

Genetics & Reproduction

Cells

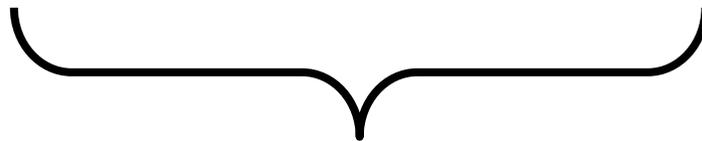
Activity 1: Microscopes

Activity 2: Animal Cells

Activity 3: Plant Cells

Activity 4: Specialised Cells

Activity 5: Cell Division



DNA

Activity 1: What is DNA

Activity 2: DNA Extraction

Genetics

Activity 1: Video questions

Activity 2: Variation

Activity 3: Genetic disorders

Activity 4: Three parents?

Activity 5: Ethics debate

Plant reproduction

Activity 1: Plant dissection

Activity 2: Germination

Activity 3: Pollination &
Fertilisation

Human reproduction

Activity 1: Video questions

Activity 2: Fertilisation

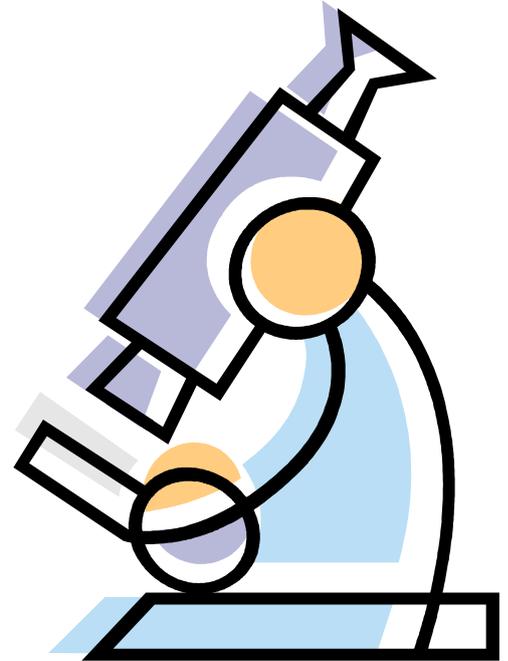
Activity 3: Embryo development

Microscopes

Label

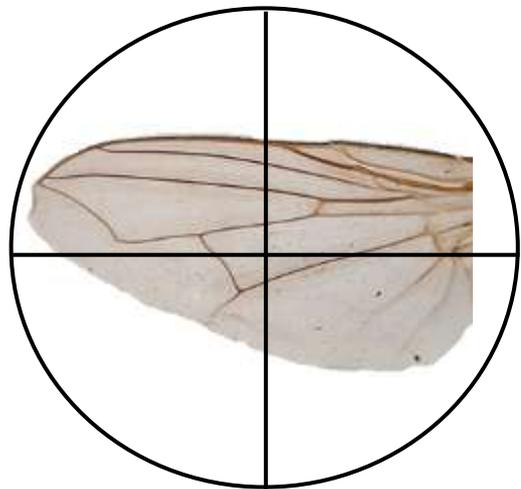
the diagram of the microscope

Focussing Knob	Objective lens
Stage	Eye piece lens
Mirror	Stage clip



Using a Microscope

- Objects must be mounted on a glass slide
- Select low magnification objective lens first
- Raise the stage to highest position under objective lens
- Centre object
- Focus until clear image is seen
- Try a higher magnification.



Looking at Slides

- Follow your instructions on how to use a microscope.
- Draw what you see on 3 different slides.
- Use a circle divided into 4 to make it easier to draw what you see accurately.
- Make sure you label each drawing clearly.

Animal Cells

Animal cells have similar characteristics and the same general parts.

Cheek cells are an example of an animal cell that can be found in the lining of the mouth.

Discuss:

- what other kinds of animal cells do you think there may be?
- What do you think a cheek cell will look like?

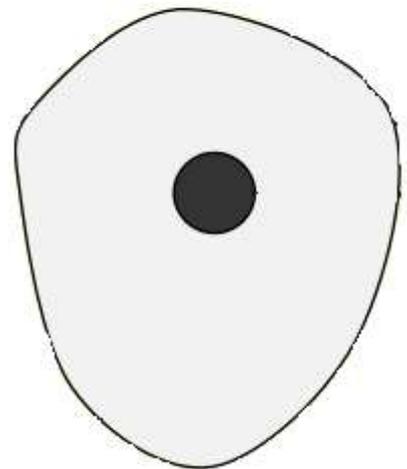
Use the following words to help **write a set of instructions** on how to make and view cheek cells. You may be able to carry out this activity.

The following words might help...

Antiseptic , swab, glass slide, methylene blue, cover slip, Bunsen burner.

Draw and label the basic animal cell in your jotter...

The basic parts are called a cell membrane, a nucleus and cytoplasm.



Answer the following questions...

1. Where is the control centre of a cell?
2. What is the barrier called? Cell membrane
3. What does the cell membrane allow to enter the cell?
4. What substances leave the cell? waste
5. What is the purpose of the cytoplasm? Make new parts
6. What does the cytoplasm use to make new parts for the cell membrane?

Plant Cells

You will be looking at the cells that make up an onion.

Onions are made of plant cells.

What you will need:

A glass slide, coverslip, onion, knife, iodine, dropping pipette, and microscope



1: Peel off a piece of the thin clear skin found on the inside layers of the onion.



2: Spread out the clear skin on a microscope slide.



3: Stain the cells using a few drops iodine

4: Place a coverslip over the skin.

(Use a pencil to lower it slowly so the air is pushed out)

5: Look at the onion cells under a microscope.

6: **Draw a slide diagram** of what you see

Discuss and Record (in sentences!):

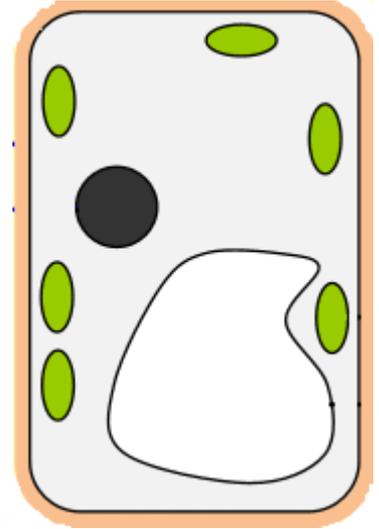
1. Is what you thought you would see similar to what you really saw?
2. What differences are there between the onion cells and the cheek cells?
3. What similarities are there between the cheek cell and onion cell?
4. Why did you need such a thin piece of onion skin?
5. What was the purpose of the iodine?
6. Why do you lower the coverslip slowly and press gently?

Plant Cells

Copy the following diagram of a plant cell and label it.

Answer the following questions in sentences.

1. What substance is contained in the cell wall of a plant cell?
 2. What raw materials does a plant need to make food from sunlight?
 3. What parts of the plant cell convert the sun's energy into sugars?
1. What colour are chloroplasts?
 2. Give two characteristic features of root cells?



Same or Different

This is a comparison of the two basic cells you have seen. You will find the function of the parts. Use textbooks and any other information provided.

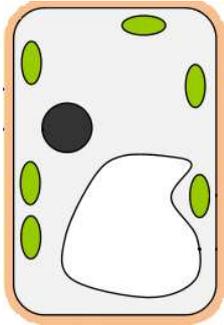
Part of cell	function	Is this part present in either or both cells	
		Animal cell	Plant cell
nucleus			
Cell membrane			
Cell wall			
chloroplast			
vacuole			
cytoplasm			

Specialised Cells

- **Read** page 68 of Starting Science book 1
- **Collect** the specialised cells cut-out
- **Match** the diagrams to the descriptions
- **Check** you've matched them correctly with your teacher
- **Stick** the diagrams with their descriptions in your jotter under one of the headings...

specialised animal cell or specialised plant cell.

For example:

Specialised Animal Cell		Specialised Plant Cell	
	<p><u>Red Blood Cell</u></p> <p>No Nucleus Carries Oxygen to all other cells in the body</p>		<p><u>Palisade Cell</u></p> <p>Lots of Chloroplasts to capture as much light as possible</p>

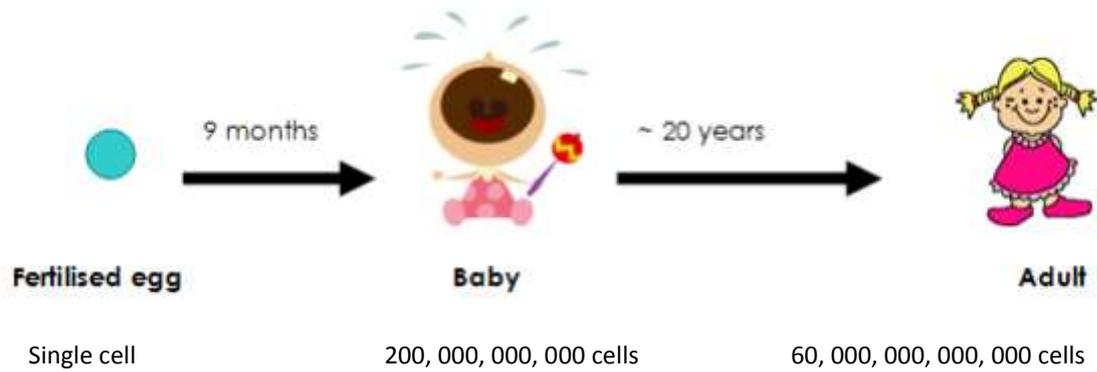
Stem cells

Stem cells can be collected and grown into specialised cells. This means they can be used to replace tissue if it is needed.

The best stem cells come from a human embryo that is just a few days old, but there are many ethical issues surrounding their use.

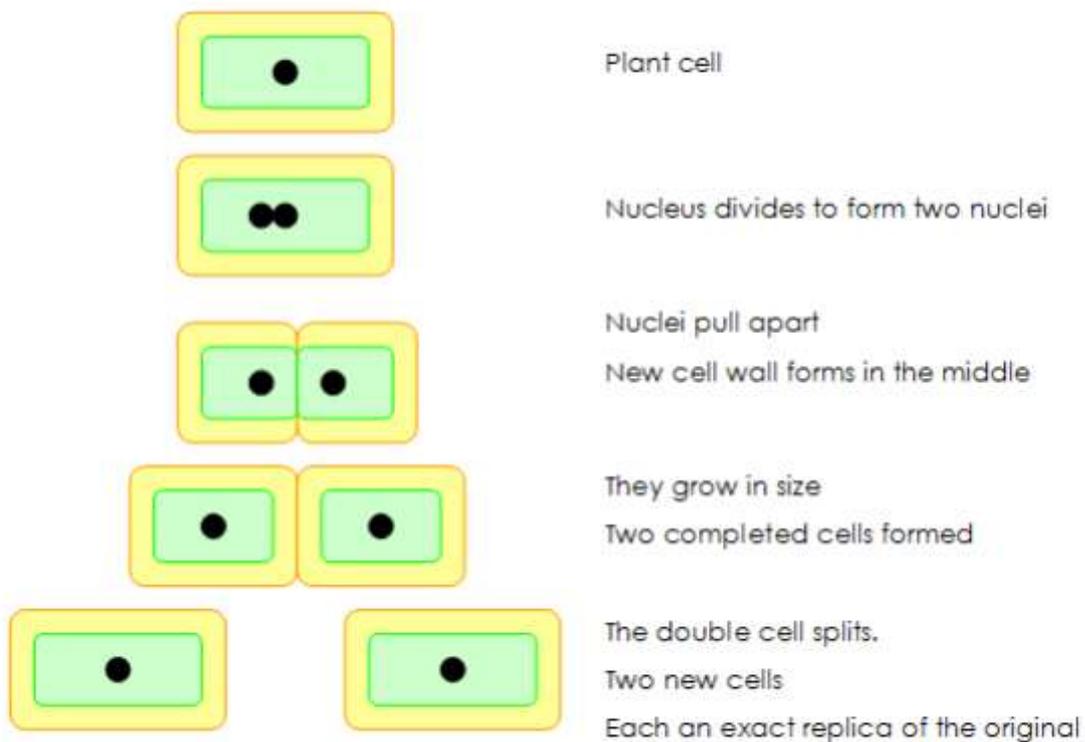


Cell Division



Cells multiply by cloning themselves.

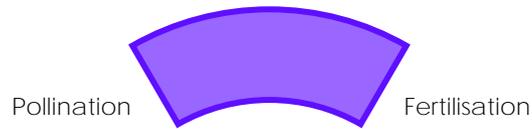
The following diagram shows how a plant cell will clone itself to reproduce.



Answer the following questions in sentences:

1. Draw and label a set of diagrams to show how an **animal cell** would divide, starting with a single cheek cell.
2. If a single cell divides 4 times, how many cells are produced.
3. Bacteria are single (plant) cells which can divide every 20 minutes.
 - If one bacterium enters a cut in your finger and continues to divide, how many bacteria would there be in your cut:
 - After 20 minutes
 - 40 minutes
 - 1 hour
 - 6 hours

Plant Reproduction



Life Cycle of a Plant



Bamboo can grow 30 cm in 24 hours.

Durian fruit smells so bad it has been banned from a number of hotels, bars and airports.

A King's holly plant in Tasmania has been growing for around 40,000 years

The biggest seed in the world is from the coco-de-mer, in the Seychelles. They can weigh 30 kilos.

Banana are the UK's most popular fruit, in the UK we eat, on average, 130 bananas a year.

Germination

Discuss

Where do seeds come from?

What sort of seeds could you find in your kitchen, the garden or in a forest?

What happens to seeds to produce a plant?

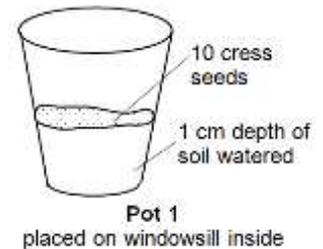
What do seeds need to grow?

Investigating conditions for germination

Hypothesis:

Plants need light, water, soil and warmth to germinate and grow.

Copy and complete this table.



Pot number	Soil?	Light?	Water?	Warmth?	Hypothesis	Growth?
1	yes	yes	yes	yes		yes
2	no	yes	yes	yes		yes
3	yes	yes	no	yes		no
4	yes	yes	yes	no		no
5	yes	no	yes	yes		yes

Results for pot 5				
	Number of days since	Signs of Growth		
		Length of longest shoot (cm)	Total number of leaves	Colour of shoot
22/5	0	0	0	N/A
23/5	1	0.5	0	yellow
24/5	2	0.8	2	yellow
27/5	5	2	5	yellow
28/5	6	2.5	5	yellow

Draw a line graph for length of shoot against days since planting.

Answer the following questions in sentences.

1. What are the four variables controlled?
2. What are the variables being measured?
3. What variables would need to be controlled to make the investigation fair?
4. What are the conditions needed for germination?
5. Was the hypothesis correct, give a reason?
6. What comments can you make on the results for pot 5.

Pollination and Fertilisation

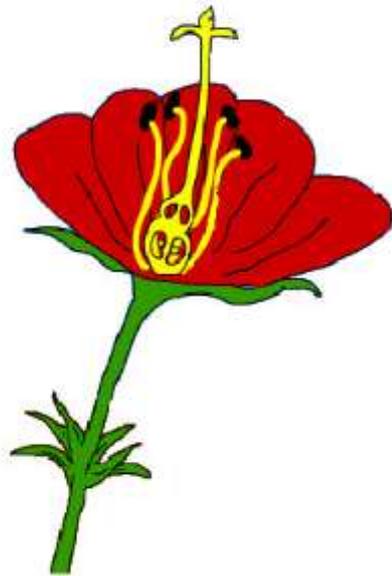
Answer the following questions in sentences.

1. The male sex cells in flowers are called?
2. What can pollen be carried by?
3. What do some flowers produce to attract insects to carry their pollen?
4. What happens in fertilisation to allow the genetic material from the pollen grain to reach the ovule.
5. What is the male part of a flower called?
6. What is the female part of a flower called?

- **Carry out a plant dissection** and identify the main parts of a flower.
- **Complete the worksheet** of flowers to label the parts.

Key words for plant dissection:

Carpel, Stamen, Stigma , Pollen, Ovules, Ovary, Anther, Filament, Sepals, Nectary



Can you think of a way to show the life cycle of a plant (without making a poster)



The buttercup and the grass shown have very different pollen. What sort of differences would you expect?

Human Reproduction

Discuss

What order would you put these titles in the life cycle of a human?

Birth, Embryo development, Puberty, Growth, Fertilisation

Watch the DVD on Human reproduction and **answer** the following questions:

1. What contains the woman's life-time store of eggs?
2. How many times will a woman ovulate in her lifetime?
3. How long will an unfertilised egg survive in the fallopian tubes?
4. How many sperm are released at once?
5. How long is the sperm tube
6. What is the vagina walls covered with?
7. For what reason?
8. How long does it take for most sperm to die?
9. What temperature does the embryo develop at?
10. What is used to first view an unborn baby in the womb?

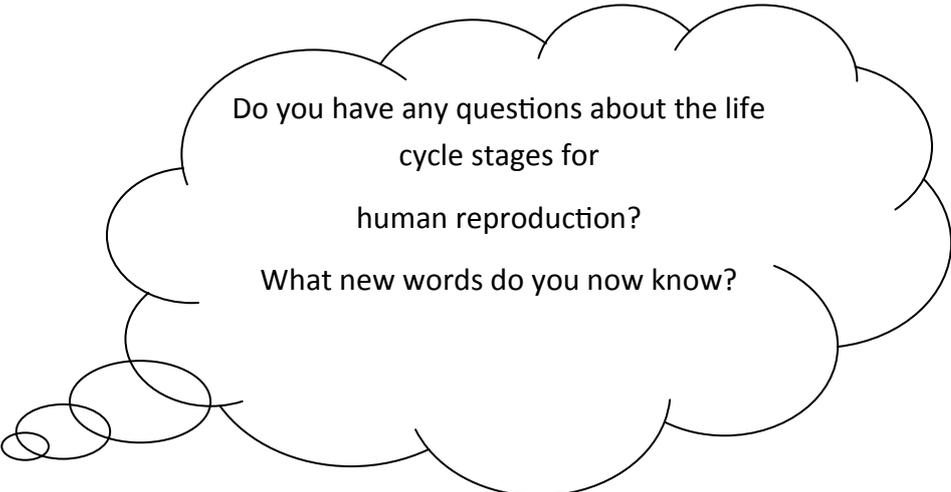
Embryo development

Complete the

development modelling activity

Read page 72-74, SS 1

Complete the worksheet on the developing embryo for your notes



Do you have any questions about the life cycle stages for human reproduction?

What new words do you now know?

DNA, Chromosomes and Genes

Inside the nucleus...

DNA forms clumps called chromosomes in preparation for cell division

Genes...

A section of DNA that carries the information to make one thing

Chromosome...

The chromosomes are sections of DNA which have copied themselves

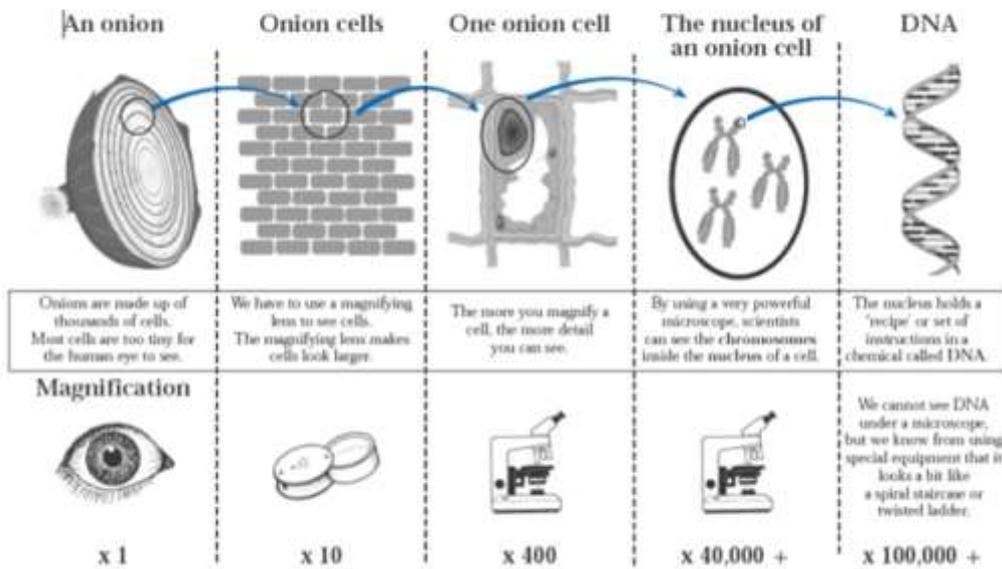
Copy and complete the following paragraph. You will need the facts you have learnt so far, as well as the information from sheet 1.

There are key words to help you.

1. DNA can be found in the of a cell.
2. Every cell in your body contains about of DNA.
3. When cells undergo division sections of DNA clump together and copy themselves to make
4. A human cell contains chromosomes.
5. They can be organised by their in pairs.
6. The 23rd pair are the sex chromosomes. A female has two large Chromosomes and a male have one X chromosomes and a very Y chromosome.
7. A is a specific section of DNA found on a specific location in a chromosome.
8. Genes determine all of your inherited

DNA Extraction

From an onion to an onion cell's DNA, the 'Recipe for Life' is found inside cells.



Procedure

1. Pluck off the green sepals from a strawberry.
2. Pop it into a polythene bag and seal it.
3. Crush the fruit for several minutes to **completely** liquidise it.
4. Add 10 ml of ice-cold detergent/salt mixture and crush for another two minutes. Be careful not to generate too many bubbles!
5. Watch your teacher demonstrate the correct filtration technique, then filter the mash into a boiling tube.
6. Add 10 ml of ice-cold ethanol slowly down the side of the tube, so it forms a layer on top of the juice.
7. Watch for the development of air bubbles attached to a misty cloud. This cloud is DNA!
8. Spool the DNA onto a thin splint - it is easier if you hold the tube at a slight angle.
9. Pull out the DNA and place it onto a clean watch glass.
It will look like wet cotton wool at first, but dries to resemble threads of silk.
Each thread contains millions of DNA strands.



Genetics DVD

How to build a human?

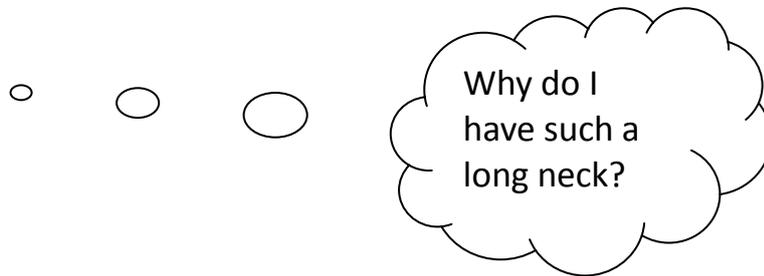
1. In the beginning (of the planet earth) how did cells multiply?
2. What is at the centre of the cell?
3. What are contained within the nucleus?
4. What are carried on these chromosomes?
5. How many chromosomes contain all of the genes needed to build a human being?
6. Name two things that are determined by the structure of our DNA?
7. How many chromosomes are carried in :
 - a. Sperm?
 - b. Egg?
8. Where is our DNA inherited from?
9. Who discovered the structure of DNA?
10. Which four letters spell out the chunks of information that we call our genes?
11. What is the name given to the process of scientists altering genes?
12. How long is the DNA in each cell?
13. What is the difference between chromosomes in males and females?
14. How many genes does it take to build a human?
15. At what age does the baby develop a gender (male or female)?
16. How are **identical** triplets formed?

Passing on Instructions

As you grow you start to notice and develop characteristics. Are you a tongue roller? Are you tall? Do you have brown eyes? Some of your characteristics are passed on from your parents, we call this inherited characteristics.

Some of your characteristics will develop because of the environment around you.

Try and organise the nature and nurture cards into two piles, one for the characteristics you develop because of your genes (nature) and one for the characteristics you develop because of your environment (nurture).



Fact or Fiction Glossary

Hereditary and Inheritance – The passing on of physical or mental traits that you inherit from your parents e.g. eye colour, tongue rolling.

Chromosome – Enormous molecules which you have 46 of, which contain your genes.

Genes – Biological code which every living thing has, these control all your living processes and many physical traits.

DNA – Very big molecules which make up genes and chromosomes.

Trait – A physical or mental feature which an individual has.

Variation

Although humans have the same basic feature, they all look different. The slight differences are due to the instructions in sex cells which are passed on during fertilisation.

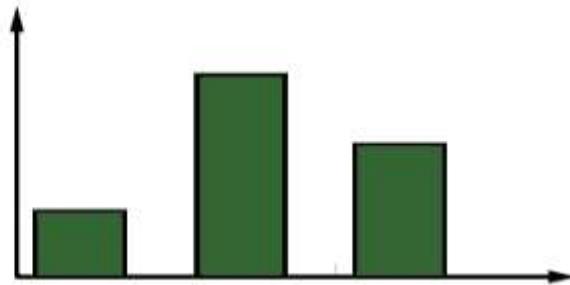
Imagine you are meeting someone you have never seen before.

Make a list of five questions you could ask them to give you an idea of what they look like without asking them what they will be wearing.



Continuous Variation

- No distinct categories
- Tends to be quantitative
- Controlled by a lot of genes
- Strongly influenced by the environment



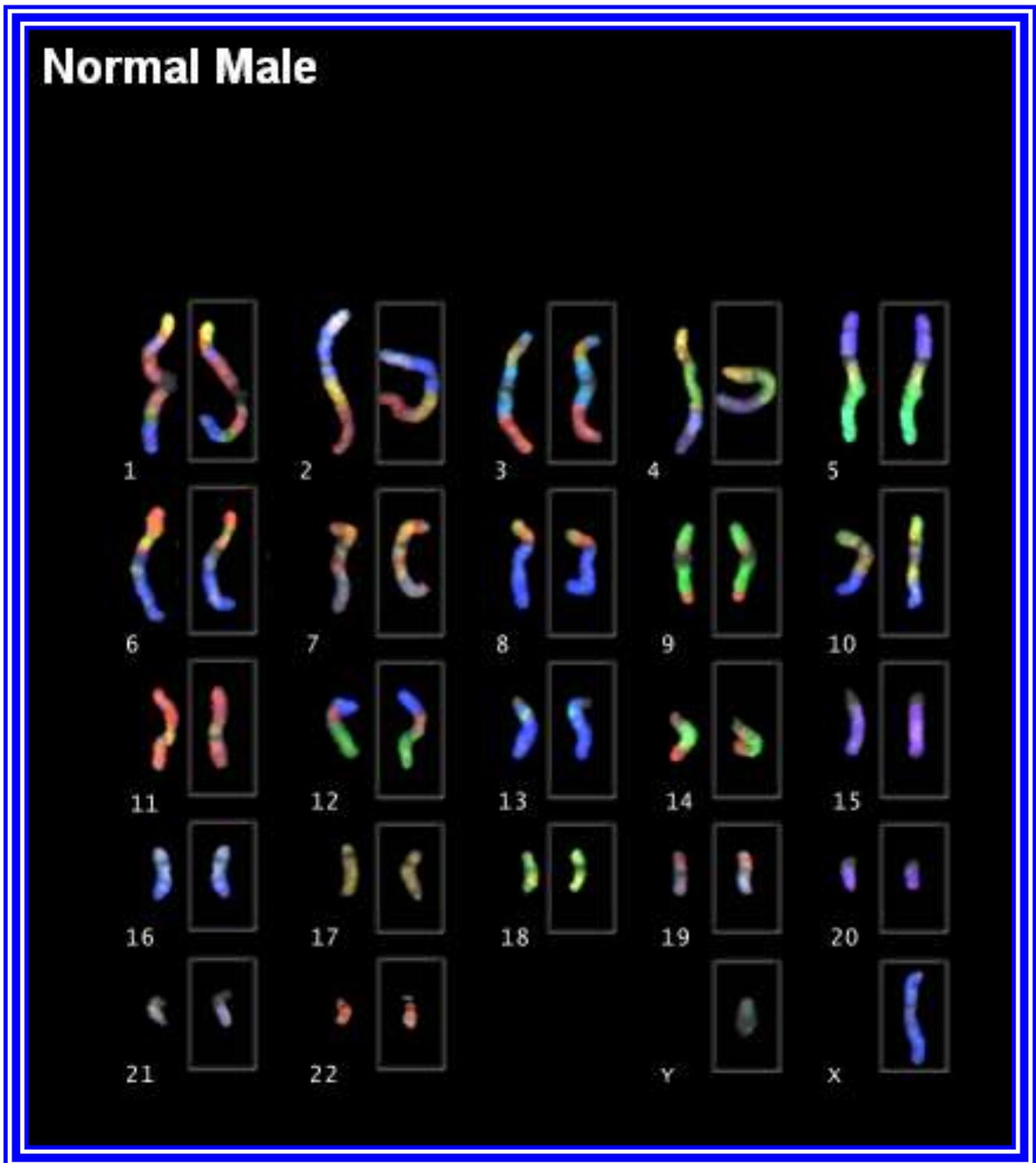
Discontinuous Variation

- Distinct categories
- Tends to be qualitative
- Controlled by a few genes
- Unaffected by the environment

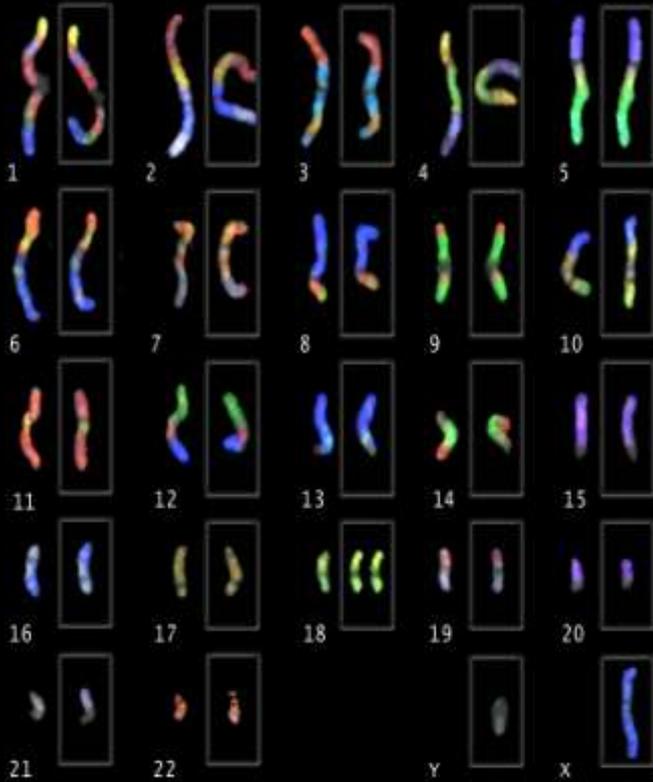


Chromosomes

The pairs of chromosomes can be arranged by their size to show a karyotype for an individual. The following picture is of the chromosome pairs from a normal male's cell. Chromosomes can be different shapes but the genes are always in the same place (they are marked by the different colours).



Trisomy 18



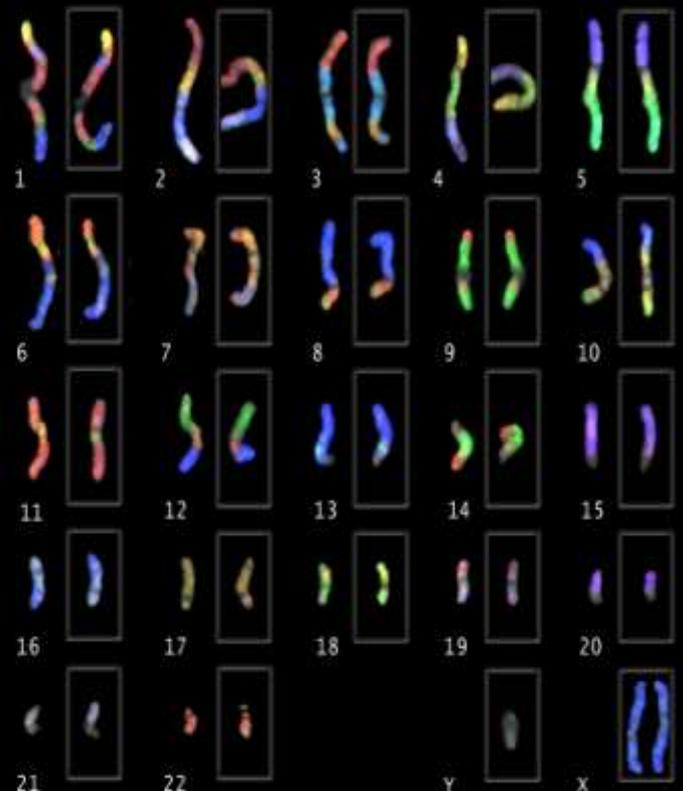
Genetic Mutations

1. How many chromosomes did the normal male have?
2. How many chromosomes does a person with trisomy 18 have?
3. Down's syndrome (trisomy 21) is another genetic disorder, where do you think the mutation will be and what do you think the mutation is?
4. What pair shows the mutation for Klinefelters syndrome?

Discuss

- Do you know any other information about genetic mutations?
- What about genetic mutations in plants?
- Can it ever be beneficial?

Klinefelter Syndrome



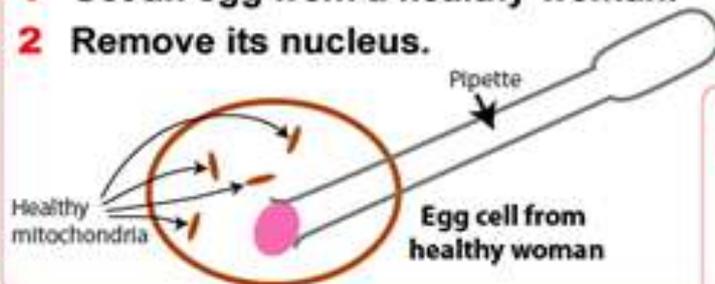
Three Parents?



Newcastle scientists tried out something new. In future their technique might help people like Maya and Jake. It works like this:

1 Get an egg from a healthy woman.

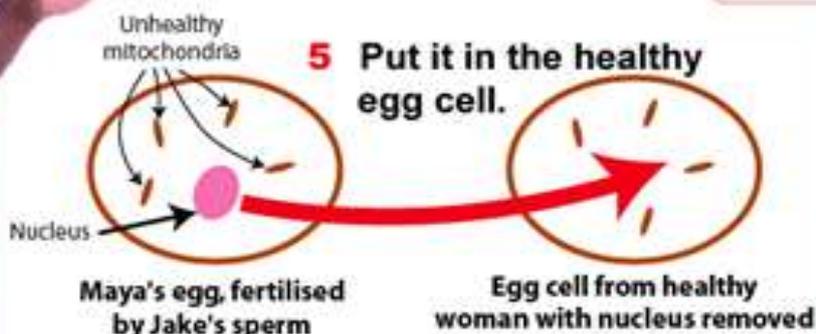
2 Remove its nucleus.



3 Fertilise Maya's egg with Jake's sperm in a glass dish.



4 Take the nucleus out of their fertilised egg.



5 Put it in the healthy egg cell.

6 Wait for the egg to develop into an embryo.

7 Put it in Maya's womb.

The embryo inherits everything from Maya and Jake except the damaged mitochondria. The embryo inherits mitochondria from the healthy woman. **So the baby ends up with one dad... and two mums!**

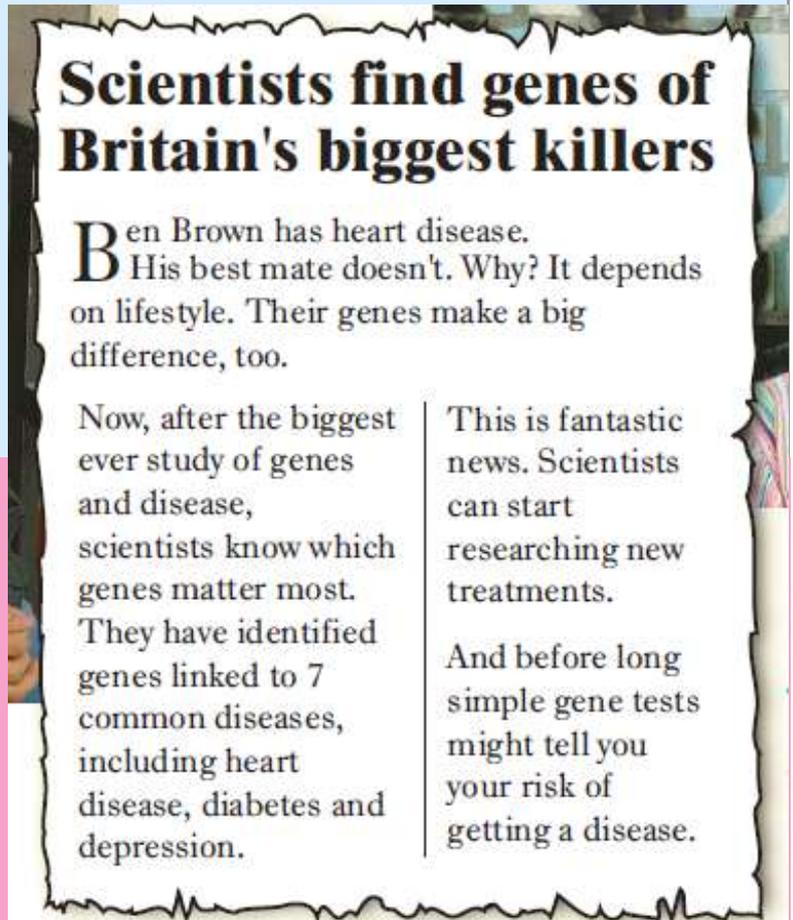
Genetic Ethics Debate

Each member of your group should have a different role in the debate.

- Positive view research
 - Negative view research
 - Spokesperson and chair for the debate, will have to share the groups findings to the class.
 - Scribe for the positive research
 - Scribe for the negative research
- 20 minutes for research and forming the main points for the argument.
 - 10 minutes for presentation of positive views
 - 10 minutes for presentation of negative views
 - 10 minutes for questions and conclusions

Each group member must have a conclusion on how they feel about the issue and why.

This conclusion will be shared with the whole class



Should companies be allowed to buy the rights for inventions based on the structure of our genes?

Should gene technology be used for gene enhancement (making people stronger, smarter etc.)?

In the future, many more tests for genetic conditions will be available. Should screening for diseases or defects be allowed when there is no cure or treatment? Why or why not?

Who do you think should have access to the results of genetic testing?

Understanding Gene Testing

What does a predictive gene test tell you?

An accurate gene test will tell you if you do or do not have a disease-related gene mutation. If you do, a variety of factors can influence whether you will actually develop disease. Nearly everyone with the familial adenomatous polyposis genes will - unless he or she takes effective preventive measures - someday develop colon cancer. On the other hand, women who carry the BRCA1 breast cancer susceptibility gene have an 80-percent chance of developing breast cancer by the age of 65; their risk is high but not absolute.

Of course, even family members who escape the inherited susceptibility gene are not exempt from risk. Like anyone else, they could develop mutations in that same gene during their lifetimes. Or, they could have inherited a different, unknown susceptibility gene

Genes and disease: *the science*



Diseases

Heart disease
Diabetes types 1 and 2
Inflammatory bowel disease
High blood pressure
Rheumatoid arthritis
Bipolar disorder (*a mental illness*)

All these diseases are **multi-factorial** – they are caused by genes and environmental (lifestyle) factors.



Results

Scientists found versions of genes (alleles) that increase the risk a person will get a certain disease.

These discoveries will help us develop new treatments. **Scientist**

Fifty research groups did this study. They analysed over 10 billion pieces of genetic information from 17,000 people. This is an amazing achievement. It will help us work together in future. **Scientist**

Employers and insurance companies will want genetic test results. People with positive results might not get jobs or insurance. This is discrimination.

Medical ethics expert



What people are *saying*...

This is a new dawn – we've found out more about genes and disease in the past year than in the previous 15 years. **Scientist**

We have to be careful not to worry people. If you test positive for a 'disease gene' you won't definitely get the disease. The risk is only between 1.2 and 1.5 times more likely than for those who test negative

Doctor

These are some of the commonest diseases, but still we don't know how to prevent them. Now we are another step closer. **Scientist**

Early identification of people with these genes could save hundreds of lives. We could advise about lifestyle to make them less likely to get the disease.

Doctor

Young people might think it's OK to have unhealthy lifestyles if they think this research will lead to miracle cures in future.

Doctor

A person might want their partner to get genetic tests before they try to have a child together. So there'd be lots of broken relationships.

Counsellor

Testing for 'disease genes' will make my job easier, as I will have more information to advise my clients on. Some couples are worried about passing on 'bad' genes to their children.

Genetics counsellor