S3 Biology

MULTICELLULAR ORGANISMS
Unit 2: Section 1: Circle of Life

NAME:
CLASS:

Traffic light the Experiences and outcomes below.

Topic 1: Producing new cells			
No.	Level	Outcome	Rating
1	N4	I can state the importance of cell division to living things	
2	N5	I can describe the sequence of events of mitosis	
3	N5	I can use the terms chromatid, equator and spindle fibres	
4	N5	I understand that mitosis maintains the diploid chromosome complement	
5	N5	I can explain that specialised cells of the same type are grouped into tissues.	
6	N5	I understand that related tissues join together to form organs which work in groups to form systems.	
7	N5	I can describe the hierarchy of organisation in multicellular organisms: cells → tissues → organs → systems	
8	N5	I can state that stem cells in animals are unspecialised cells	
9	N5	I can state that stem cells divide in order to self-renew.	
10	N5	I understand that stem cells can divide and develop into many different types of cells. I can state that stem cells are involved in growth and repair.	
11	N5	I can describe some of the potential uses of stem cells and am aware of the ethical issues surrounding their use.	
12	N4	I can compare the growth and development of different organisms	
13	N4	I can state the optimum conditions for growth following seed germination experiments	
14	N4	I can describe how chemicals and radiation can affect growth and development	
15	N4	I can describe how plants are grown commercially	
16	N4	I can explain the importance of suitable conditions to maintain growth and development	
17	N4	I can discuss the links between diet and growth and development disorders	

Topic 2: Reproduction

No.	Level	Outcome	Rating
18	N4/N5	I can state that sexual reproduction involves two parents and produces offspring that are different to each other	
19	N4	I can describe sexual reproduction in flowering plants	
20	N4	I understand that sexual reproduction is important for introducing variation in a population and enables a species to adapt to changing environmental conditions.	
21	N5	I understand that sex cells in plants and animals are called gametes. I can name male and female gametes in plants	
22	N5	I can state where gametes are produced in plants.	
23	N4	I can describe and give examples of asexual reproduction in plants	
24	N4	I understand that asexual reproduction does not produce variation but it allows populations to grow quickly.	
25	N4	I have propagated plants (seeds, cuttings, bulbs, tubers or runners)	
26	N4	I have investigated the use of plants commercially to produce food, fuel, raw materials and medicines	
27	N4	I can describe the use of plants for aesthetic reasons	
28	N4	I have investigated pharming as a way to genetically modify plants to produce medicines.	
29	N4	I can describe methods of propagating plants	
30	N4	I can compare different methods of reproduction and discuss how these relate to species survival	
31	N4	I can describe sexual reproduction in animals	
32	N5	(I understand that sex cells in plants and animals are called gametes). I can name male and female gametes in animals	
33	N5	I can state where gametes are produced in animals	
34	N5	I can explain that a cell described as haploid contains one set of chromosomes and a cell described as diploid contains a double set of chromosomes. I can state that all gametes are haploid and all other cells are diploid.	
35	N5	I understand that fertilisation is the joining of two haploid gametes to produce a diploid zygote.	

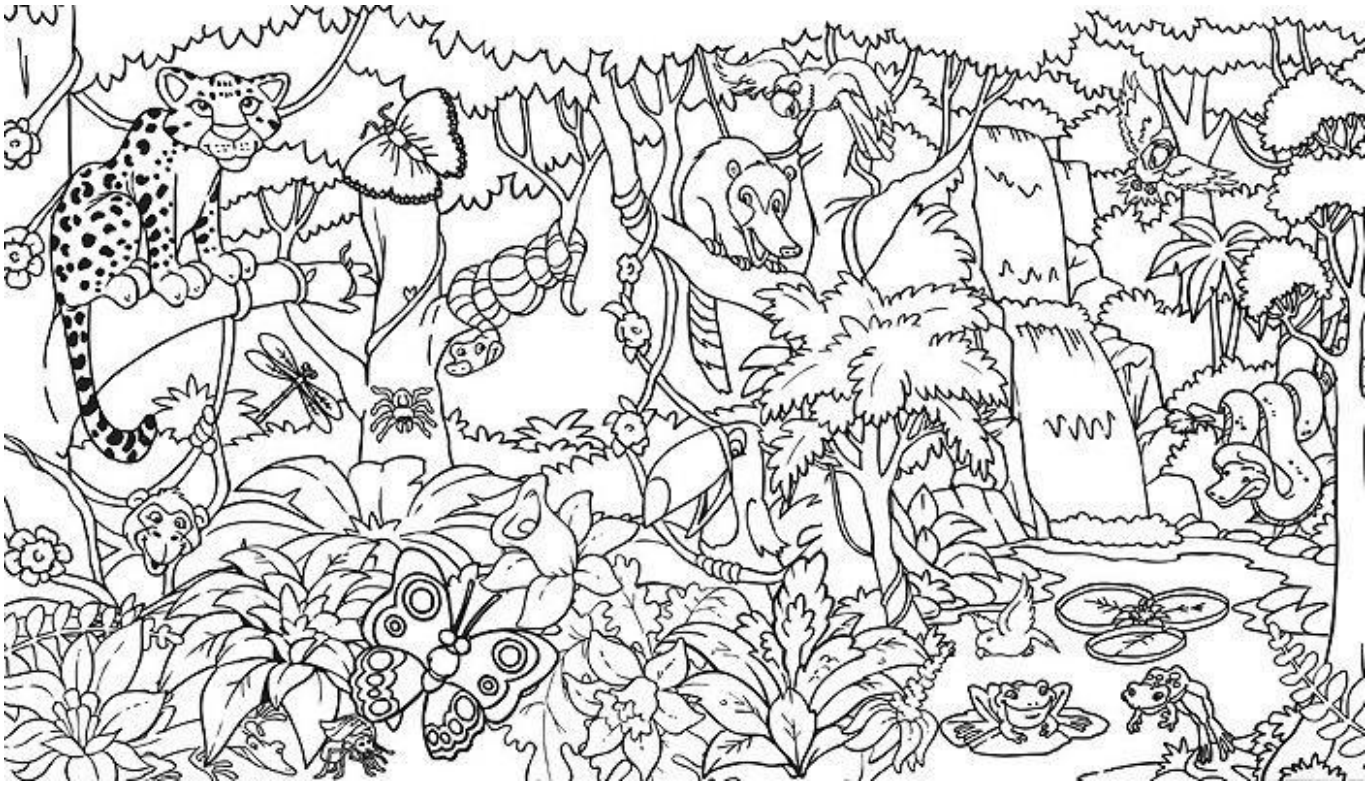
Topic 3: Variation and Inheritance

No.	Level	Outcome	Rating
36	N4	I can state that **DNA** is found in the **nucleus** of cells.	
37	N4	I can state that **genes** are short sections of DNA.	
38	N4	I can state that **chromosomes** are made from long strands of DNA.	
39	N4/5	I can state that genes can take two forms called **alleles**	
40	N4	I can state that our genes determine our **features**.	
41	N4	I can state that as we **inherit** half of our DNA from our father and the other half from our mother this ensures **variation**.	

42	N5	I can use a named example (e.g. eye colour) and alphabetical representation to show a **dominant** allele (If an allele is overpowering enough to "mask" another allele) and **recessive** allele (the one being masked).	
43	N5	I can describe the difference between **heterozygous** and **homozygous** genotypes	
44	N4/N5	I can draw a **Punnett square** to predict the outcome of breeding based on the alleles possessed by parents.	

Topic 1: Producing new cells

Multicellular organisms



Organisms made of more than one cell are said to be _____.

These include most animals and plants. In this booklet we will be looking at how multicellular organisms grow and develop. We will also learn about how living things carry out reproduction.

Some ideas to think about….

1. How many different multicellular organisms can you see in the jungle scene above?
2. What things do you think they need to grow and survive?
3. Are there any differences in the way they grow, develop and reproduce?
4. Are there any similarities in the way they grow, develop and reproduce?

Cell division and its role in growth and repair (N4)

New cells are made by _____ _____. Cells need to divide for **growth** and **repair**.

Use the power point to write down why living things need cell division in the arrow below

Did you know?

Scientists estimate that there are about 37 trillion cells in the human body!

All of your body cells must be replaced if they are damaged, faulty or destroyed!

Some cells must be replaced very frequently. Why do you think they have such short lifespans?

_____

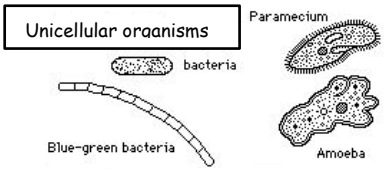
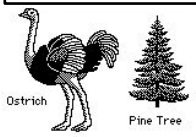
_____

_____

CELL TYPE	LIFESPAN
Stomach lining cells	
Sperm cells	
Colon cells	
Epithelia of small intestine	
Platelets	
Skin epidermal cells	
Lymphocytes	
Red blood cells	
Macrophages	
Endothelial cells	
Pancreas cells	
Bone Cells	

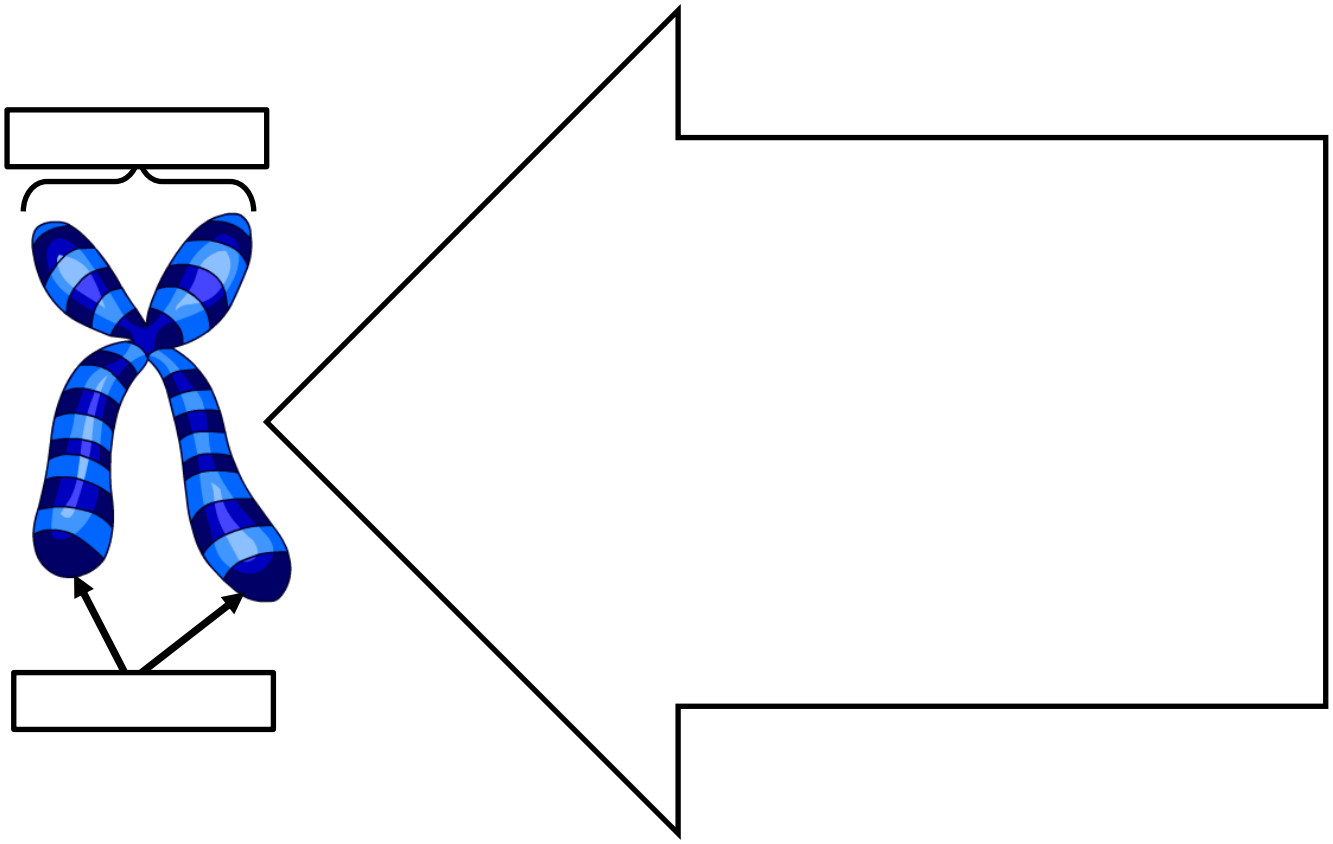
Mitosis

Growth and repair is only possible because of cell division. Cell division is also called _____. During mitosis, the parent copies all its information (found in c_____).

What do **unicellular** organisms use mitosis for?	What do multicellular organisms use mitosis for?
Unicellular organisms 	Multicellular organisms 

The genetic information is stored inside chromosomes in the _____. When each original chromosome is copied, it remains joined to the copy until they become separated. When joined together like this, each strand is called a _____.

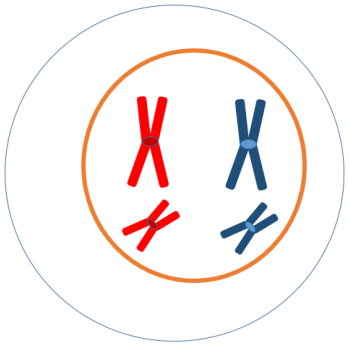
Use the power point to label the chromosome and complete the box:



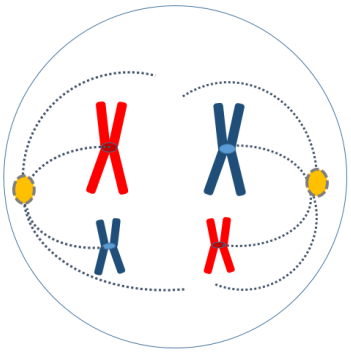
Mitosis

Use the power point to describe the stages of mitosis. Remember to add labels to the diagrams

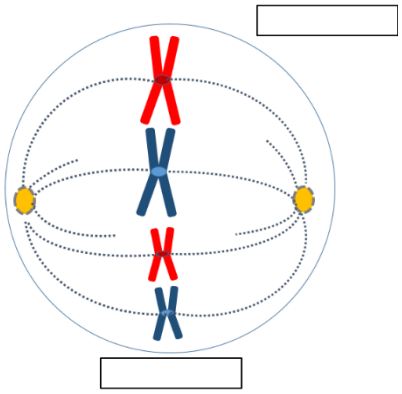
Stage 1:



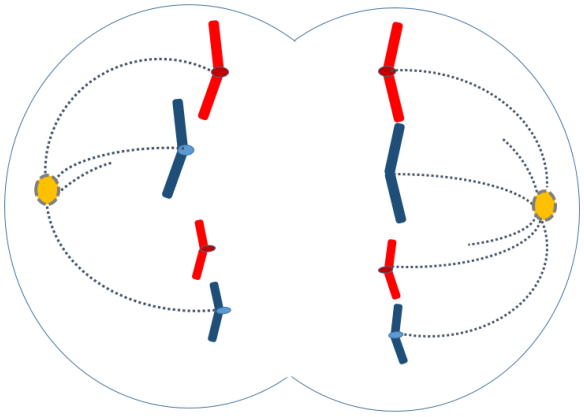
Stage 2:



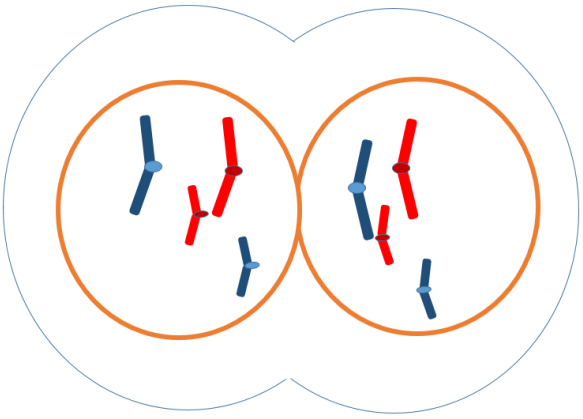
Stage 3:



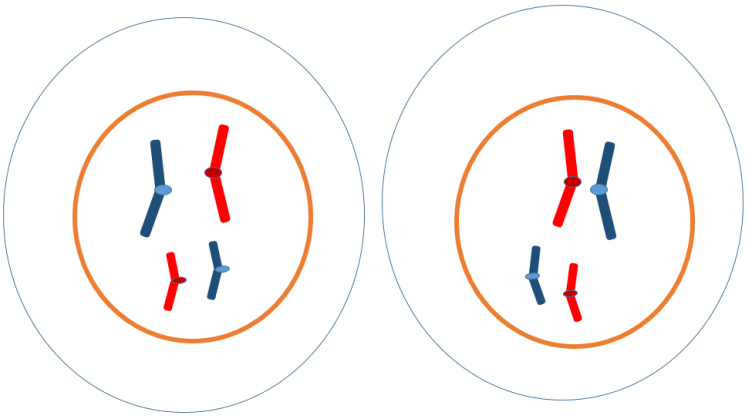
Stage 4:



Stage 5:



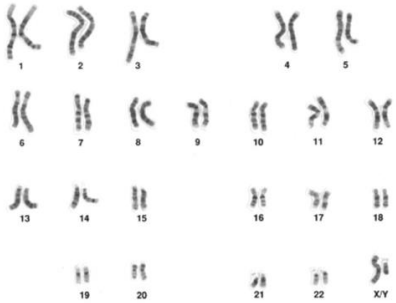
Stage 6:



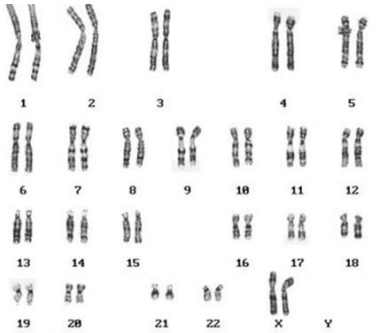
The Importance of Mitosis

The number of chromosomes an organism has is called its _____ _____. Humans have a chromosome complement of __ chromosomes. ___ of these chromosomes were inherited from _____ parent. When you can see the chromosomes at division that is called a _____.

Human male chromosome complement



Human female chromosome complement

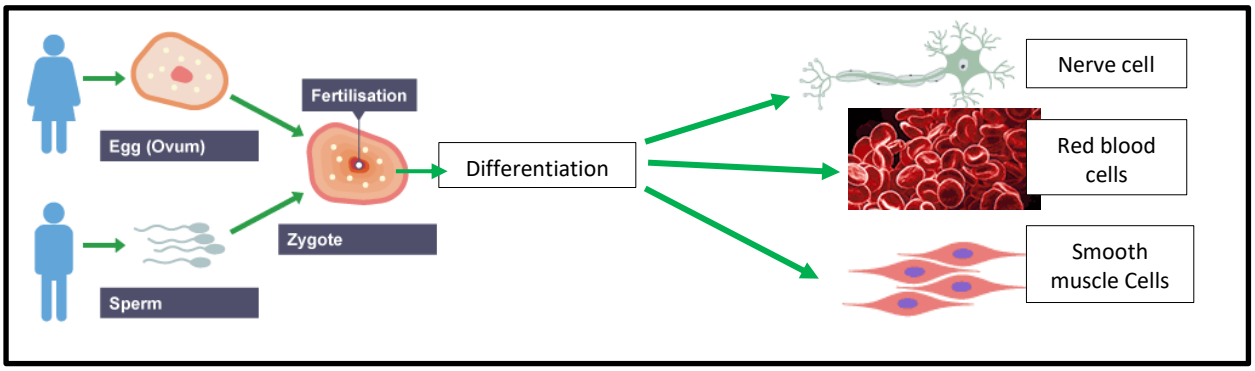


All body cells are _____. This means that they have two copies of each chromosome. Mitosis maintains the _____ chromosome complement. This ensures that each new cell produced by mitosis has all of the DNA that is needed for the cell to _____ properly.

Cells tissues and organs

Specialised cells

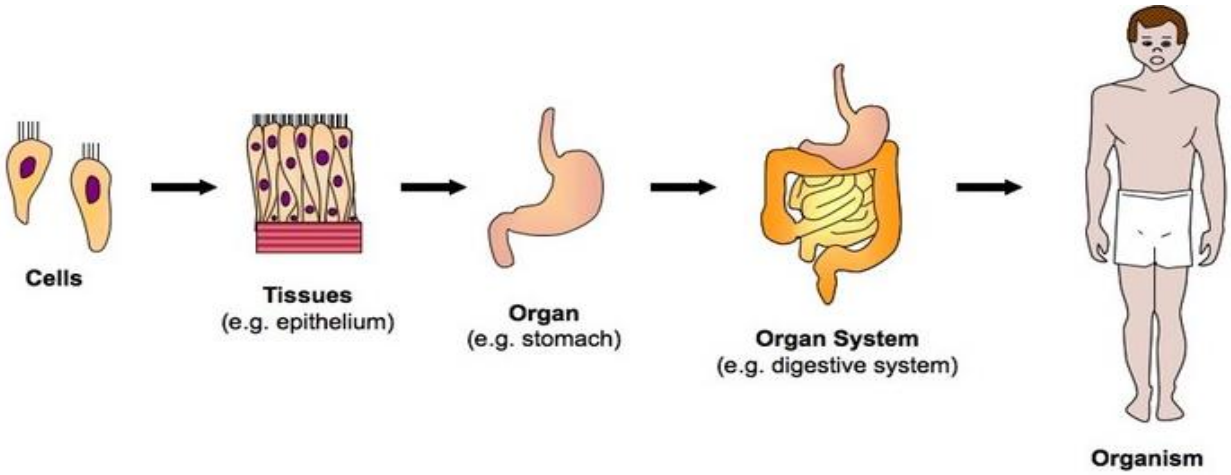
All cells in a multi-cellular organism have developed from a single cell, a _____. Through differentiation, cells become _____ by a change in their _____ to allow them to carry out different _____ e.g. nerve cells are long and _____ to carry _____ signals all over our body. Cells become specialised because certain _____ are turned off and _____ in each different cell.

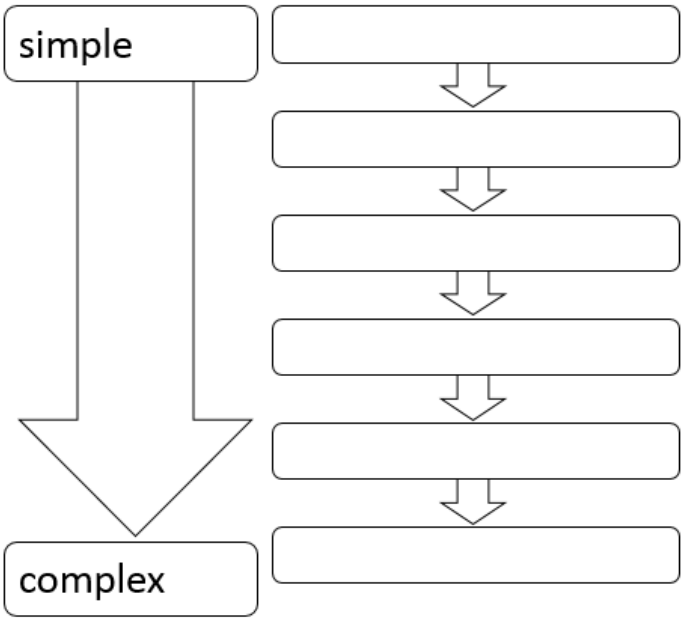


Pick **two** of the **differentiated** cells on the previous page and complete the table below:

Specialised cell	Special Structure(s)	Function (How does the structure help the cell carry out its special function?)
e.g. Sperm Cell 	*Tail* *Pointed head* *Mid-section*	*Tail helps sperm swim to egg.* *Contains genetic information (in nucleus) and enzymes to help penetrate the egg cell.* *Contains mitcochondria to release energy.*

Cells which carry out similar roles join together to make _____ which build up into _____. Groups of organs work together to form _____ _____.



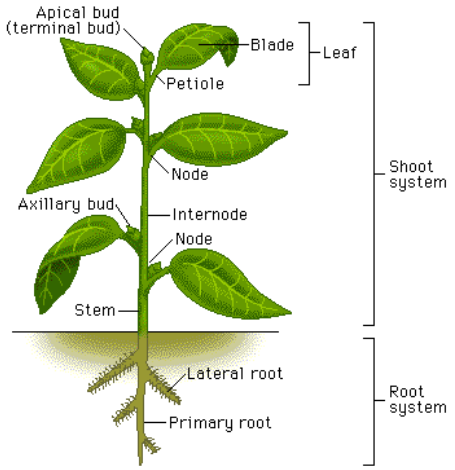


Complete the table below to show examples of organ systems:

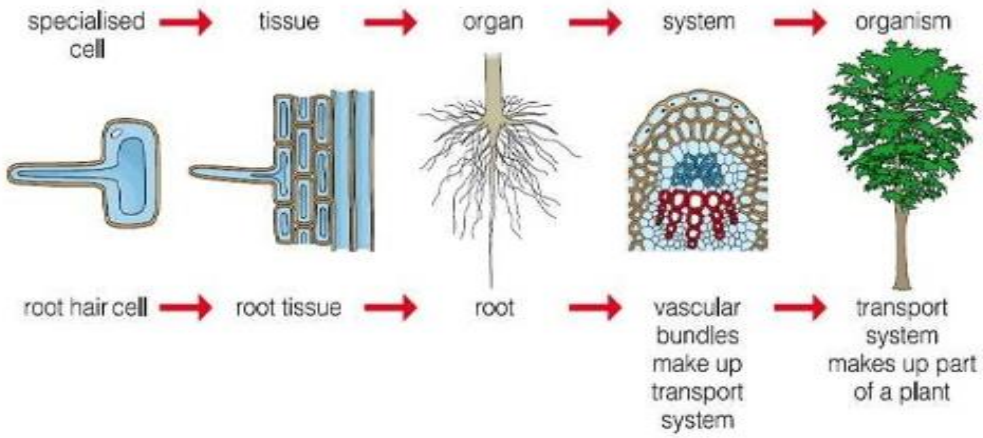
Organ system	Function
	provides structure to the body and protects the organs
muscular	
	Controls sensation, thought, movement and virtually all other body functions
digestive	
	Takes in oxygen and releases carbon dioxide
circulatory	

Plants have organ systems too:

Plant Organ Systems



Organ system	Function
Shoot	_____ carry out photosynthesis
	_____ provide structure
	_____ produce seeds
Root	Tap roots store _____
	Fibrous roots absorb _____ and _____ from soil

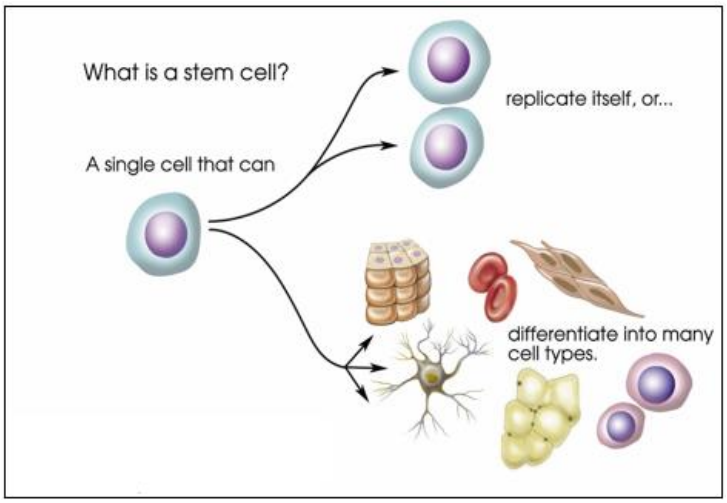


Stem cells

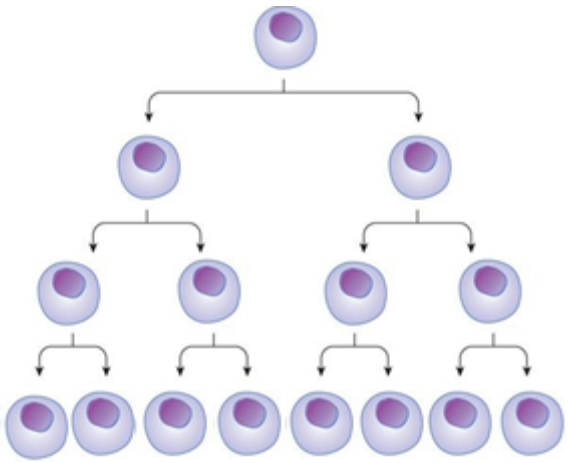
All of the specialised cells in an animal develop from stem cells.

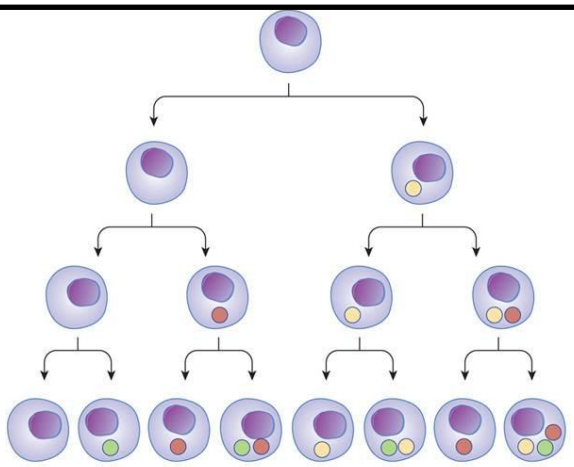
Stem cells produce _____ cells in animals and are involved in growth and _____.

They can either _____ to produce more stem cells or they can _____ into specialised body cells.



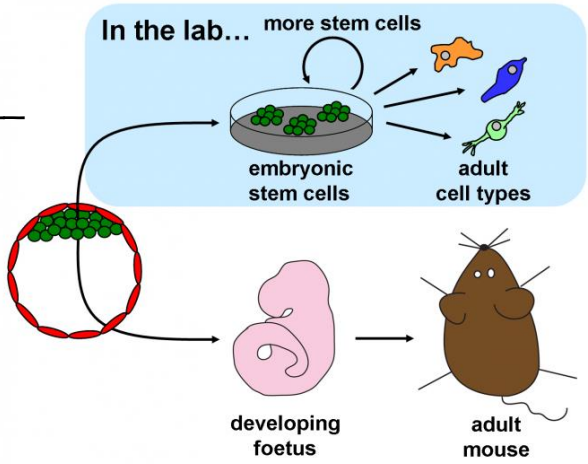
Stem cells have two important features:



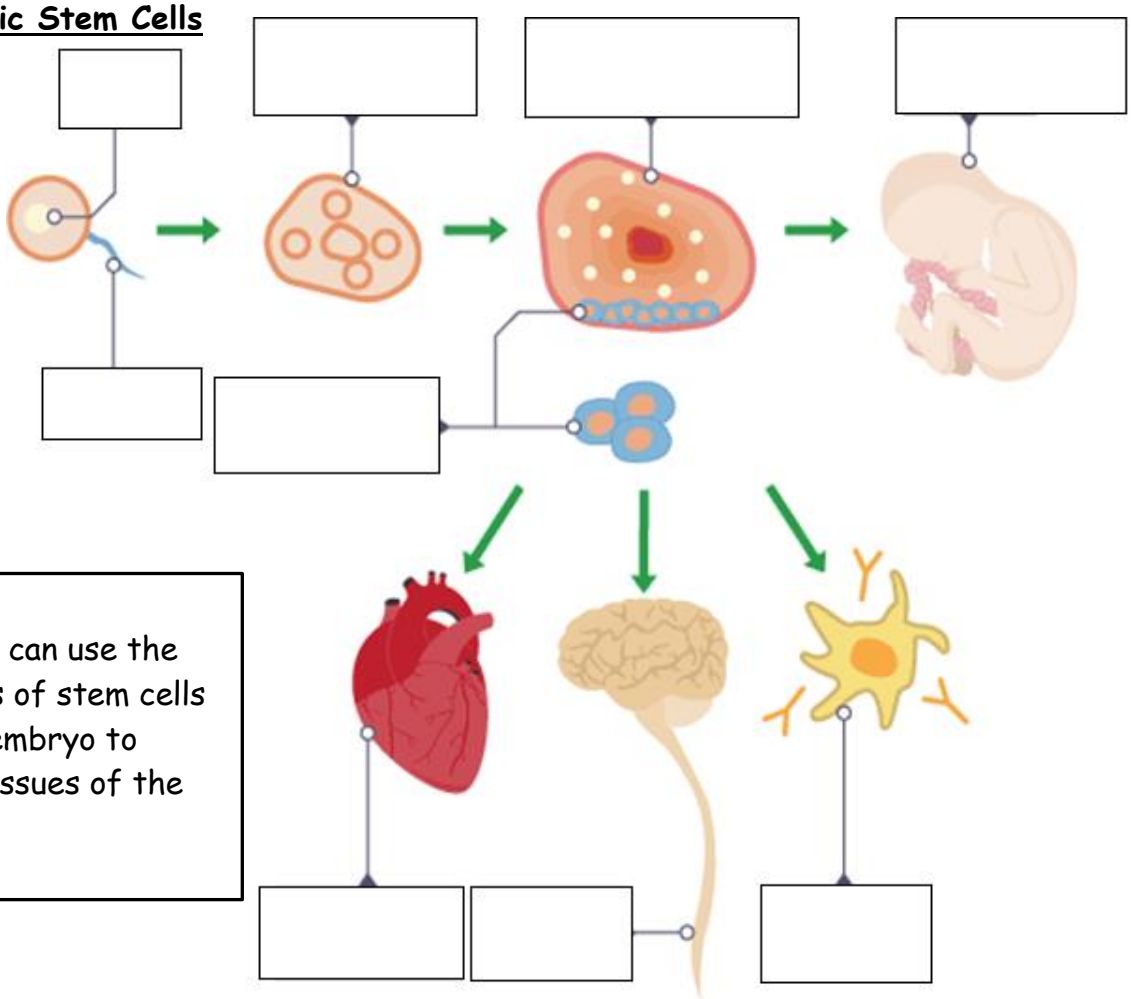


Embryonic Stem Cells

In the early stages of life, animal _____ contain stem cells which can divide and differentiate into specialised cells to form the body tissues that make organs.



Embryonic Stem Cells

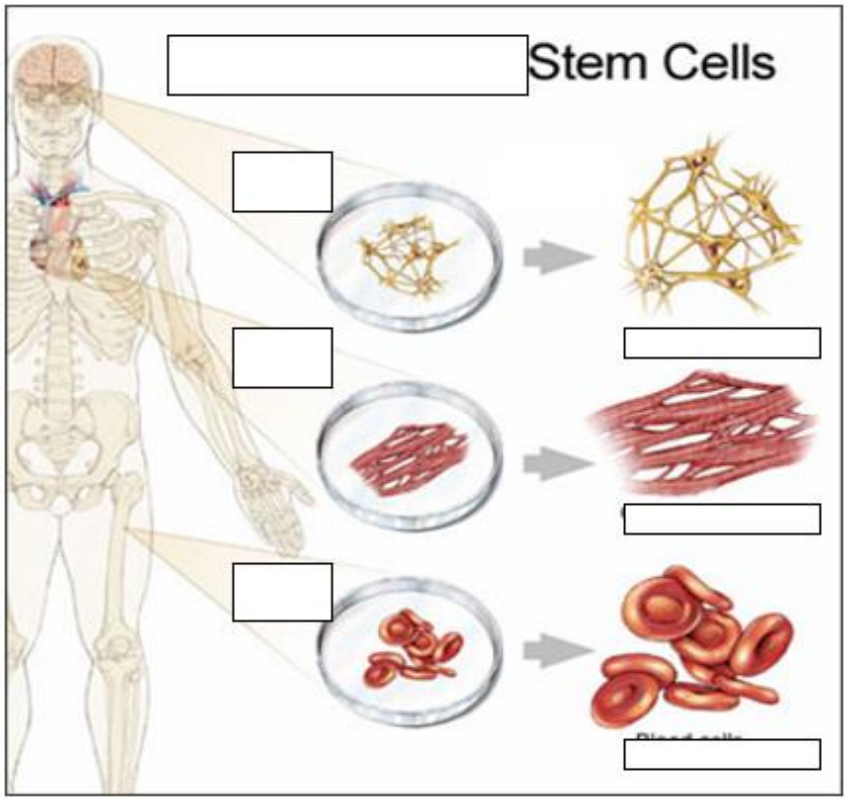


Scientists can use the inner mass of stem cells inside an embryo to produce tissues of the body

Adult Stem Cells

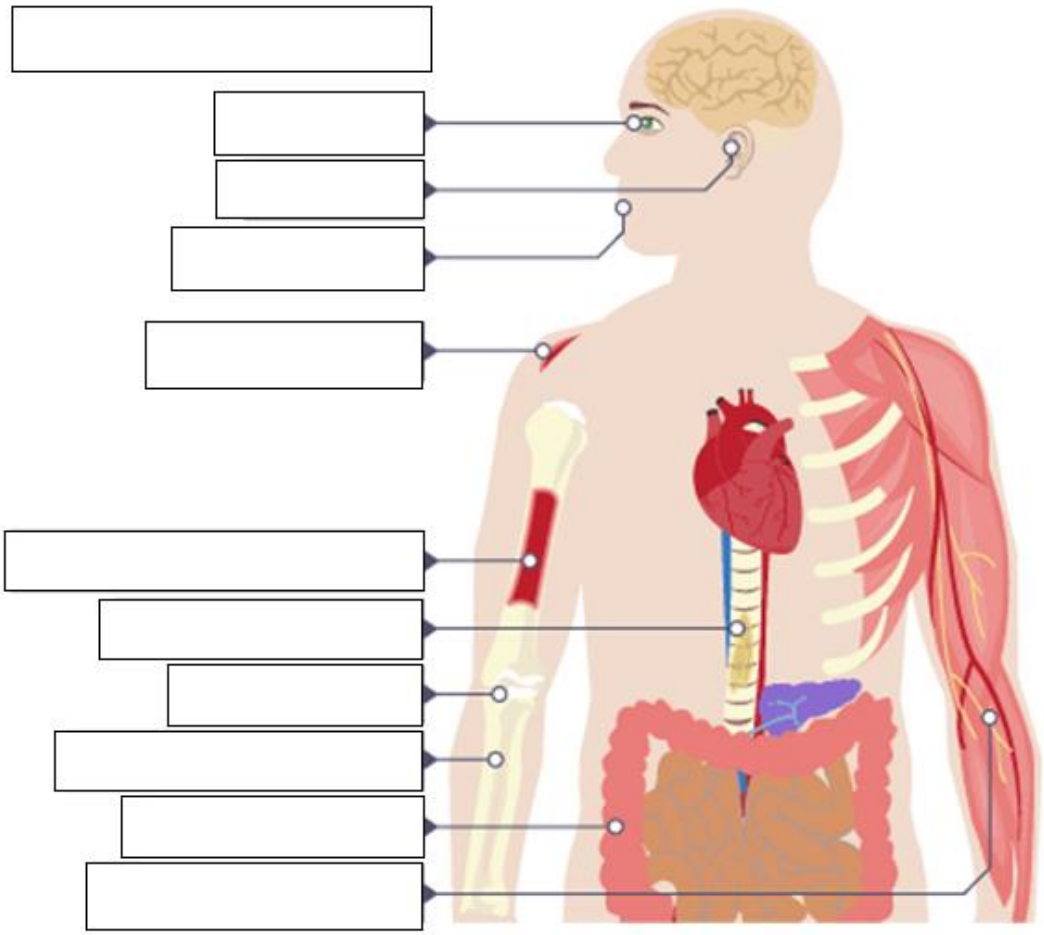
Some locations in the adult body, such as the lower layers of the skin and small intestine, still contain populations of stem cells.

These cells can divide to produce a limited range of specialised cell types to replace cells that have been damaged.



Uses of Stem Cells

Stem cells produced in cell culture have the potential to be used to replace specialised cells in a person affected by _____ or _____.



Stem Cells Activities

Case Study/Numeracy task

Your teacher will show you a video about Alzheimer's disease

Research Task:

Your teacher will give you a type of disease to research. You should include:

- symptoms of the disease,
- how common the disease is,
- what the current treatment for the disease is,
- how can stem cells be used to treat the disease.

Ethical discussion:

Stem Cells can be controversial. Your teacher will give you the opportunity to look at the opinions and ethics surrounding stem cells and stem cell research.

Stem Cells summary:

Complete the mind map below using the following headings:

- What is a stem cell? *(describe features and name two types of stem cell)*
- Stem Cells in the body *(what do stem cells do inside the body?)*
- Therapeutic uses of Stem Cells *(what diseases can stem cells be used to treat)*
- Ethical issues and Stem Cells *(why might Stem Cells be controversial?)*

Stem Cells

Look for the following words

specialized	types	human	embryo	copies	understand
diseases	develop	new drugs	treatments	baby	stem cells

T	I	I	S	G	U	R	D	W	E	N	T	K	F
V	Y	T	A	C	O	P	I	E	S	E	S	B	Q
W	C	Q	G	Y	C	B	C	S	M	P	T	A	Q
J	H	H	B	T	V	L	L	B	E	M	R	B	J
E	G	U	J	W	G	L	R	C	Q	N	E	Y	N
K	X	M	N	U	E	Y	I	J	V	A	A	W	C
I	T	A	L	C	O	A	I	Q	P	X	T	R	Z
Z	L	N	M	B	L	Y	G	O	K	R	M	H	I
L	T	E	U	I	N	T	L	B	J	V	E	Y	N
E	T	E	Z	W	O	E	Y	V	R	G	N	W	I
S	H	E	M	W	V	X	E	P	E	G	T	R	C
G	D	J	Y	E	N	B	O	K	E	L	S	G	R
X	M	F	D	L	D	I	S	E	A	S	E	S	W
T	V	D	N	A	T	S	R	E	D	N	U	A	R

Plant Growth (N4)

Plants need certain conditions in order to grow. They need water, _____ (for respiration), _____ _____ (for photosynthesis) and a suitable temperature. They also need minerals from the _____ for healthy growth.

Experiment: Seed Germination

Set up 3 petri dishes as shown:

A:	B:	C:
10 cress seeds	10 cress seeds	10 cress seeds
1 filter paper disc	1 filter paper disc	1 filter paper disc
10mL water	10mL water	10mL water
0°C (Fridge)	20°C (Room)	40°C (Oven)

Ensure that the seeds have been evenly spaced. Leave the dishes for 48hrs and then count the number of seeds that have germinated.

Results:

Dish	Temperature (°C)	No. of seeds germinated	Percentage no. of seeds germinated (%)
A			
B			
C			

Conclusion:

The greatest number of seeds germinated (_____ %) at _____ °C.
This is the _____ temperature for seed germination.

Jotter Questions

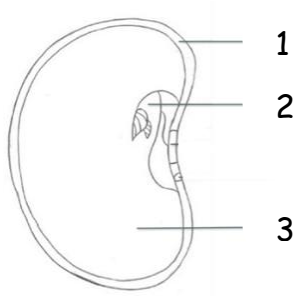
1. What variable was measured in the experiment? (dependent variable)
2. What variables have been altered in this experiment? (independent variable)
3. What variables have been kept the same in this experiment?
4. What would be a good **aim** for this experiment?
5. How could you make the results more reliable?

Seed germination

Seeds need three conditions in order to germinate:

- _____ helps to break the seed dormancy.
- _____ for respiration. Seeds have a food store. When seeds germinate, the starch inside the food store is broken down to glucose which is used for respiration.
- _____ _____ helps to break the seed dormancy. Seeds germinate when the conditions are right. This improves the survival of seedlings.

Seed structure revision:



1: Seed coat
2: Embryo
3: Starch food store

Remember the WOW factor???

Seeds need water, oxygen and warmth to germinate!

Experiment: Requirements for germination

You have seen that seeds need a **suitable temperature** in order to germinate. Seeds also need water and oxygen to germinate.

Design a suitable experiment to show that seeds need **water** to germinate.
OR
Design a suitable experiment to show that seeds need **oxygen** to germinate.

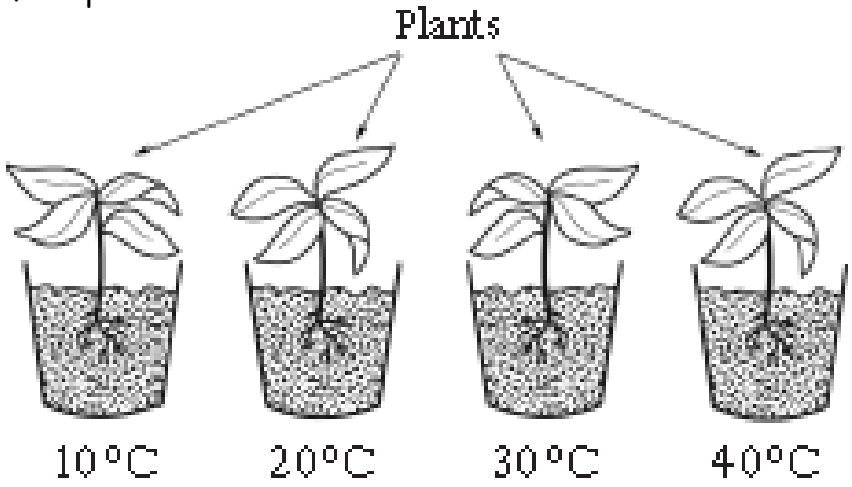
Show your teacher your plan and carry out your investigation.

Conclusion:

The percentage germination was highest when _____.
Seeds need _____, _____ and a _____ _____ in order to germinate.

Growing Plants Problem Solving Qn 1:

A student carried out an investigation into the effect of temperature on the growth of four plants:



The heights of the plants were measured at the start and after four weeks. The results are shown in the table below:

Temperature (°C)	*Height of plants* (cm)		
	At start	*After 4 weeks*	*Change in height*
10	20	25	5
20	20	32	12
30	20	36	16
40	20	28	8

(i) Identify **two** variables that should have been kept the same when setting up this investigation

Variable 1: _____

Variable 2: _____

(ii) Suggest an improvement which would make the results more **reliable**.

_____

Growing Plants (N4)

Growing plants require a range of _____ from the soil. The table below gives examples of soil minerals and their function in plants.

Mineral	Function
Nitrate	
Phosphate	
Potassium	
Magnesium	

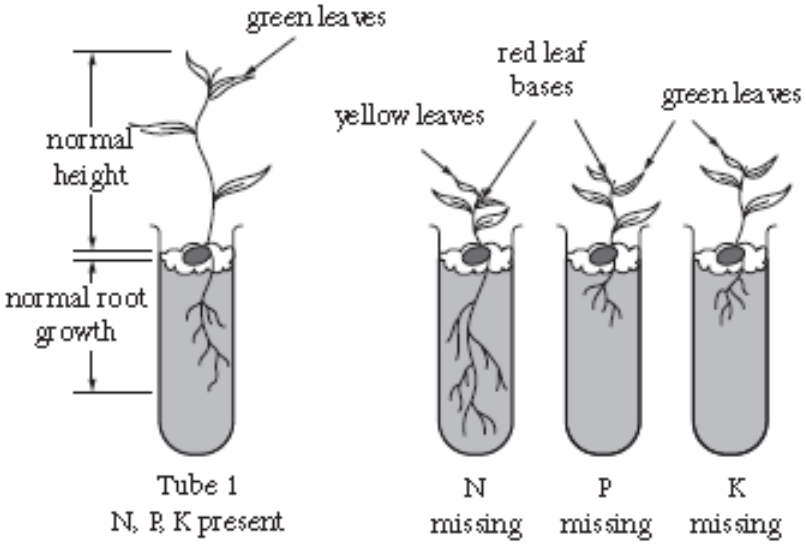
Plants lacking these minerals fail to grow properly. This might mean that the plant has a _____ size or that the leaves, roots and shoots become unhealthy. Sometimes, these minerals are added to the soil to improve plant growth. _____ can be used to add minerals and plant nutrients to the soil.

The problem solving question on the next page is about the effect of minerals on the growth of plants.

Growing Plants Problem Solving Qn 2:

The diagram below shows an investigation into the effect of three minerals, nitrogen (N), phosphorus (P) and potassium (K) on plant growth.
The solution in Tube 1 contained N, P and K.

The other tubes each contained a solution which had one mineral missing.



(i) What colour are the leaves of a plant grown in a solution containing N, P and K?
Colour: _____

(ii) Describe **two** features of plants grown in a solution containing no nitrogen.
Feature 1: _____

Feature 2: _____

(iii) A plant is found to have red leave bases and short roots. The absence of which mineral is likely to cause this effect?
Mineral: _____

(iv) Tube 1 is the control. What was the purpose of including a **control** in this investigation?

_____

_____

Genetic Influences on growth and development (N4)

An individual's growth and development is affected by the genes they inherit from their parents. Some environmental factors can cause problems in growth and development because they alter the genetic information an individual possesses.

A change to an organism's genetic material is called a _____. Mutations can occur naturally but some factors increase the chance of them happening.

Some forms of **radiation** and some **chemicals** increase the frequency of mutation. Anything that increases the frequency of mutations is called a _____.

Complete the table below to give some examples of mutagenic agents:

Type of mutagen	Example
Radiation	_____ can be used to diagnose broken bones. Too much of this type of radiation can cause mutations.
Radiation	_____ light from the sun can cause mutations in skin cells. This can result in skin cancer.
Chemicals	Chemicals in _____ _____ like benzene are known to cause cancer.

N4 Project and N5 Consolidation opportunity

- Undertake a project on Growth and Balanced Diet
  OR
- Try out some N5 questions to improve your skills

Human Growth (N4)

For healthy growth and development humans require a _____ diet.

The major food groups that make up a balanced diet are _____, _____ and _____ .

V_____ and _____ are also needed in small quantities to keep us healthy and prevent diseases.

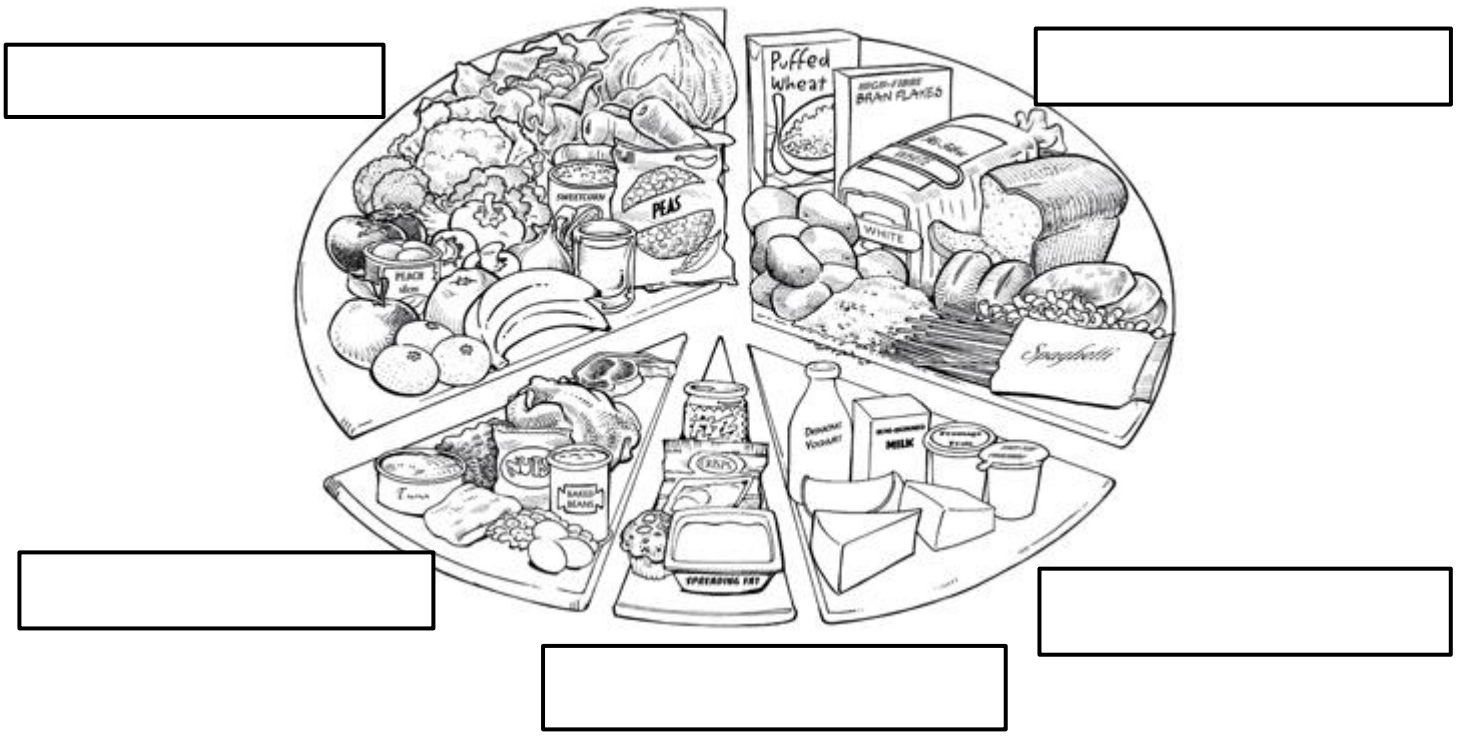
Word Bank:	*minerals*	*proteins*	*balanced*
	vitamins	*carbohydrates*	*fats*

The "Eatwell Plate"

For a healthy diet we need to have the right balance of foods:

- About 1/3 of our daily food consumption should be fruit and vegetables.
- About 1/3 of our daily food consumption should be carbohydrates.
- The remaining third should be made up of dairy foods, protein and a small amount of fat and sugar.

Use the underlined words to label the healthy plate below:



Your teacher will show you some resources to help you complete the summary tables on the next page.

Food Groups

Food group	Examples	Function
Carbohydrates		Energy for cell activities
Fats		
Proteins		Building materials for growth and repair

Vitamins

Vitamin	Examples of sources	Function	Deficiency symptom
A		Healthy skin, good vision, immunity	Night blindness
C		Maintains body cells, helps repair injuries	Scurvy
D		Helps to absorb calcium	Rickets

Minerals

Mineral	Examples of sources	Function	Deficiency symptom
		Bones, blood clotting, muscle contractions	Rickets
Iodine		Needed for healthy hormones	Goitre
Iron		Needed for blood clotting protein	

Topic 2a: Reproduction in Plants

Revision

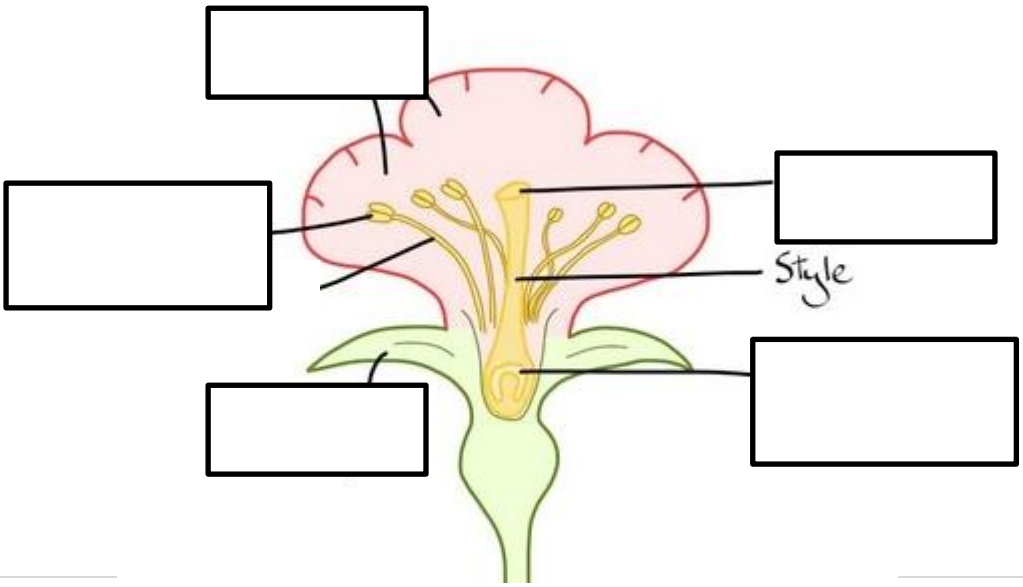
Why do animals and plants need to reproduce?

In this topic you will learn about reproduction in different living things. You will learn that there are two different types of reproduction:

- **Sexual reproduction** which involves two parents. All of the offspring produced are different from each other. Sexual reproduction is important for introducing variation in a population and enables species to adapt to changing environmental conditions.
- **Asexual reproduction** which involves only one parent and all the offspring produced are identical to that parent. Asexual reproduction does not produce variation but it allows populations to grow quickly.

We are going to investigate reproduction in plants first. Plants can carry out both sexual and asexual reproduction.

Sexual reproduction in plants N4



Structure	Function
Anther	
Petals	
Stigma	
Sepal	
Ovary	
Pollen	
Ovules	
Nectary	

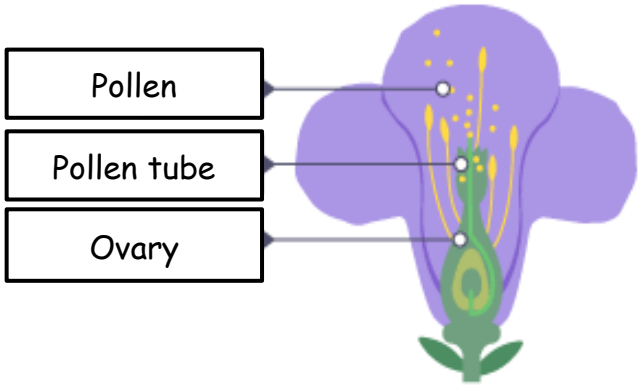
In plants, the male _____ is the pollen and the female gamete is the _____.

When the _____ from one plant reaches the _____ of the same or another plant it is called _____.

After pollination, a pollen _____ forms and grows down to the ovary, carrying a pollen _____.

Pollination and Fertilisation

The nucleus of the pollen and the nucleus of the ovule join. This is called _____. Both pollen and ovule contain a single (_____) set of chromosomes.



A fertilised ovule with a _____ set of chromosomes is formed and is found inside the seed. The ovary _____ may develop into a _____.

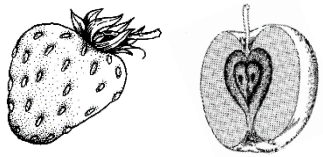
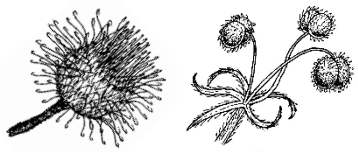
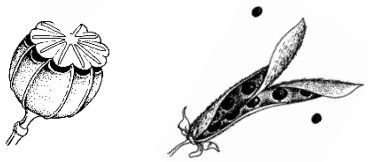
The following stages of plant sexual reproduction are in the wrong order. Put numbers (1-7) to show the correct sequence:

Number	Stage
6	The seed contains the plant embryo, which contains genetic material from both parents.
	The nucleus of the pollen grain travels down the pollen tube.
7	The ovary develops into the fruit.
	The pollen nucleus fertilises the nucleus in the ovule. This is **fertilisation**.
	Pollen lands on the stigma. This is **pollination**.
	A pollen tube grows down through the style to the ovary.
5	The fertilised ovule develops into a seed.

Propagating and growing plants – N4

The series of changes that a _____ goes through as is develops from a certain stage until it reaches the same stage in the next generation is called its LIFE _____. (E.g. from the seed _____ in one generation to the seed geminating in the next _____)

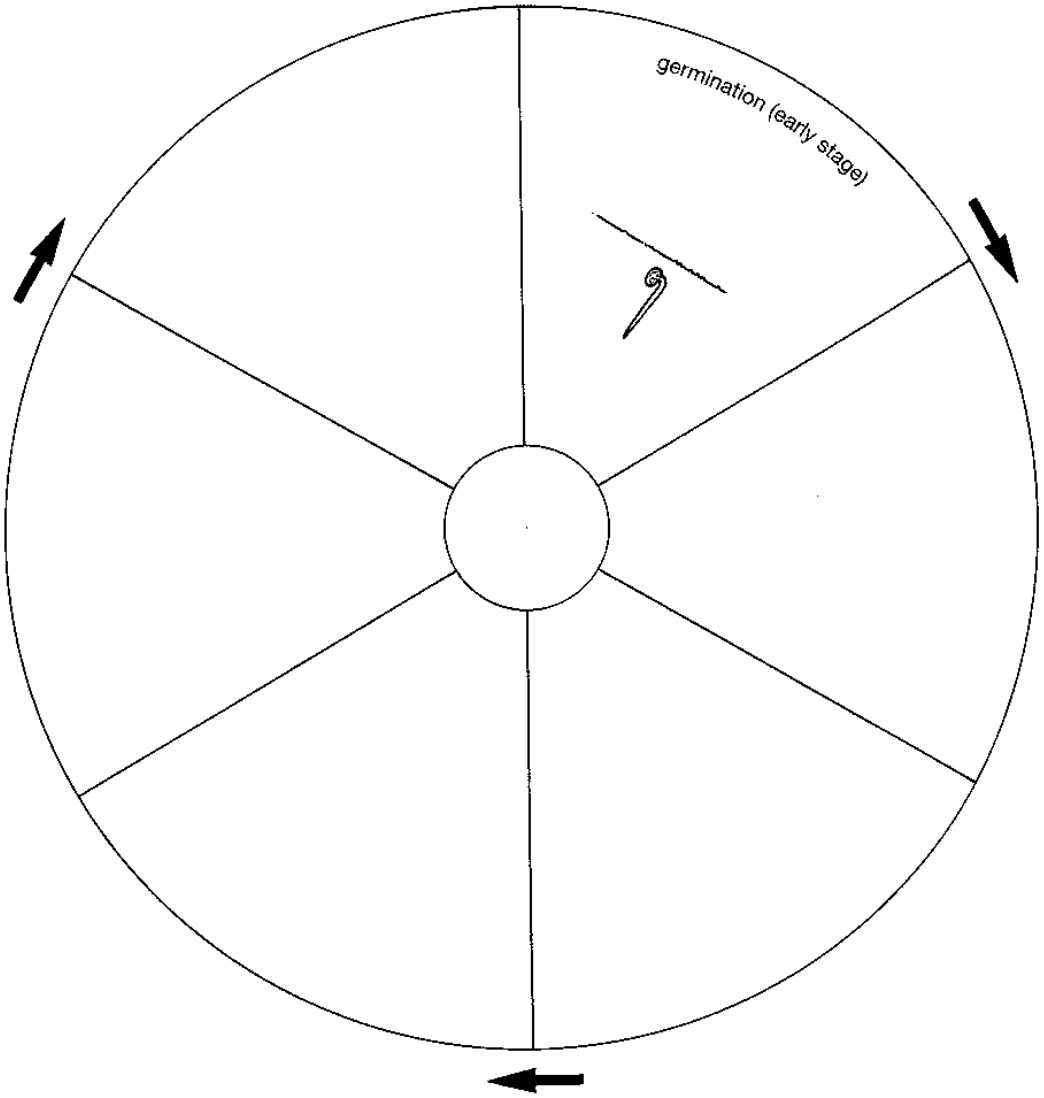
Seeds are produced by _____ reproduction and can be used to propagate plants. Plant _____ is the process of creating new plants. In nature, seeds created by sexual reproduction may be dispersed. Seed dispersal is important as it allows seeds to germinate away from the parent plant and other plants. This reduces _____. Seeds may be dispersed by a number of methods summarised on the next page:

Method of seed dispersal	Example(s)	Drawing
Wind		
Animal internal		
Animal external		
Explosive / self - propelled		

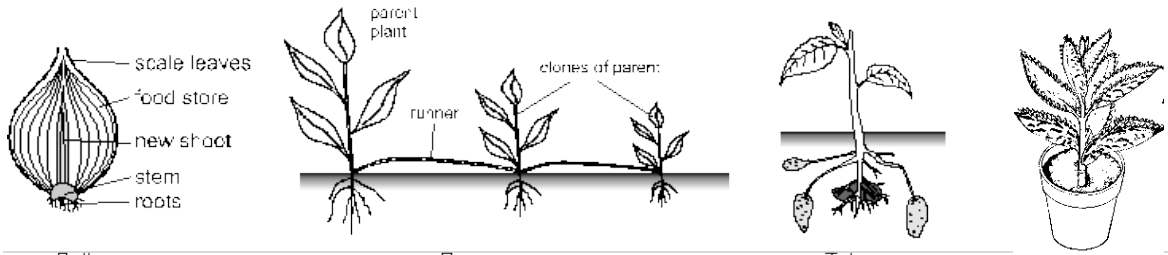
Summary: Asexual Vs Sexual Reproduction in plants

Your teacher will help you make a Venn diagram to show the similarities and differences between sexual and asexual reproduction.

Your teacher will give you a cut out sheet with the stages of the plant life cycle. You should arrange these in the correct order and stick them into the diagram below:



Plants may also be propagated in a natural way through special organs and structures which allow new plants to be created **asexually**. In other words, new plants can be created with only one parent and the offspring are genetically _____ to the parent plant. The main methods of asexual reproduction in plants are b_____, r_____, t_____ and leaf p_____.



Let's get propagating!!!

Your teacher will allow you to try some different methods of plant propagation. Under each of the headings below, name the plant you have propagated and write brief notes on how you did it:

Sexual method of reproduction (seeds)

Natural asexual method of reproduction (leaf plantlets, bulbs, tubers)

Artificial asexual method of reproduction (cuttings, stem grafts)

Commercial uses of plants (N4)

Commercial plant growers can use the above methods to make a large number of plants to sell (in garden centres) or to produce raw materials, medicines (pharming), fuels and food crops. Make notes on each of the following:

Plants can be grown for:

1. **Food**

2. **Drink**

3. **Raw materials**

4. **Decoration**

5. **Fuel**

6. **Pharming**

Extension: Is Pharming the Future?!!

In Unit 1, you learned about Genetic Modification. Through pharming, plants are genetically modified so that they can produce medically useful substances such as drugs and vaccines. Make notes on plants that have been genetically modified to make medicines:

Pharming is controversial

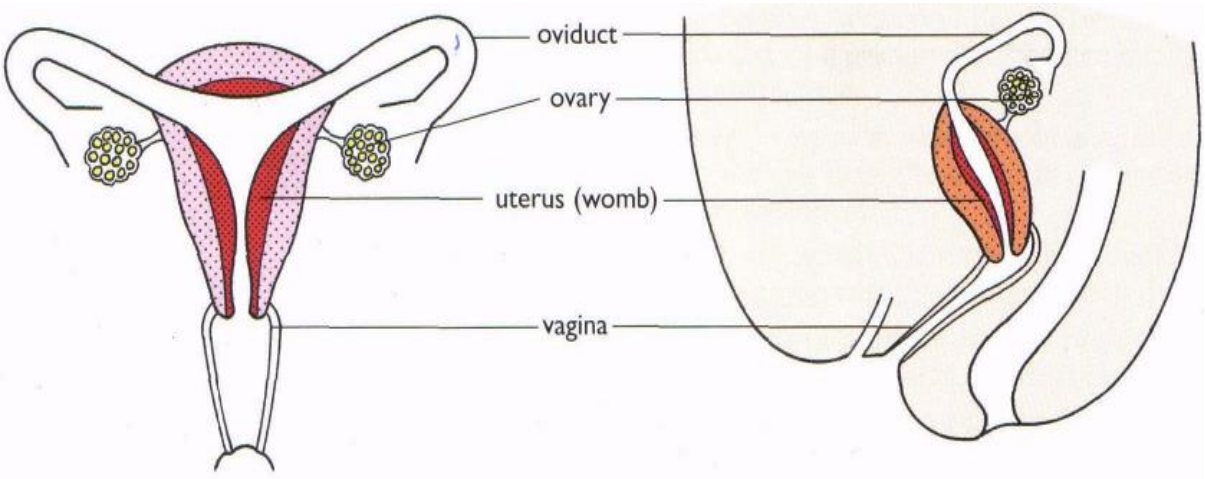
Pharming is useful to humans as the products are easier and cheaper to produce than is possible at the moment. However, the process is very controversial. Using your knowledge of pollination, can you explain why some people have concerns about the growing of GM crops that have been engineered to produce medicines?

Topic 2b: Reproduction in Animals

Sex cells (in humans, sperm and _____) are called _____.

Sperm are produced in the _____ of the male. They contain a nucleus in the head and a _____ to swim. Eggs are produced in the _____ of the female and contain a nucleus and a food _____.

Female reproductive system



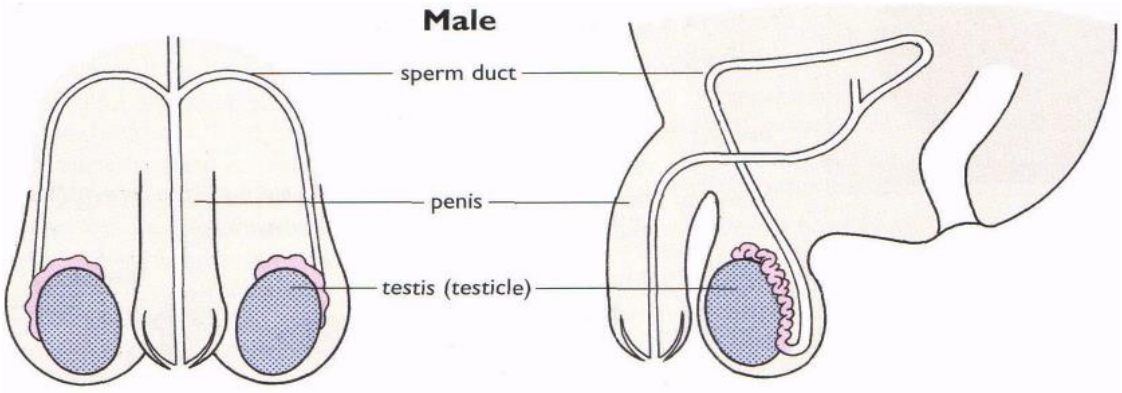
The _____ has hair-like _____ which waft the egg from the ovary, through the oviduct.

The gametes are specialised cells because they have structures which allow them to perform specific functions.
What features do the human gametes have that make them well suited to reproduction?

Egg: _____

Sperm: _____

Male reproductive system (N4/N5)

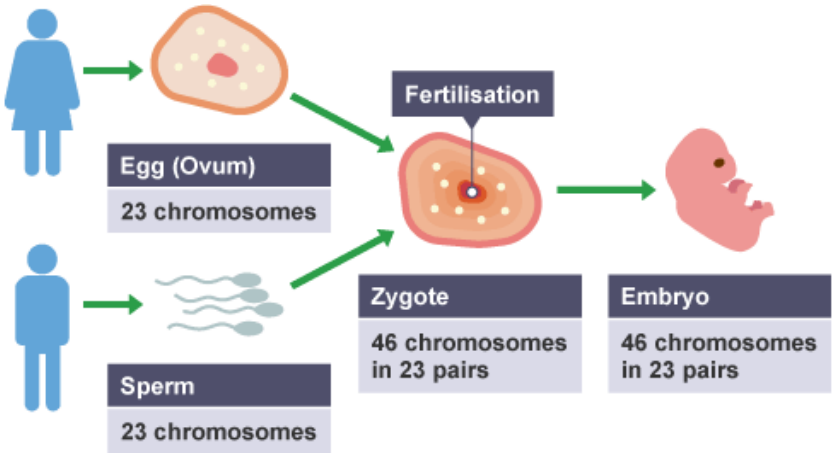


Sperm cells travel down the sperm _____ and are placed in the female's _____ with the penis.

Fertilisation N5

Fertilisation is the process where a sperm _____ fuses with an _____ nucleus in the oviduct. The fertilised egg is called a _____.

All sex cells contain ____ set of chromosomes. This is called a _____ set. In humans, this is 23 single chromosomes.
After fertilisation, the _____ egg contains two sets of chromosomes. This is called a _____ set. All _____ cells contain diploid sets. In humans, this is 23 _____, or 46 chromosomes.



Topic 3: Variation and Inheritance

Characteristics such as eye colour, height and body mass differ between individuals in a population. These differences are called _____.
Features that are visible in an organism's appearance are called _____.

_____ _____ increases variation in the offspring because different forms of genes from each parents combine to give offspring that are different to both of the parents.

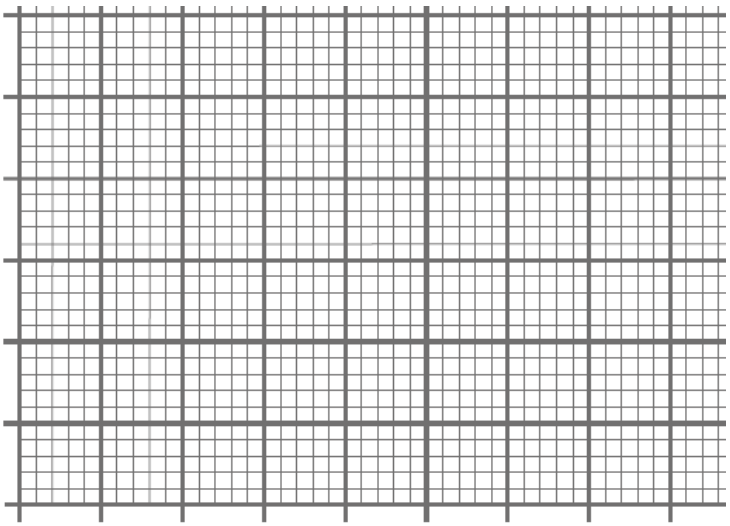
_____ controlled by a _____ gene (one copy inherited from each parent) tend to have _____ that fall into separate categories. They show _____ _____.

Discrete Variation

Blood groups are an example of _____ variation. Blood type is an inherited characteristic controlled by one gene (the ABO gene). There are different forms of this gene called _____.

Use the table to produce a **bar graph** of the different blood types in Scotland.

Blood Type	**Percentage of Scottish population**
O	51%
A	35%
B	11%
AB	3%



Remember:

- Title
- X-axis label
- Y-axis label
- Units?
- Plot

Continuous Variation

Features that show a wide range of values and can be measured on a scale are described as _____ variation.
Usually characteristics that show continuous variation are controlled by more than one gene. This is called _____ inheritance.
Continuous variation in a group of individuals can be shown using a _____ graph or a _____.

_____ is a good example of a characteristic that shows continuous variation.

An individual's height may be any value on a range. Sometimes, height can be plotted on a line graph but more often it will be plotted on a chart called a histogram.

Use the data below to tally the number of people on each height range, then make a histogram. *Hint: Cross off each height you have tallied*

Heights:

157	158	135	162	162	135
143	142	145	146	147	142
153	153	154	159	160	161
155	156	154	154	154	148
163	163	164	165	166	168
136	137	140	141	142	142
144	145	146	147	148	149
149	159	155	156	157	158
150	150	150	151	151	152
169	170	~~131~~	~~132~~		

Tally:

Height Category	Number
Up to 129	0
130-134	2
135-139	
140-144	
145-149	
150-154	
155-159	
160-164	
165-169	
170-174	
Over 175	0

Use your tally to make a histogram on graph paper.

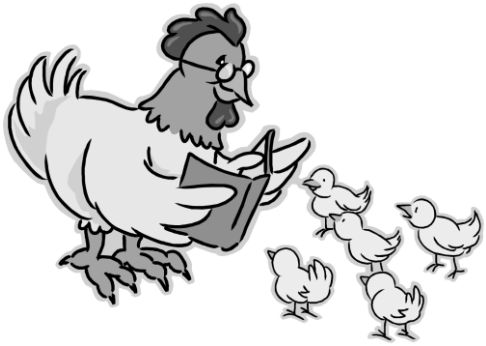
Your teacher may get you to measure the heights of everyone in your class and produce a histogram showing height variation for your class.

Variation Activity

The following characteristics show variation. Complete the table to show your characteristics and decide if each show either continuous or discrete variation.

Characteristic	Value	Continuous/Discrete
Hand clasp	left / right	
Height	_____cm	
Eye colour		
Tongue roll	yes / no	
Shoe size		
Ear lobes	free / attached	
Body mass	_____kg	

Studying Inheritance



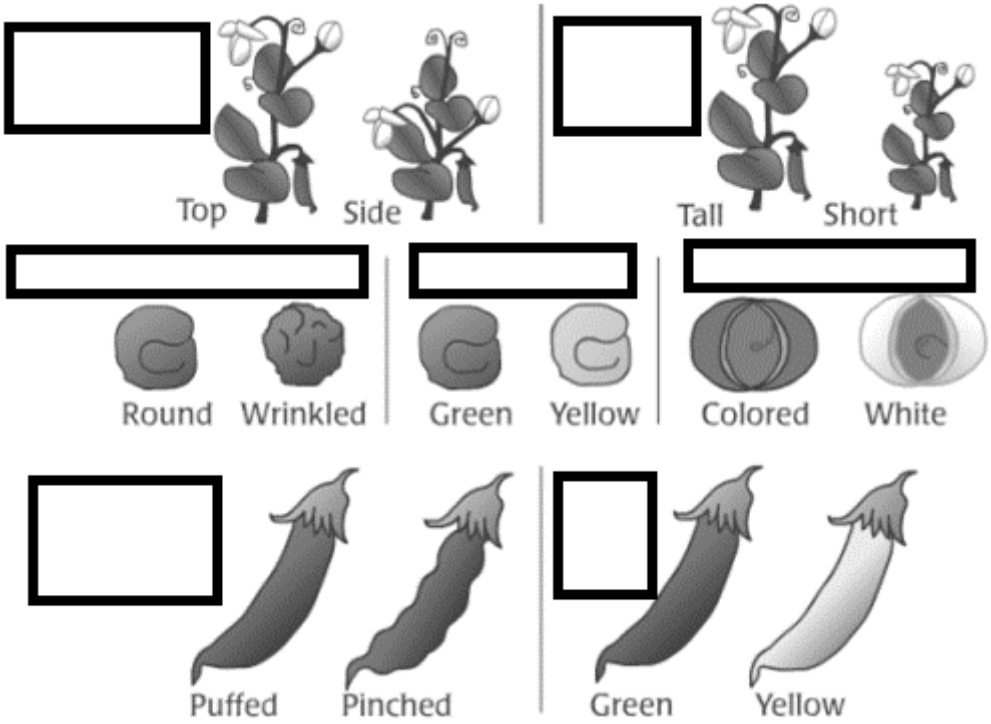
_____ is the study of inherited characteristics and of those factors that determine or affect inheritance.
_____ characteristics are passed on from generation to generation.

Gregor Mendel was a Czech scientist who studied Genetics. Use the "Gregor Mendel Information Sheet" to make some short notes on his work

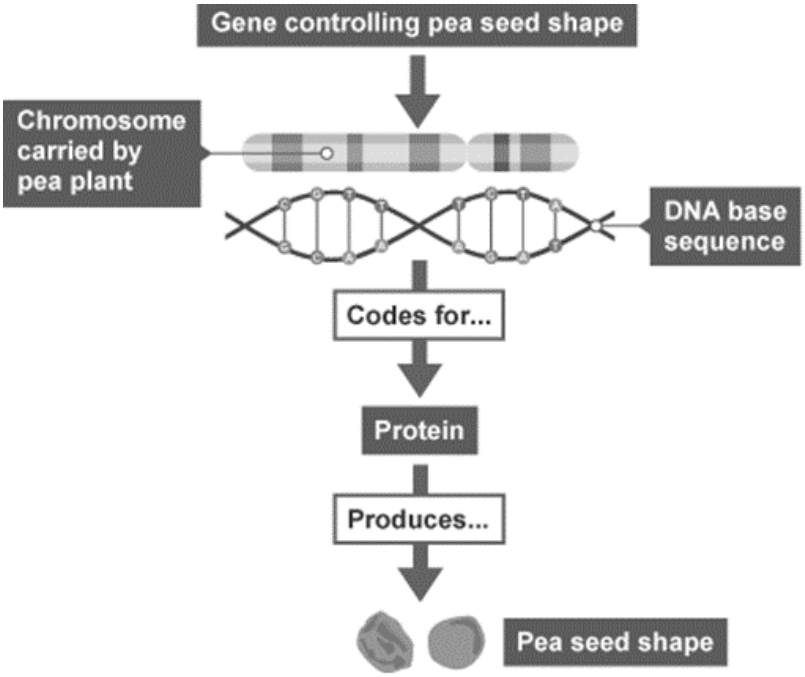
Mendelian Genetics

Pea Plant Genetics

Use the information sheet to complete the diagram below. It shows pea plants and the 7 traits that Gregor Mendel studied.

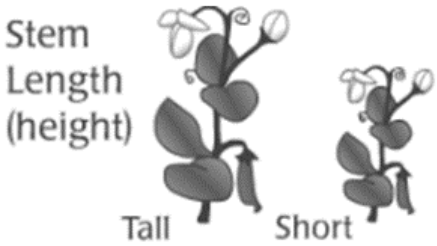


An organism's characteristics (_____) are controlled by the genes it inherits from its parents.
A gene is a _____ on a chromosome where there is a DNA base sequence that codes for a _____ that controls a particular characteristic.
An individual usually receives _____ copies of the gene for each characteristic. One copy is carried on a chromosome passed on by the _____ gamete and one on the matching chromosome passed on by the female _____.



Each of the seven features of the pea plant are controlled by genes and each gene has different forms. Different forms of a gene are called _____ . There may be a _____ allele which is always seen in the phenotype or a _____ allele. Recessive alleles can be _____ if there is a dominant allele present. Recessive traits need ___ copies of a recessive allele to be shown in the phenotype.

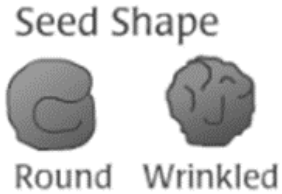
Stem length in peas can be either tall or short.
Tallness is a dominant phenotype.
Shortness is a recessive phenotype.
In the genotype, tallness is the dominant allele so it is given the symbol uppercase T.
Shortness is the recessive allele so it is given the symbol lowercase t.



Phenotype	Genotype
Tall	TT or Tt
Short	tt

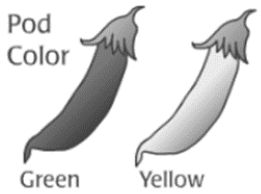
Try to complete the examples below:

Seed shape in peas can be either round or wrinkled.
Roundness is a dominant phenotype.
Wrinkled is a recessive phenotype.
In the genotype, _____ is the dominant allele so it is given the symbol uppercase __.
_____ is the recessive allele so it is given the symbol lowercase __.



Phenotype	Genotype
Round	
Wrinkled	

Pod colour in peas can be either green or yellow.
Green is a dominant _____.
Yellow is a recessive _____.
In the _____, _____ is the dominant _____ so it is given the symbol uppercase __.
_____ is the recessive _____ so it is given the symbol lowercase __.



Phenotype	Genotype
Green	
Yellow	

Genetic Crosses

Genetic crosses can be used to predict what features offspring will have as a result of sexual reproduction.

Example:

$P_{phenotype}$	Tall	x	Short
$P_{genotype}$	TT	x	tt
$G_{gametes}$	only T	x	only t
F_1	All offspring: "tall" phenotype, "Tt" genotype		

If the individuals of the first generation (F_1) are crossed……

$P_{phenotype}$	Tall	x	Tall
$P_{genotype}$	Tt	x	Tt
$G_{gametes}$	T *or* t	x	T *or* t
F_2	?		

A **Punnett square** can be used to predict the offspring when the parents have more than one allele present in their genotype……

Possible male gametes

Possible female gametes

	T	t
T	TT	Tt
t	Tt	tt

The Punnett square shows:

- If the male and female gamete both carry a dominant allele then the resulting genotype will be "TT" and the phenotype will be "tall".
- If the male and female gamete both carry a recessive allele then the resulting genotype will be "tt" and the phenotype will be "short".
- If the male and female gamete both carry different alleles then the resulting genotype will be "Tt" and the phenotype will be "Tall" because the recessive allele is hidden.

WORDBANK

Word	Definition
Cell	
Chromatid	
Chromosome	
Diploid	
Equator	
Haploid	
Mitosis	
Spindle fibre	
Stem cell	
Tissue	
Anther	
Asexual reproduction	
Bulb	
Cutting	
Egg	
Fertilisation	
Gamete	
Ovary	
Ovule	
Pharming	
Pollen	
Propagation	

Sexual reproduction	
Sperm	
Testes	
Tuber	
Zygote	
Variation	
Continuous Variation	
Discrete Variation	
Inheritance	
DNA	
Gene	
Chromosome	
Genotype	
Phenotype	
Allele	
Dominant	
Recessive	
Gamete	
F1 generation	
F2 generation	
Punnett Square	
Heterozygous	
Homozygous	

Brain Training!

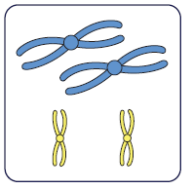
Extended Response Questions:

In Biology, you may be asked to give answers to questions that need more information than just one sentence. The examples below will give you some practice.

N5 Unit 2 Key Area 1 – Producing New Cells

a. Explain the importance of mitosis to multicellular organisms. (3)

b. The diagram shows an animal cell about to undergo mitosis.



Describe the sequence of events of mitosis that would lead to this cell producing two daughter cells. (3)

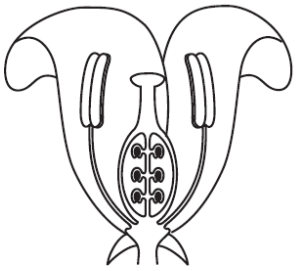
c. Describe the similarities and differences between embryonic and adult stem cells. (3)

d. Describe the ethical issues surrounding research into human embryonic stem cells. (3)

N5 Unit 2 Key Area 3 – Reproduction

a. Describe the structural differences between a mammalian sperm and an egg. (3)

b. The diagram below shows a section through a flower.



Name the sites of production of pollen grains and ovules in a flower. Describe how these gametes are formed and describe the process of fertilisation. (5)

c. Describe how fertilisation is achieved in a flowering plant. (3)

N5 Unit 2 Key Area 5 Variation and Inheritance

1. The table contains information about an experimental cross involving coat colour of mice. The original parents were both true breeding.

	Symbol	*Phenotypes*
Parents		Brown x white
First generation of offspring		
Second generation of offspring		75% brown 25% white

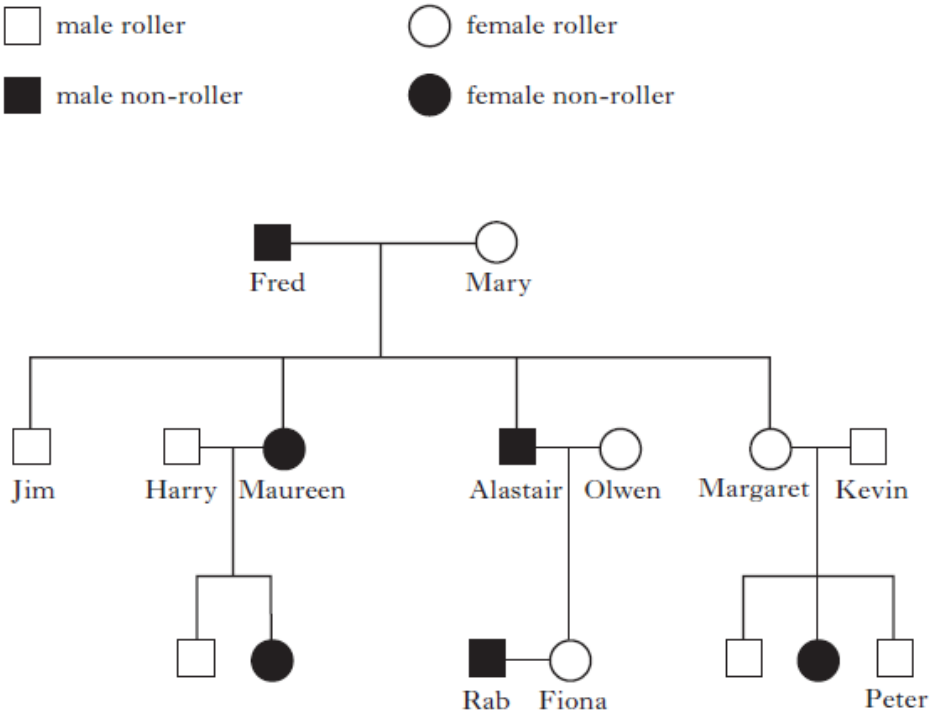
a. Copy and complete this table. 3

b. Copy and complete the table to decide if each of the statements are True or false, putting in an appropriate correction for the underlined word if you tick (✓) false.

Statement	*True*	*False*	*Correction*
Information about the forms of a gene in an individual is called the <u>genotype</u>.			
In the nucleus of a cell each gene is part of a <u>characteristic</u>.			
Cells which carry only one form of a gene to the offspring are called <u>embryos</u>.			

3

2. Tongue-rolling is an inherited characteristic. The diagram below shows the pattern on its inheritance in one family.



a. Using **R** for the dominant form of the gene and **r** for the recessive form, state the genotypes of: Maureen, Jim and Kevin. 1

b. If Rab and Fiona have a child, what are the chances of the child being able to roll its tongue? 1

c. Which of the original parents could be described as true-breeding? Choose from Fred, Mary, both or neither. 1

d. Name a tongue-roller from the F_1 generation. 1

e. What is the term used for the different forms of the same gene? 1

Biology Mindset Maker

Do you want to be an even better learner?

By practicing skills you make your brain stronger. You can also learn skills that let you use your brain in a smarter way. Many people miss out on making their brain stronger because they believe they can't do it or that it's too difficult. The activity below is designed to let you think about your learning and help you figure out how your mindset can help you improve.

Think about the experiences in the table below. Think about all that you have achieved in this topic. Can you think of examples from this topic?

Experience	Example	How did it make you feel?	Teacher Support
Taking on a challenge			
Learn from your mistakes			
Accept feedback and criticism			
Practice and apply strategies			
Persevere			
Ask questions			
Take risks			