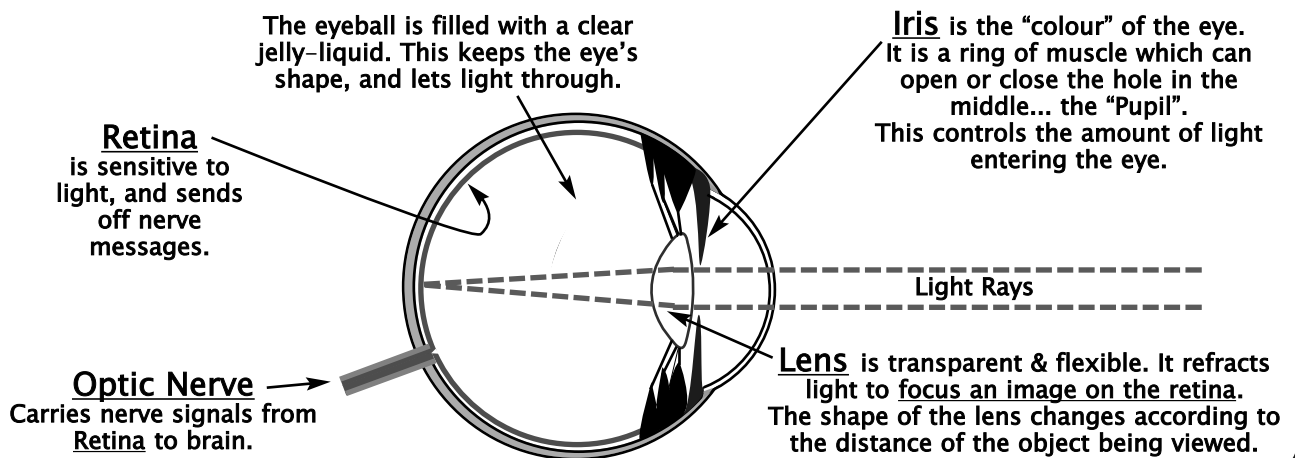
Sensory Organs

Before the CNS can decide what to do and issue nerve commands it must receive information to tell it what is happening outside and within your body.

To pick up this information, you are equipped with special “sensory organs”. Special cells in the eye detect light waves. Cells in the ear detect sound waves. Cells that are sensitive to pressure and temperature give us a “sense of touch” and cells sensitive to various chemicals allow us to smell and taste.

The Eye

Your eyes really don’t “see” anything. All your eyeball does is focus light rays onto the light-sensitive cells of the retina. The retina responds to light energy by sending nerve messages to the brain. It is in the brain that these messages are interpreted and you actually “see” things.



Sense of Touch

Your sense of touch is actually a number of different senses. Tiny sensory organs in your skin, internal organs and in your bone joints react to various, different stimuli and send messages off to the brain.

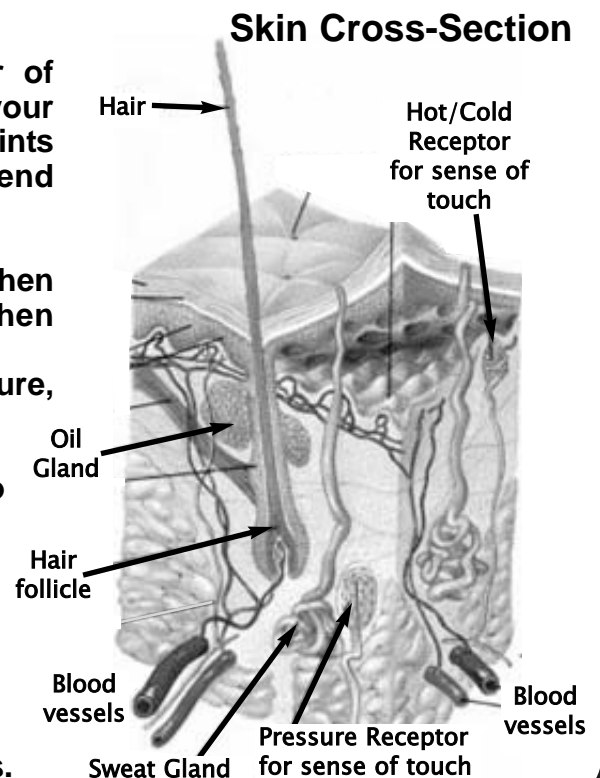
Pressure Some nerve receptors detect when something presses on you, such as when someone pats your shoulder, or bumps you. Another type of receptor detects light pressure, such as the touch of a feather.

Temperature Some receptors react to temperature and send “hot” or “cold” signals to the brain.

Pain Another type of receptor detects extreme pressure and tissue damage. This sense of “pain” helps you to minimise damage.

Position Sensors

You always know the position of your arms, legs and body from information constantly sent from sensors in your muscles and joints.



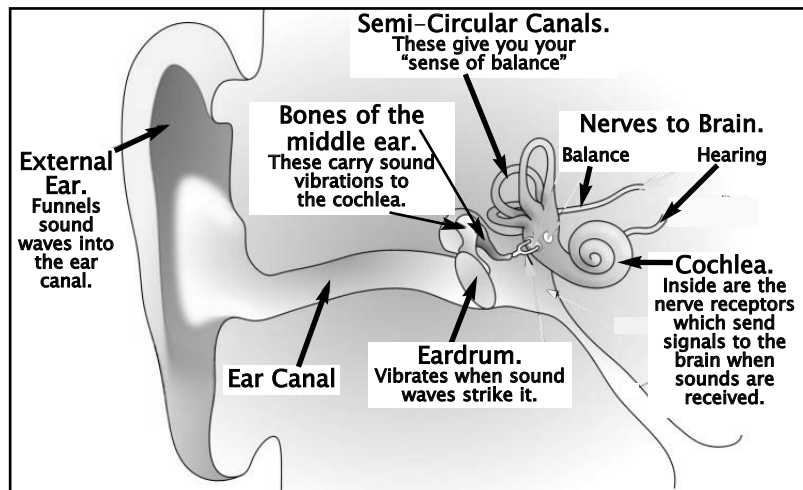
The Ear

In your “inner ear” is a small, spiral shaped structure called the **cochlea**. (In Latin, cochlea means “snail”.)

Inside the cochlea are thousands of receptor cells which have microscopic hairs attached. When sound waves pass through the cochlea, the hairs vibrate and the receptor cells fire nerve messages to the brain.

All the other bits, such as the eardrum and the tiny bones of the middle ear, are simply to carry the sound vibrations into the cochlea.

As always, it is in the brain that you really “hear” things.



Also in your inner ear is the receptor for your “**sense of balance**”. The semi-circular canals send messages to the brain so that you know (even with eyes closed) if you are upside-down, sideways, or whatever.

This sense can be easily confused, so that you become “dizzy” if you spin around, or even if you have an ear infection.

Taste

Your tongue contains many nerve receptors which react to certain chemicals in food and send signals to the brain.

Although you can recognise hundreds of “flavours”, in fact your tongue can only detect 4 different tastes... **sour**, **sweet**, **bitter** and **salty**.

If you can only taste 4 different things, how can you recognise so many flavours?

It’s all about smell.



Smell

Your sense of smell is located in the walls of your nose passageways above your mouth.

You have hundreds of different receptor cells which, between them, can detect about 3,000 different odours.

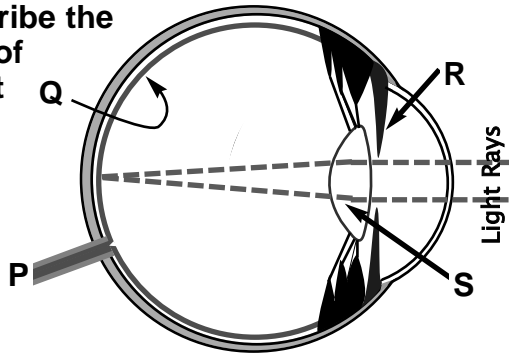
The many flavours of food are mainly recognised by smell. As you chew, many food chemical vapours move up into the nasal passages and stimulate the smell receptors. It is the combination of the 4 tastes and what you smell as you chew, which gives “flavour”.

You may notice that when you have a head cold and your nose is completely blocked, food “loses its flavour”.

Worksheet 2 Sensory Organs

Student Name.....

1. Complete the table below to name and describe the function of important parts of the eye.



Label	Name	Function
P		
Q		
R		
S		

2. a) Where is your “sense of touch” located?

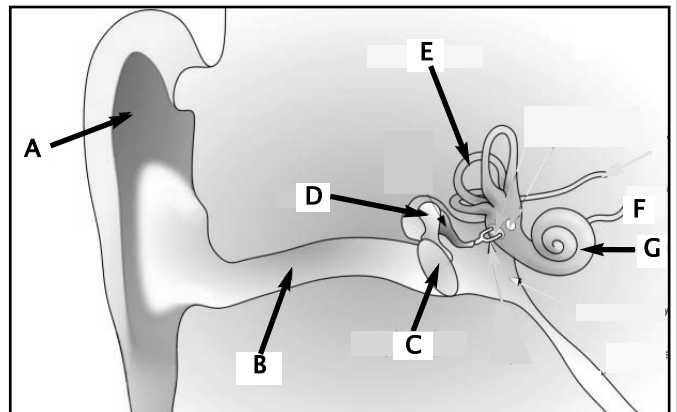
b) The sense of touch is actually more than just one sense. List 3 types of things that are detected by your sense of touch.

3.a) Similar to touch, your sense of taste detects just a few different things. List the 4 tastes it can detect.

3. b) If you can only taste 4 things, explain how it is possible to recognise hundreds of different “flavours” of food.

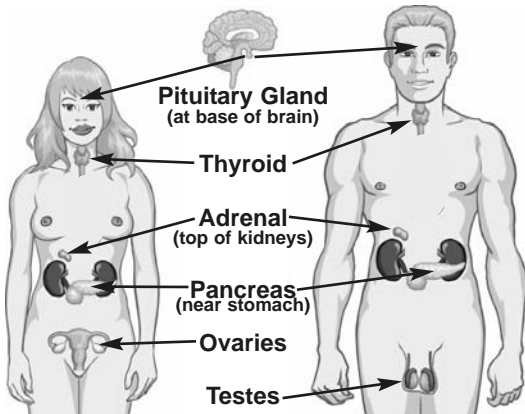
4. Complete the table to name and describe the function of important parts of the ear which are shown in the diagram below.

Label	Name	Function
A		
B		
C		
D		
E		
F		
G		



The Endocrine System

The Nervous System does most of the controlling and co-ordinating of your body activities and functions. However, there is also a system of glands which release special chemicals called hormones into the blood stream. Each hormone has the effect of controlling a process or function in the body.



After puberty, the male hormone "Testosterone" controls sperm production, and causes the development of a deeper voice, facial hair, and other "male secondary sex characteristics".

"Growth Hormone" from the pituitary gland controls your growth during childhood.

"Thyroxin" from the thyroid gland controls how fast all the chemical reactions in all your cells run.

"Insulin" from the pancreas controls your blood sugar levels.

The female hormones, oestrogen & progesterone control the menstrual cycle of egg production. Progesterone is also vital during pregnancy, while oestrogen controls development of "female secondary sex characteristics" such as breast growth and hip shape.

Interaction Between Nerves & Hormones

The hormones control certain body functions in a very different way to how the Nervous System works. However, there is no doubt about which system is really in overall control. The entire Endocrine System is controlled from the brain.

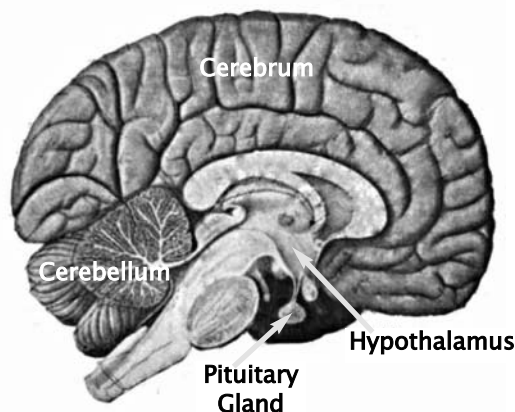
The Pituitary Gland

This gland is located at the base of the brain attached to the brain hypothalamus.

The pituitary is often called the "master control gland" because it releases a cocktail of hormones into the blood stream. Each hormone regulates one of the other endocrine glands, controlling the release of its hormone(s).

For example, the Thyroid gland (throat) releases thyroxin hormone to control metabolic rate. The amount of thyroxin released is controlled by a pituitary hormone called "TSH". (thyroid stimulating hormone)

Hypothalamus Control



All the individual hormone glands are controlled by the pituitary, but it is controlled, in turn, by the brain hypothalamus.

Connections from the brain run into the pituitary gland and stimulate it to release its hormones in greater or lesser amounts.

Human Reproduction

Like all mammals, humans reproduce sexually and rely on meiosis cell division to make gamete cells (egg & sperm) with half the chromosome number.

Fertilisation occurs inside the female and the foetus develops in the mother's womb, supplied with food and oxygen through the placenta.

When fully developed, the baby is born and fed on milk produced by its mother.

The male reproductive system is nothing more than a sperm delivery system.

In contrast, the female system is much more complex, since it must be able to produce eggs, support the pregnancy and feed the foetus.



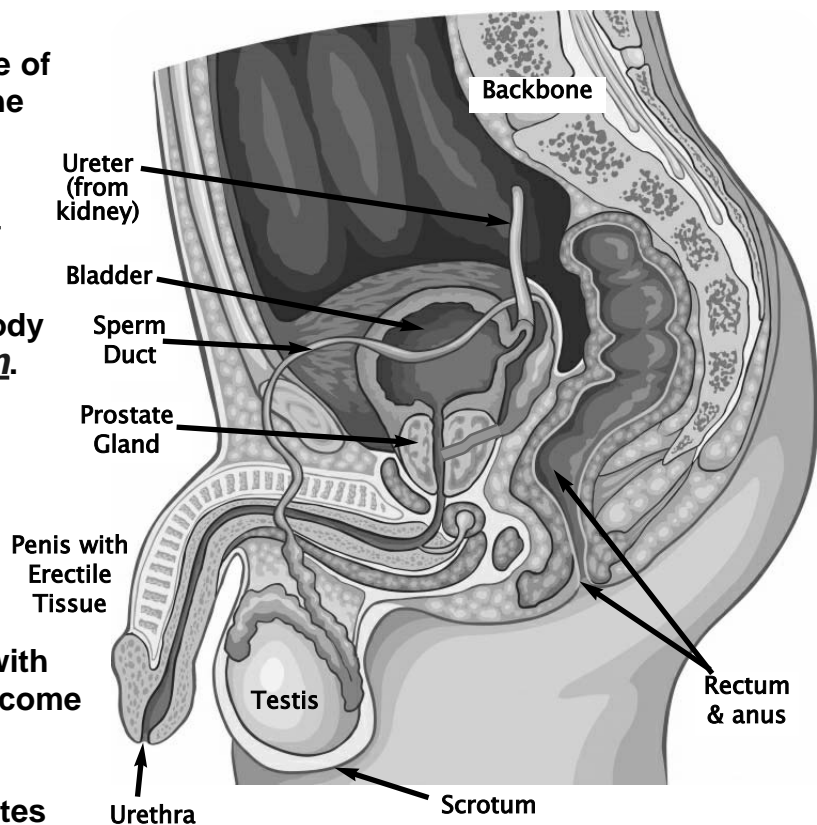
The Male Reproductive System Structure and Function

The testes (sing: testis) are made of long tubes coiled into balls. The cells in the walls of the tubes carry out meiosis and manufacture millions of sperm cells.

The testes hang outside the body in a pouch called the scrotum. This allows the testes to be maintained at a slightly lower temperature. This is important to produce healthy sperm.

The penis is filled with "erectile tissue". This can fill with blood to cause the penis to become hard and erect.

Sperm cells move from the testes to the penis through a tube called the sperm duct. Along the way, fluids are added from several glands. The fluid nourishes the active sperm cells and keep them healthy. This fluid with sperm cells in it is called semen.



During sexual intercourse, semen is ejaculated from the urethra by waves of muscular contractions. Typically, only a few millilitres of semen is released, but it may contain about 200 million sperm cells.

Worksheet 3 Endocrine System

Fill in the blank spaces.

The Endocrine System is made up of a number of small organs called a)..... which release chemicals called b)..... into the c)..... Each hormone controls a special function of the body.

The glands are:

The d)..... at the base of the brain. The e)..... in the neck. The f)..... glands which are on top of each kidney. The g)..... near the stomach. The reproductive organs, h)..... and

Student Name.....

Examples of some hormones and what they control are:

Insulin from the i)..... controls j)..... levels. k)..... from the l)..... gland controls your rate of metabolism. (Rate of chemical reactions)

The amount of each hormone released is controlled by other hormones from the m)..... gland. This gland, in turn, is controlled by the n)..... part of the brain. Therefore, the entire o)..... System is under the control of the p).....

Worksheet 4 Male Reproductive System

1. Fill in the blank spaces.

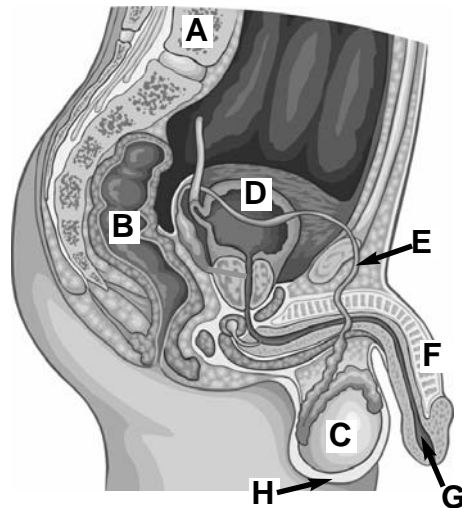
Male reproductive cells are called a)..... cells. They are produced in the b)..... by the cell division c)..... The testes hang outside the body in the d).....

Sperm cells move through the e)..... to join the urethra. Various glands add fluids to keep the sperm healthy. This fluid containing sperm is called f).....

The penis is filled with g)..... tissue which can fill with h)..... to make the i)..... hard. During sexual intercourse, j)..... is ejaculated from the urethra into the female k)..... Sperm cells then swim to find and l)..... the egg.

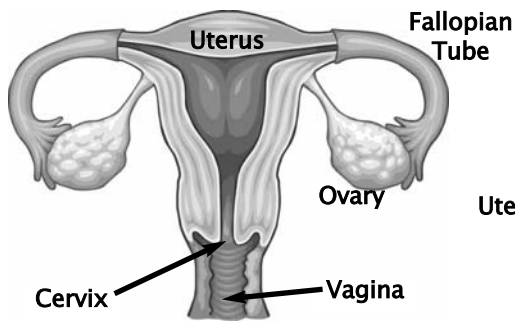
Student Name.....

2. Identify the structures labelled A,B,C, etc.



- | | |
|-----------|-----------|
| A = | E = |
| B = | F = |
| C = | G = |
| D = | H = |

Front View



Before a girl is even born, **meiosis** has occurred in her **ovaries** and 50,000 immature eggs are present.

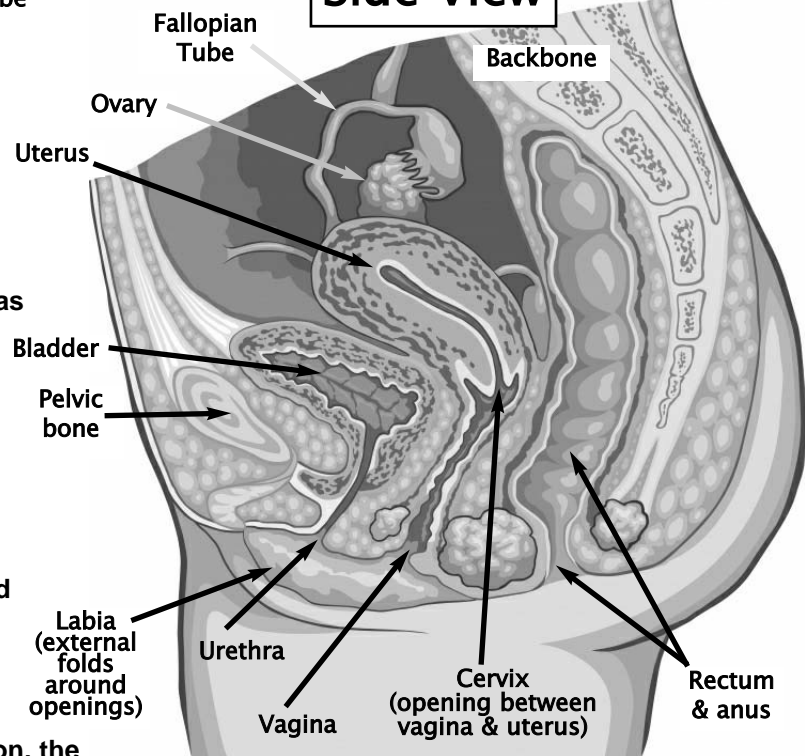
After puberty, one egg per month matures and is released into a **fallopian tube**.

Male sperm cells may swim from the vagina through the cervix, uterus and fallopian tube and **fertilise** the egg.

The **zygote** (fertilised egg) begins to divide by **mitosis** and becomes an embryo. Several days after fertilisation, the embryo reaches the uterus.

The Female Reproductive System

Side View



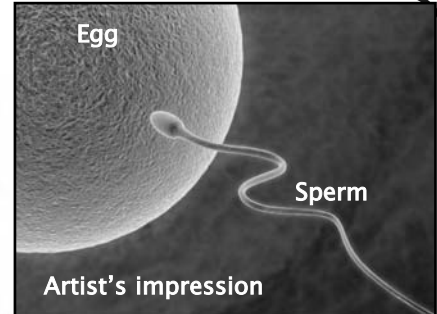
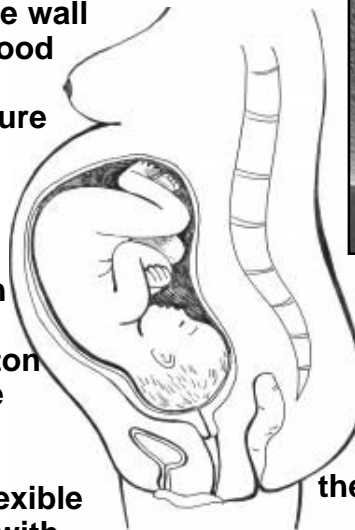
Pregnancy & Birth

The embryo implants itself into the wall of the **uterus** and begins to get food and oxygen from the rich blood supply. Gradually a special structure called the **placenta** grows in the uterus.

The placenta allows exchange of food, oxygen and wastes between the blood of the mother and the developing foetus. Your belly button is where the **umbilical chord** once connected you to the placenta.

The foetus is enclosed within a flexible bag (the **amnion**) which is filled with amniotic fluid. This supports the foetus and acts as a "shock absorber".

After about 270 days (9 months) the foetus is fully developed and ready to be born. The birth process is set off by a hormone released from the **pituitary gland**. It is called **oxytocin**.



Oxytocin causes the **cervix** to "dilate" (relax and open wider) to allow the baby to pass through.

The amnion bursts and the amniotic fluid seeps out.

Oxytocin hormone causes periodic contractions of the tummy muscles. These get stronger and more frequent until they expel the baby through the cervix and vagina.

Later, the contractions expel the placenta as the "after-birth".

Hormones Control Reproduction

The Endocrine System of hormones controls a number of things from growth, to blood sugar levels to metabolic rate.

However, no other body system is so thoroughly controlled by hormones as is the Reproductive System.

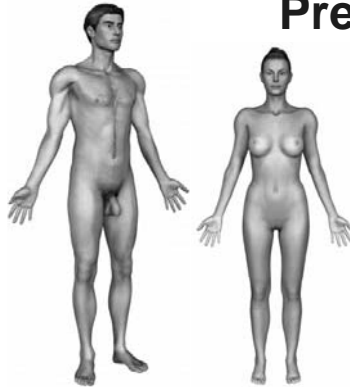
Puberty

Except for their external genitals, a little boy or a little girl have exactly the same body shape and pitch of voice.

At puberty this changes dramatically. Hormones from the pituitary gland set off the production of “sex hormones” in the reproductive organs.

In the testes, the male hormone testosterone causes growth changes which deepen the voice, cause facial and body hair to grow and allow for heavier muscle growth.

In the ovaries, the female hormone oestrogen causes development of breasts and changes to the shape of the hips to allow for later child birth.



Pregnancy & Birth

During pregnancy, hormones produced by the placenta suppress any further egg production and maintain the state of the uterus. Hormones cause enlargement of the breasts in preparation for milk production.

The birth process is also set off by a hormone, already described.

Lactation (=milk production)

After the baby is born, yet another hormone is produced from the pituitary. This hormone causes the breast tissues to make milk to feed the baby.

Menstrual Cycle

The monthly cycle of egg production and menstrual bleeding is a complex process which is completely controlled by hormones...

The Menstrual Cycle

The Build-Up

Increasing levels of a pituitary hormone called FSH cause increased release of oestrogen and another hormone called LH. These cause one of the immature eggs in an ovary (the ovaries usually take turns) to begin to mature inside a cyst-like bubble called a follicle.

Approximately 10-14 days into the cycle, the follicle bursts open and releases the egg. (Some women can feel this happen.) The egg now moves slowly along the fallopian tube. The woman is now “fertile” and can become pregnant anytime over the next 3-5 days.

The remains of the egg follicle in the ovary now produces yet another hormone:

Progesterone Hormone

The shattered remnant of the follicle is not finished yet! It pumps out a hormone called progesterone.

Progesterone causes the lining of the uterus to thicken and grow more blood vessels to supply a possible embryo. It also causes changes in the breasts to prepare for possible milk production.

The Break-Down

About 10 days after ovulation (egg release) the follicle remnant finally dies and progesterone suddenly shuts off. The lining of the uterus breaks apart and sloughs away as the menstrual “period”. This continues for 3-4 days until FSH production kicks back in and the cycle begins over again.

Worksheet 5

Female Reproductive System

1. Fill in the blank spaces.

In females, a)..... (cell division) occurs in the b)..... before a girl is born. After puberty, the eggs mature (usually) 1 per month.

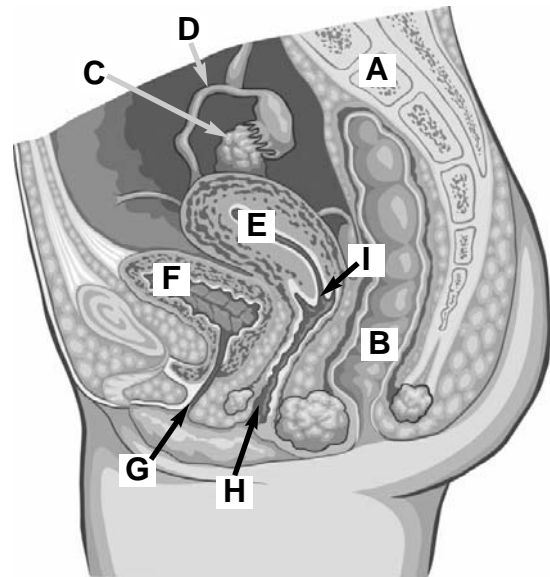
The mature egg is released from an ovary into the c)..... While travelling through this tube the egg can be d)..... by a male e)..... cell.

The fertilised egg, or “f).....” begins dividing by g)..... (cell division) to form an h)..... The embryo implants into the wall of the i)..... and draws nourishment from the blood-rich tissue. Gradually, a structure called the j)..... grows. This allows exchange of k)....., and wastes from mother to foetus. The foetus develops surrounded by a membrane (the “l).....”) filled with fluid to cushion the baby.

Student Name.....

2.

Identify the structures A,B,C, etc.



A = E =
 B = F =
 C = G =
 D = H =
 I =

Worksheet 6

Hormones Control Reproduction

Fill in the blank spaces.

Puberty

The male hormone a)..... causes development of the “secondary sex characteristics” such as b)..... voice and c)..... hair.

In females the hormone d)..... causes development of the e)..... and changes to hip structure to allow for f).....

Menstrual Cycle

Hormones from the g)..... gland increase levels of oestrogen and cause an egg to mature in a “bubble” called a h)..... This bursts and releases the egg.

Student Name.....

The remnant follicle releases a hormone i)....., which causes the wall of the j)..... to prepare for a pregnancy. If this does not occur, hormone changes allow the wall to slough away as menstrual bleeding.

Pregnancy & Birth

If pregnancy does occur, high levels of k)..... hormone continue. This suppresses l)..... (egg production) and maintains the uterus and placenta. The birth process is set off by a hormone from the m)..... gland. This causes the n)..... to dilate, and produces o)..... of muscles to expel foetus and placenta.

A disease is when something is wrong with the functioning of your body. There are many different diseases, but they can all be grouped into just 2 types.

Diseases

Infectious Diseases

These are caused by a “pathogen”. A pathogen is a living thing (a “germ”) which has invaded your body and is attacking your cells and organs, or is living within you and producing toxic chemicals which make you sick.

You “catch” an infectious disease when you are infected by the pathogen.

Non-Infectious Diseases

This type of disease cannot be “caught” because there is no pathogen “germ” involved.

There is a huge variety of non-infectious diseases. They can be due to not eating a healthy diet, or being exposed to dangerous radiations or chemicals. Some are caused by malfunctions within your body organs or cells.

Non-Infectious Diseases

There is a huge range of non-infectious diseases. These few examples will give you an overview.

Inherited Diseases

These are genetic disorders inherited from your parents. Examples are haemophilia (blood won't clot) and muscular dystrophy. (progressive muscle wasting)

Nutritional Diseases

These are diseases related to what you eat, or don't eat.

Scurvy is due to a lack of vitamin C. It killed thousands on long sea voyages in earlier centuries. Very rare today.

Obesity is one of the modern “life-style” diseases due to over-eating, especially of “junk foods” and under-activity.

Anorexia is often described as an “eating disorder”, but it involves important psychological factors.

Lifestyle & Environmental Diseases

Melanoma is a deadly form of skin cancer which kills several thousand Australians each year. Its main cause is exposure to UV rays in sunlight, so our sunny climate is partially to blame. Our outdoor-beach-sport culture and lifestyle contributes, plus the fact that many Australians are fair-skinned.

Cancer

Cancer is not one disease, but many. Some cancers are known to be set-off by virus infections. Others have some genetic link because they tend to run in families.

Some cancers occur when malfunctions occur in cells in your body. Perhaps a mutation occurs during a cell division and the cell formed is abnormal. If it begins to multiply out of control and invade healthy tissue it may form a deadly tumour.

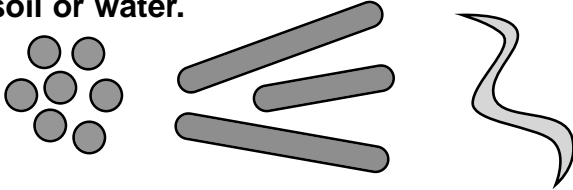
Allergies & Auto-Immune Diseases

These can range from annoying “hay-fever” to Type 1 diabetes to crippling forms of arthritis. These diseases are caused by malfunctions of the immune system in which the body's defences attack healthy tissues.

Meet the Pathogens

Most infectious diseases are caused by microscopic life-forms belonging to one of the following groups.

Bacteria are all unicellular, and have very small cells in a variety of shapes. Most are harmless decomposers living in soil or water.



Some are round.

Some are rod-shaped.

Spirals

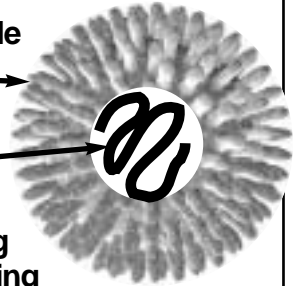
Some bacteria are pathogens. They can breed rapidly in your body and either damage your cells and organs directly, or release toxic chemicals.

Diseases caused by bacteria include a simple sore throat, and deadly cholera, typhoid or pneumonia.

Viruses

Viruses are the smallest of all, and are non-cellular... they are not made of cells at all.

Each virus is a tiny capsule of protein, with some genetic material inside. (DNA or RNA)



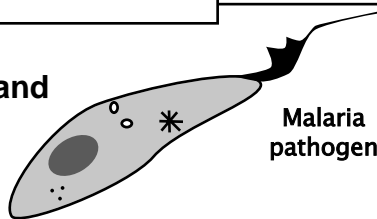
Viruses operate by “taking over” living cells and forcing cells to kill themselves making new virus particles. Every virus is a pathogen.

Human diseases caused by viruses include measles, influenza (‘flu), A.I.D.S., and the common cold.

Protozoa

Protozoa are unicellular and have animal-like cells.

Compared to bacteria & viruses, not many diseases are caused by protozoan pathogens. However, some of the diseases are very serious. Malaria kills millions of people each year, mainly in Africa and Asia. This pathogen is carried by mosquitoes.



Malaria pathogen

Fungi

While most fungi are harmless decomposers in the soil, there are a few that cause diseases.

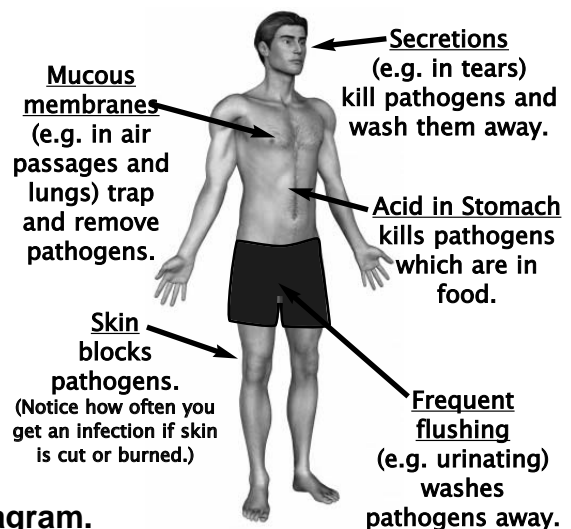
Examples include tinea (“athlete’s foot”), ringworm and “thrush”.

Body Barriers to Stop the Pathogens

Your body has many “barrier defences” to keep pathogens out.

Mucous membranes are special moist tissues which line the air passageways to your lungs. The cells secrete a sticky fluid called “mucus” which traps dust and any pathogens that are in the air you breathe. Tiny cell-hairs beat back-and-forth to move the mucus up to the throat where it is swallowed. Acid in the stomach then destroys the pathogens. Coughing and sneezing are reflexes which help move the mucus faster.

Other barrier defences are shown in the diagram.



Worksheet 7 Diseases & Pathogens

Fill in the blank spaces.

If a disease can be “caught” it is said to be a)..... Diseases like this are caused by a “b).....” This is a living thing (usually c)..... in size) which invades your body and damages cells & tissues.

Most infectious diseases are caused by a pathogen belonging to one of the following groups.

The d)..... are small, unicellular organisms. Most are harmless e)..... in soil and water, but some cause serious diseases, such as cholera or typhoid.

f)..... are non-cellular. They “take over” living cells and force them to make g)..... Human disease examples include h)..... and

Student Name.....

i)..... are unicellular, with animal-like cells. Not many diseases are caused by these, but some are very serious, such as j).....

Most k)..... are harmless decomposers, but there are a few which cause human diseases such as l).....

Your body has many “m)..... defences” to prevent pathogens getting in. The most obvious is your n)..... covering the whole body. “o)..... membranes” line your breathing passages. These secrete p)..... which traps pathogens. Any germs you might swallow are mostly killed by the q)..... of your stomach. In other cases, germs are washed away by urine, or r)..... such as tears from the eyes.

Worksheet 8 Non-Infectious Diseases

Answer the following questions.

1. What is meant by an “inherited disease”? Give an example.

2. a) What causes “nutritional disease”?

b) Hundreds of years ago, scurvy was a serious problem on long sea voyages. Today it never happens. Explain.

3. a) What is melanoma?

Student Name.....

3. (cont)
b) What is a major cause of melanoma?

c) Explain how melanoma is partly due to the environment, partly due to lifestyle choices, and partly due to genetic factors.

4. Give an example of a disease that is due to a malfunction:

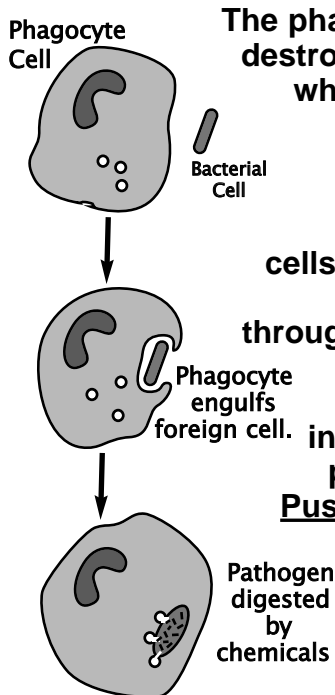
a) occurring during cell division.

b) of the immune system.

The Immune System

The barrier defences are not perfect. Sooner or later a pathogen gets past them. Now your body must fight to kill the pathogens before they kill you. This task is carried out by special white blood cells which are of 2 main types.

Phagocytes (Phago=eating, cytes = cells)



The phagocytes “eat” and destroy any foreign cells which they recognise are “not self”.

Phagocytes can squeeze between cells to leave the blood stream and crawl throughout your tissues.

At the site of an infection, millions of phagocytes gather. Pus is a pale coloured fluid which forms where many phagocytes are attacking pathogens in a “sore”.

Lymphocytes

Lymphocytes are another type of white blood cell which can recognise specific pathogens and their chemicals.

They must first “learn” to recognise each virus or bacterial cell. This takes several days. Meanwhile, the pathogen may cause symptoms of the disease and (untreated) may be fatal.

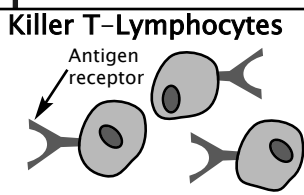
This “learning” involves matching the shape of some chemical associated with the pathogen. This chemical (which might be a protein of a virus, or a bacterial toxin) is called an “antigen”.

Once the antigen shape is matched and “learned”, the lymphocytes multiply to form millions of cells able to target that specific antigen.

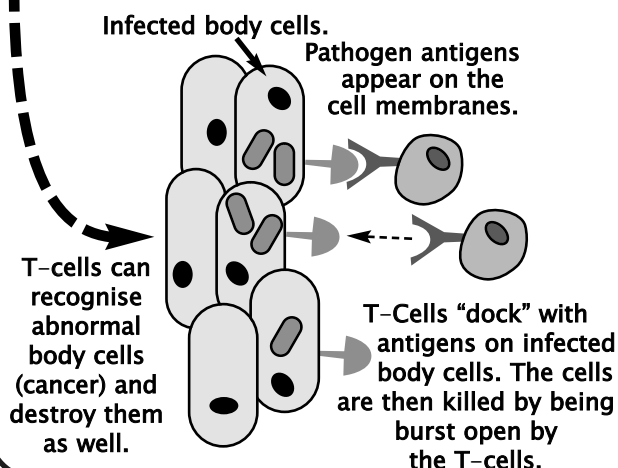
They then attack in 2 different ways...

Killer Cells and Antibodies

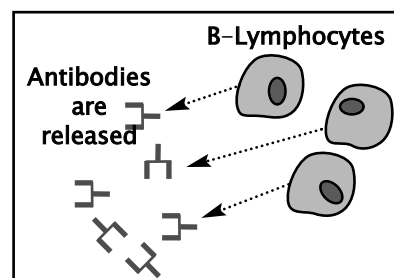
The lymphocytes come in 2 varieties known as “T-cells” and “B-cells”. Each is able to target specific pathogens by matching the shapes of their antigens.



T-Lymphocytes are called “killer cells”. The diagram explains why.

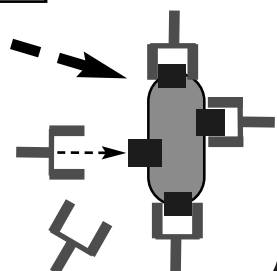


B-Lymphocytes produce billions of antibodies



Antibodies are proteins with a shape which fits exactly to an antigen on the pathogen.

Antibodies “lock onto” pathogens so they are neutralised and immobilised. Phagocytes then destroy them.



Immunity to a Disease

If you catch an infectious disease and recover from it, you may become immune. This means that if you are infected with the same pathogen again, it has no effect on you and you do not get sick at all.

Memory Cells

This “natural immunity” works because long after the B-cells and T-cells have conquered a pathogen, some special versions of them remain in the body.

These “memory cells” already know the exact shape of the antigen for their “target” pathogen.

If you become infected with that same pathogen again, there is no delay while your body “learns” the antigen. The response is fast and furious. A flood of killer T-cells and antibodies destroy the invader so rapidly that no symptoms appear and you don’t even realise that you were infected.

Immunity

That is why, for some diseases, you can only get sick once. In the Middle Ages, the few people who survived “the plague” or recovered from smallpox were known to be immune. They were valued as nurses for the sick, and as handlers of the many dead bodies because they could not catch the disease again.

In fact, for some diseases, you do catch it again. Colds and ‘flu are caused by viruses which keep mutating and changing their antigens. Each time you get infected, your immune system has to start over and “learn” new shapes. Meanwhile, you get sick again.

Immunisation by Vaccination

One of the greatest achievements of Medical Science has been the development of artificial immunisation by “vaccination”, to prevent infectious disease.

Natural Immunity is Risky

The problem with natural immunity is that, for serious diseases, many people die, or suffer terribly, before their immune system “learns” to fight the pathogen.

Vaccination

Vaccination means to deliberately provoke the immune system by introducing antigens into the body.

The “vaccine” (can be injected or by mouth) contains antigens of a disease germ. The antigen could be pathogen cell fragments, or even living pathogens which have been specially bred, or treated, so they are harmless.

The vaccine does not cause the disease, but stimulates the immune system to produce lymphocytes against that disease. Once immunised correctly, you can never catch it.

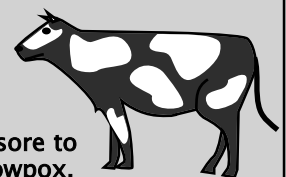
Impact of Vaccination

The chances are high that 200 years ago, you’d already be dead! Infectious diseases used to kill a large percentage of people, especially children.

You have probably been immunised against polio, diphtheria, measles, mumps, tetanus, rubella, TB, etc, etc. Programs of mass-immunisation have greatly reduced the effects of infectious diseases on our society.

“Vaccination” comes from the Latin “vacca” = “cow”.

Edward Jenner (English, 18th century) noticed that milkmaids always caught a mild disease “cowpox” from the cows, but never suffered the deadly smallpox.



Jenner used pus from a cowpox sore to deliberately infect people with cowpox. This caused later immunity to smallpox. We now know that these viruses are so similar that antibodies for one disease, work against the other.

Professor Ian Frazer, Australian Immunologist

Dr Frazer was born and educated in Scotland. He began studying Physics, but switched to Medicine and specialised as a researcher in immunology. He emigrated to Australia in 1980.

He currently leads a University of Queensland research team at the Princess Alexandra Hospital, Brisbane.

In 2005, Frazer's research team concluded 20 years of research with clinical trials of a new vaccine which is highly effective in preventing cervical cancer.

Cervical cancer is the second most common cancer in women, world wide. It often shows few symptoms until it has reached a deadly stage of progress, but is easily treated if detected very early. Most cases are caused by a virus called HPV which is very common in the population and is transmitted sexually.

In Australia, deaths due to cervical cancer have been minimised by early detection programs based on women having regular "PAP smears".

Professor Frazer's team developed a vaccine which has been approved for use, not only in Australia, but in the USA and in Europe.

The vaccine is 100% effective against the strain of the virus which causes 70% of cervical cancer cases.

In recognition of this great achievement, Professor Frazer was named "Australian of the Year" in 2006. He has also been awarded special prizes and honours from the Cancer Research Institute and other bodies.

In 2007, the Australian Govt. Health Department began a program of free immunisation of all females between the ages of 12 and 27.

The Cancer Council and other expert bodies recommend that PAP smear tests be continued, even after immunisation.

People Make Choices About Science

Science creates many important benefits for humanity, such as immunisation.

Some people, however, choose to reject these benefits because of their ethical, moral or religious beliefs.

Why People Reject Immunisation

Some people believe that immunising against diseases like cervical cancer will lead to immoral behaviour. Since cervical cancer can be caused by a sexually-transmitted virus, they argue that making people immune to it will encourage more sexual activity.

The Autism Debate

There is an "urban myth" that certain vaccines, or having multiple vaccines to prevent many diseases, cause Autism in some children.

There is no scientific evidence which suggests that this is true. Unfortunately, it is impossible to prove this belief false. Meanwhile some parents refuse to have their children immunised.

Tragic Results of Choice

From about 2001, religious leaders in parts of Nigeria became suspicious that vaccines made in USA or Europe were secretly designed to harm their people. They recommended that their followers stop immunising their children.

Over several years, the almost-extinct disease polio re-appeared in Nigeria and several neighbouring countries. In 2005, over 20,000 cases of measles were reported and 600 children died. Over 200 children died in a similar outbreak in Indonesia in 2007.

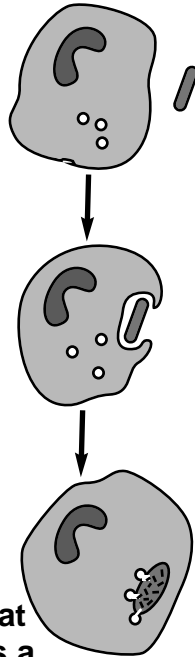
Serious outbreaks of measles and whooping cough have occurred in Netherlands and Ireland (2000) and USA (2005). Each outbreak was centred around a religious community which objects to immunisation.

Worksheet 9 The Immune System

Student Name.....

Answer the questions.

1. The diagram shows a white blood cell “eating” a pathogen cell.



a) Name this type of white blood cell.

b) Where is “pus” likely to form?

c) We tend to think pus is horrible, yukky stuff. In what way is the formation of pus a good thing?

2.

a) Name the other type of white blood cell which fights disease pathogens.

b) What is an “antigen”?

c) How are “T-cells” and “B-cells” different in the way they deal with pathogens?

3.

a) How can you become naturally “immune” to a disease?

b) Explain why you can usually only catch a disease such as measles once in your life.

c) Why do you catch some diseases (such as ‘flu) over and over?

4.

a) Why is “natural immunity” risky?

b) What is “vaccination”?

c) What is in the vaccine?

d) Describe the impact of vaccination on our society.

Topic Test

Health & Reproduction

Student Name.....

Score = /26

Answer all questions in the spaces provided.

1. (8 marks)

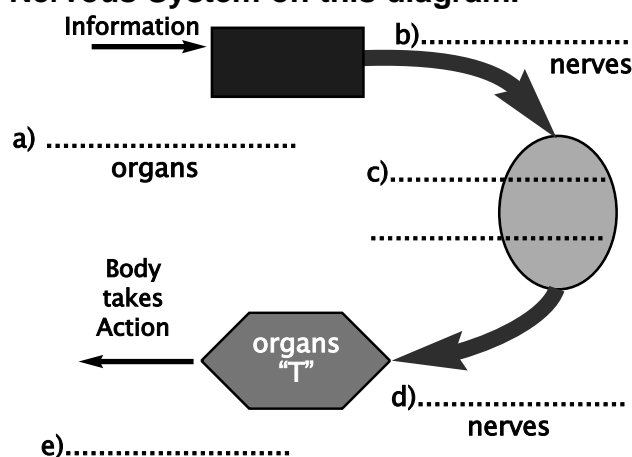
Match each description to an item from the list. To answer, write the letter (A,B,C, etc) of the list item beside the description.

<u>Description</u>	matches with	<u>List Item</u>
a) Part of the brain where you “think” and remember.	
b) Automatic response to a pain or threat.	
c) Light-sensitive tissue in the eye.	
d) Endocrine “master control” gland.	
e) Place where fertilisation occurs.	
f) Structure which feeds the foetus during pregnancy.	
g) Male hormone.	
h) Disease-causing organism.	

List Items Not all will be used. Some may be used more than once.

- | | |
|---------------|-------------------|
| A. retina | F. pituitary |
| B. placenta | G. cerebrum |
| C. reflex | H. fallopian tube |
| D. sperm duct | I. pathogen |
| E. lymphocyte | J. testosterone |

2. (5 marks) Identify the parts of the Nervous System on this diagram.



3. (3 marks)

a) Name a gland of the Endocrine System.

b) Name a hormone produced by the gland you named in (a).

c) Outline what this hormone controls.

4. (4 marks)

Puberty, the menstrual cycle and the birth process are all controlled by hormones.

Choose one of these processes and discuss (briefly) the effects of a named hormone in controlling the process.

5. (6 marks)

What is the difference between:

a) infectious and non-infectious disease?

b) an antigen and an antibody?

c) a “barrier defence” and the immune system?

Answer Section

Worksheet 1

- control & co-ordination (of the body).
- Sensory organs. e.g. eye, ear.
 - muscles.
 - Q=sensory S=motor nerves.
 - brain & spinal chord.
- neurons.
 - Nerve messages can only go in one-way through a neuron, so another nerve is needed to carry messages in the opposite direction.
 - They are long and thin like wire.
 - The signal is not electricity. It is a wave of chemical changes moving along the neuron.
- W=cerebrum X= cerebellum
Y= brain stem Z= hypothalamus
 - i) W ii) W iii) W iv) Y v) X
- An automatic response to a sudden pain, or other "stimulus".
 - spinal chord.
 - U, R, Q, P, S, T

Worksheet 2

- | 1. | <u>Name</u> | <u>Function</u> |
|----|--------------|--|
| P | Optic nerve. | Carries signals to brain |
| Q | Retina. | Detects light, sends nerve signals. |
| R | Iris | Control amount of light by opening or closing pupil. |
| S | Lens | Focuses light image onto retina. |
- Sensors are all over your skin, and in joints & muscles throughout body.
 - Pressure, light pressure, temperature, pain.
 - Sour, sweet, bitter & salty
 - While chewing food a lot of food chemicals are detected by smell. The combination taste + smell = flavour.

- | 4. | <u>Name</u> | <u>Function</u> |
|----|----------------------|---|
| A. | External ear | Funnels sound to ear canal. |
| B. | Ear canal | Carries sound to eardrum. |
| C. | Eardrum | Vibrates & transmits vibration to middle ear. |
| D. | Bones of middle ear | Carry vibration to cochlea. |
| E. | Semi-circular canals | Sense of balance |
| F. | Nerve | Carries signals to brain |
| G. | Cochlea | Sensory organ. Detects sounds, sends nerve signals. |

Worksheet 3

- | | |
|-----------------|---------------------|
| a) glands | b) hormones |
| c) blood stream | d) pituitary |
| e) thyroid | f) adrenal |
| g) pancreas | h) testes & ovaries |
| i) pancreas | j) blood sugar |
| k) Thyroxin | l) thyroid |
| m) pituitary | n) hypothalamus |
| o) Endocrine | p) Nervous System |

Worksheet 4

- | | |
|---------------|--------------|
| a) sperm | b) testes |
| c) meiosis | d) scrotum |
| e) sperm duct | f) semen |
| g) erectile | h) blood |
| i) penis | j) semen |
| k) vagina | l) fertilise |
- | | |
|-------------|--------------------------|
| A= backbone | E= sperm duct |
| B= rectum | F= penis/erectile tissue |
| C= testis | G= urethra |
| D= bladder | H= scrotum |

Worksheet 5

- | | |
|-------------------|---------------|
| a) meiosis | b) ovaries |
| c) fallopian tube | d) fertilised |
| e) sperm | f) zygote |
| g) mitosis | h) embryo |
| i) uterus | j) placenta |
| k) food, oxygen | l) amnion |

Worksheet 5 (cont)

2.

- | | |
|-------------------|------------|
| A= backbone | E= uterus |
| B= rectum | F bladder |
| C= ovary | G= urethra |
| D= fallopian tube | H= vagina |
| | I= cervix |

Worksheet 6

- | | |
|------------------|----------------|
| a) testosterone | b) deeper |
| c) facial / body | d) oestrogen |
| e) breasts | f) child birth |
| g) pituitary | h) follicle |
| i) progesterone | j) uterus |
| k) progesterone | l) ovulation |
| m) pituitary | n) cervix |
| o) contractions | |

Worksheet 7

- | | |
|----------------|--------------------------|
| a) infectious | b) pathogen |
| c) microscopic | d) bacteria |
| e) decomposers | f) Viruses |
| g) new viruses | h) flu / polio / measles |
| i) Protozoa | j) malaria |
| k) fungi | l) tinea |
| m) barrier | n) skin |
| o) mucous | p) mucus |
| q) acid | r) secretions |

Worksheet 8

1. These are disorders that are genetically passed on from parents to child. e.g. haemophilia.
2. a) Usually caused by incomplete diet, lacking in some essential nutrients.
b) Scurvy is caused by lack of vitamin C in fresh fruit & veg. On long sea voyages these ran out, so scurvy resulted. Today we have easy access to fresh food and can freeze food on long trips.
3. a) Melanoma is a form of skin cancer.
b) Exposure to UV rays in sunlight.
c) Sunny climate means more UV exposure. Lifestyle: some people choose to sunbake. Genetic factors: fair-skinned people are more at risk.

4.

- a) Some forms of cancer have no known cause apart from malfunction in a cell which becomes the start of a tumour.
- b) Type 1 diabetes is caused when the body's own immune system attacks & destroys the insulin-producing cells of the pancreas.

Worksheet 9

1.

- a) Phagocyte
- b) Where there is a site of infection. e.g. in a dirty wound.
- c) Pus is due to millions of phagocytes gathering to fight the infection, so it's an indication of body defences in action.

2.

- a) Lymphocytes
- b) Antigen is a chemical associated with a pathogen, which the immune system "learns" to recognise and target.
- c) T-cells attack cells (either pathogen cells or infected body cells) directly and kill them. B-cells release antibodies which immobilise pathogens or their toxins.

3.

- a) By catching the disease and then recovering.
- b) Your body retains "memory cells" which can destroy future infections by the same pathogen.
- c) Some pathogen keep changing their antigens so the memory cells do not recognise them.

4.


- a) You may become very ill, or die, before the immune system "learns" to destroy the pathogen.
- b) Vaccination means to introduce antigens into the body to provoke the immune system into making lymphocytes.
- c) Vaccine contains antigens from a pathogen. It could be dead cells, cell fragments, etc.
- d) Huge impact on public health. Vaccination has almost eliminated many infectious diseases which once killed millions.

Topic Test

1.
a) G b) C c) A d) F
e) H f) B g) J h) I
2.
a) Sensory organs
b) Sensory Nerves
c) Central nervous system (brain+ spinal chord)
d) Motor nerves
e) Muscles
3.
Many answers possible.
a) Pancreas
b) Insulin
c) Controls blood sugar levels.
4.
Many answers possible.
In a boy at puberty, the male hormone testosterone causes sperm production to begin. It also sets off a “growth spurt”, causes the voice to deepen and facial and body hair to grow.
5.
a) Infectious = caused by a pathogen.
Non-infectious = no pathogen involved.

b) Antigen = chemical of a pathogen which can stimulate the immune system.
Antibody = chemical released by a B-cell which “locks onto” its target antigen and immobilises it for destruction.

c) Barrier defences, such as skin or mucous membranes, work by trying to prevent a pathogen getting into the body. The immune system acts to destroy pathogens if they do manage to enter the body.

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