



You are a journalist. Your task is to prepare an article on the arguments for and against genetic engineering.

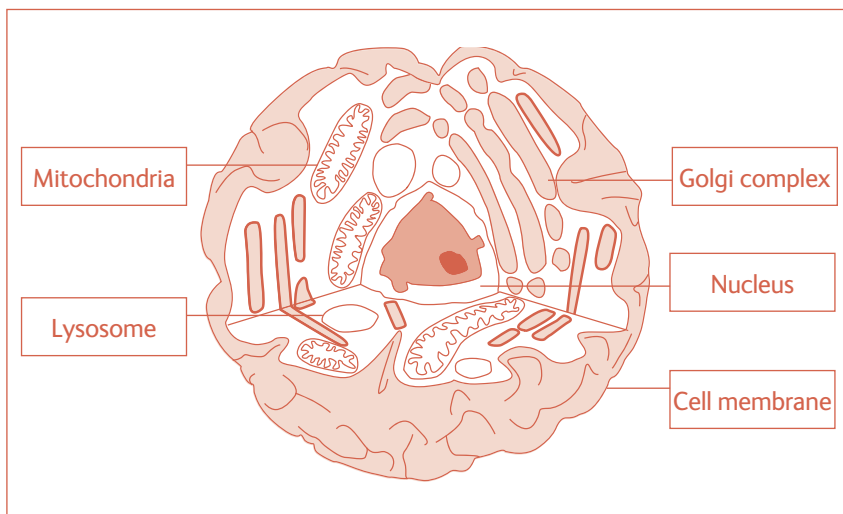
Teacher information

Gallery visited	 Human Biology
Suitable for	 Key Stage 4 (ages 14 to 16)
Curriculum links	Organisms and health.
Example page	www.nhm.ac.uk/cells-and-genetics-ks4
Pre-visit preparation	<p>Vocabulary: chromosome, DNA, allele, dominant and recessive, outcome, gene, mutation.</p> <p>Concepts: cell structure and the organelles, the sex cells, genetic disorders, screening for genetic diseases.</p>
Post-visit work	Pupils can combine information gathered from the gallery with their own research work to complete the Final report task at the end of this guide.

1 How our bodies are made up

5,000 times larger

Function	Cell structure used	Notes
Storage	Golgi complex	Assembles and stores structures made by the cell.
Supply energy	Mitochondria	Supply energy for all the cell's activities.
Protect	Cell membrane	Keeps out harmful substances but allows useful ones to enter.
Remove waste	Lysosomes	Contain destructive enzymes that break down waste products.
Instruct and control	Nucleus	Contains instructions (on chromosomes) that the cell needs to live and grow.



2 The importance of DNA

DNA is deoxyribo-nucleic acid. It is important as it contains the instructions for directing our body functions and for making the proteins from which we are constructed.

Sex cells have 23 chromosomes.

All other cells have 46 chromosomes

Key points from the Making humans display
The ovum and sperm cell each have a nucleus containing half the DNA from the female and male who produced them. A woman produces one ovum every month, a man produces millions of sperm. A sperm must meet and fertilise an ovum in order to make a new human being. Many more sex cells are produced than can achieve fertilisation and the unsuccessful ones will die.

One sperm cell is needed to fertilise an ovum.

Description of the process seen in video.
An ovum travels along a fallopian tube and sperm race to meet it. When the first sperm meets the ovum, enzymes in that sperm's head break down the ovum jelly and cell membrane so the sperm's nucleus can enter into the ovum. The sperm's tail drops away and the nucleus swells. It merges with the nucleus of the ovum and the DNA from the two sex cells combine.

3 Why sexual reproduction leads to genetic variation

The two versions of each gene are called alleles.

For the spinner activity, pupils will tick the characteristic they wish to test.

The order will vary, but the four possible outcomes of alleles (and observable characteristics below them) for thumb shape will be:

SS	bb	Sb	bS
straight	bent	straight	straight

The possible outcomes of alleles (and observable characteristics below them) for eye colour will be:

BB	bb	Bb	bB
brown	blue	brown	brown

Pupils will put tallies in the relevant boxes (below the outcomes of the allele combinations they have just written in the first line of boxes) according to the results they obtain.

It is expected that the most common result for each test will show the dominant phenotype: straight thumb or brown eyes.

brown

straight

4 How the environment can cause variation between people

Important points include: genes are important in determining how we develop but our location, up-bringing, society and diet are also important. Looking at the group of six young people it is not clear from their appearance which ones are related to each other.

Factor	Determined by our genes	Determined by our environment	Not sure
Colour of eyes	✓		
Shape of body	✓	✓	
Fingerprints	✓	✓	
Musical ability	✓	✓	
Number of eyes	✓		
Heart disease	✓	✓	
Intelligence	✓	✓	
Body weight	✓	✓	
Colour of hair	✓		
Male/female	✓		
Choice of clothes		✓	

Pupils will make notes on their discussion of the answers they recorded. It may be interesting to note that the fingerprints of identical twins, though similar, are not identical. In considering eye colour, shape of body and hair colour, it is assumed pupils will record their answers according to how we naturally develop, rather than the possibilities of people artificially changing themselves by means of coloured lenses, surgery or chemical dyes.

5 Investigating the effects of faulty genes

Notes on genetic disorders: predisposition to developing heart disease is listed in the display. Other possible examples include: colour-blindness, sickle cell disease, haemophilia, diabetes, Huntington's disease, muscular dystrophy, Down's syndrome, fragile X syndrome, hemochromatosis and predisposition to developing certain cancers.

Other factors that increase the risk of developing heart disease are lack of a healthy diet and lack of exercise. Pupils may also note factors not listed such as smoking, alcohol and stress.

6 Using our knowledge of genetics to help us make decisions

Opinions expressed in the video on whether people should be able to choose their baby's gender:

No, because:

it would be like 'playing god', it would spoil the surprise, if people have cultural reasons for choosing one gender over another it could lead to a numbers imbalance in the population, people should be happy with what they have, it won't just stop at gender – people will want to start choosing other factors, too.

Yes, because:

if there is a disease that can affect one gender more than the other, parents should be allowed to choose.

Pupils will consider and record the reasons for their opinions on whether other characteristics should be screened for.