Centre of the Cell

Curriculum links – what you can expect to cover on a visit here

Key Stage 4

Introduction

Centre of the Cell contains a large amount of content, crossing many areas of the biology curriculum, as well as sections of the English, maths and citizenship curricula. This document aims to give teachers an idea of where the Centre of the Cell content fits in with what their pupils are learning. Links are given both to the National Curriculum and to the DFES standards (or to summaries of the Key Stage 4 curricula, as appropriate).

The map is presented in two sections:

- A summary by unit, showing which games hit which unit
- A comprehensive table showing which concepts within each unit are hit by each game/interactive

Careers

We have highlighted as careers-relevant all those games that feature a real scientist, or otherwise demonstrate what scientists do in their day-to-day research. The primary careers information is available in the Patient Journeys, but other information about possible careers can be gleaned from the scientist videos in the games.

Patient Journeys tell the story of a fictional 'typical' patient with a certain condition or situation: a cystic fibrosis patient, a couple going through IVF, a participant in a clinical trial, and someone with an acquired spinal cord injury. As they are followed through their treatment, real, non-fictional staff at the Barts and the London NHS Trust and Queen Mary University of London are profiled. These are the people the patients would meet were they following the same journey, and they discuss why they do their job, what the challenges are, and how they came to their career path.

The aim of the Patient Journeys is to introduce pupils to jobs in biomedicine other than doctor or nurse, and to put those jobs into the context of a working hospital or research facility.

Games/interactives by Key Stage

The target audience for Centre of the Cell is students aged 9 – 16. Games and interactives were designed with specific key stages in mind.

Games in bold are primarily for that key stage. Games that are not bolded are suitable for that key stage but their primary target audience is another key stage.

Key Stage 2	***Key Stage 3***		***Key Stage 4***	
Zooom **Organ Surgery** **Troublesome Twins** Cell to Baby Body Balance TB Invaders Beyond Brushing Cell Turnover Build an Organ What is a Cell Bioengineering Heart Disease	**Cell to Baby** **Lab Bench Chaos** **Body Balance** **TB Invaders** **Cell Turnover** **Build an Organ** **What is a Cell** **Bioengineering** **Microscopes** **Flu Epidemic** **Animal Experimentation** **Heart Disease**	Zooom Gene Search Beyond Brushing Mitosis Maker Organ Surgery Troublesome Twins Explore a Cell Ethics: Cloning Harlequin Disease Gut Infection Patient journey: Clinical Research	**Burns Clinic** **Gene Search** **Beyond Brushing** **Cancer Survivors** **Mitosis Maker** **Patient Journey: IVF** **Ethics: Stem Cells** **Genes and Your Cells** **Explore a Cell** **Ethics: Cloning** **Patient Journey: Spinal Cord Injury** **Detecting Cancer** **What is Cancer?** **Ethics: PGD** **Harlequin Disease** **Gut Infection** **Patient Journey: Cystic Fibrosis** **Patient Journey: Clinical Research**	Lab Bench Chaos Body Balance Cell Trumps TB Invaders Build an Organ Troublesome Twins Flu Epidemic Heart Disease

Key Stage 4 by unit

(NB: Specific content points are summaries based largely on 21st Century Science)

Unit	**Game / interactive**				
Organisms and Health: *5c* The way organisms function are related to the genes in their cells	Genes and Your Cells	Gene Search	Harlequin Disease	Ethics: cloning	Troublesome Twins
Organisms and Health: *5d* Chemical and electrical signals enable body systems to respond to internal and external changes, in order to maintain the body in an optimal state	Lab Bench Chaos	Beyond Brushing	Patient journey: IVF	Patient journey: Cystic Fibrosis	Patient journey: Spinal Cord Injury
	Gut Infection	Organ Surgery	Build an Organ		
Organisms and Health: *5e* Human health is affected by a range of environmental and inherited factors, by the use and misuse of drugs and by medical treatments	**All**				
How science works: *1* – Data evidence, theories and explanation	Patient journeys	Ethics sections			
How science works: *4* – Applications and Implications	Patient journeys	Ethics sections	Lab Bench Chaos	TB Invaders	Burns Clinic
	Gene Search	Beyond Brushing	Bioengineering	Detecting Cancer	Harlequin Disease
	Microscope	Flu Epidemic	Gut Infection		
Citizenship 1.1 – Democracy & Justice	Ethics sections	Patient journey:			

			IVF			
Citizenship 1.2 – Rights & Responsibilities		Ethics sections	Patient journey: Clinical trial	Patient journey: IVF		
Citizenship 2.1 – Critical Thinking & Enquiry		Ethics sections				
Citizenship 2.2 – Advocacy & Representation		Ethics sections				
Careers		Patient journeys	TB Invaders	Burns Clinic	Gene Search	Bioengineering
		Detecting Cancer	Lab Bench Chaos	Beyond Brushing		
Specific content points						
	Cell Division	Cell to Baby	Cell Trumps	Mitosis Maker		
	Health & Disease	Body Balance	Cell Trumps	Cell Turnover	TB Invaders	Cancer Survivors
		Detecting Cancer	What is Cancer??	Flu Epidemic	Mitosis Maker	
	Cells at Work	Cell Trumps	Explore a Cell	Microscope		
	Humans (and Other Animals) / Humans as Organisms	Cell Trumps	Organ Surgery	Build an Organ	Genes and Your Cells	Burns Clinic
		Gene Search	Beyond Brushing	Patient journey: Spinal cord injury	Patient journey: Cystic Fibrosis	Harlequin Disease
		Bioengineering	Heart Disease			
	Cells, Tissues and Organs	Cell Trumps	Organ Surgery	Build an Organ	Genes and Your Cells	What is a Cell?
	Reproduction	Mitosis Maker	Genes and Your Cells	Troublesome Twins	Ethics: Cloning	Ethics: PGD
		Gene Search	Harlequin Disease			

	Chemicals into Living Things	Ethics: Cloning				

Key Stage 4

NB: As there are no DFES Standards for Key Stage 4, elaboration on the National Curriculum has been added using summary concepts taken predominantly from the 21st Century Science curriculum.

Scene	Game	Learning Aims	Year	Unit	Unit Name	Concept	Other
ALL	**ALL**			Breadth of Study	Organisms and Health	Human health is affected by a range of environmental and inherited factors, by the use and misuse of drugs and by medical treatments	
Specific content points			10	Science/Biology	Cells at work	All living things are made of cells	
02	**Cell to Baby**						
Learning aims: • *That you grew from a single cell into you* • *That you grew by your cells increasing in number*							
Specific content points			10	Science/Biology	Cell division	Know that new cells (daughter cells) are formed when old cells (parent cells) divide into two	

02 **Lab Bench Chaos** Careers

Learning aims:

- *That cells need warmth, humidity, correct pH and food to make new cells*
- *That scientists mimic the conditions found inside the human body (warmth, humidity, pH, food) in order to grow cells for their experiments*

Breadth of Study	Organisms and Health	Chemical and electrical signals enable body systems to respond to internal and external changes, in order to maintain the body in an optimal state
How science works	Applications and implications	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.

02 **Zooom**

Learning aims:

- *How small cells are*
- *How big one million million is*

02 **Body Balance**

Learning aims:

- *How the increase in number of cells in a body relates to growth*
- *That cell death in the body is natural and useful*

Specific content points

10	Science/Biology	Health & disease	Cancer is the uncontrolled division of cells leading to the development of a cancerous growth (tumour)

02 **Cell Trumps**

Learning aims:

- *That you have different cells to do different tasks in your body*
- *That cells work together to create body parts*

Specific content points

	10	Science/Biology	Cells, tissues and organs	Understand that cells are organised into tissues, tissues into organs, and organs into organ systems
	10	Science/Biology	Cells at work	The human body is made of more than 200 different types of cell
	10	Science/Biology	Cells at work	Different types of cells are each specialised to perform a particular biological task
	10	Science/Biology	Cells at work	The structures that make up a cell are organised in a way that depends on the functions of the cell
	10	Biology	Health & disease	In an immune reaction, lymphocytes and phagocytes act against invading micro-organisms
	10	Biology	Health & disease	Understand the functions of lymphocytes, phagocytes and antigens
	10	Science/Biology	Humans (and other animals)	Neurones conduct nerve impulses to muscles which respond by contracting
	10	Science/Biology	Humans (and other animals)	Know the structure of neurones and how they form nerves
	10	Science/Biology	Humans (and other animals)	Know that smooth muscle (found in the intestine wall) is different

				to skeletal and cardiac muscle. Smooth muscle contracts slowly and steadily, and does not fatigue
	10	Biology	Humans (and other animals)	Cartilage covers the ends of limb bones and helps reduce friction in the joints as bones move over one another
	10	Science/Biology	Cell division	Relate ways in which humans function as organisms to cell structure and activity

02 **Cell Turnover**

Learning aims:

- *To understand that cells are being produced and are dying inside you all of the time*
  - *To understand that some cells need to replace themselves all the time*
  - *To understand that some cells change their rate of production to respond to the body's needs*
  - *To understand that some cells never replace themselves; if you lose these cells you are permanently damaged*

Specific content points

10	Science/Biology	Health & disease	Cancer is the uncontrolled division of cells leading to the development of a cancerous growth (tumour)

02 **Mitosis Maker**

Learning aims:

- *Cell have a cycle – growth, rest, copy DNA, divide, growth, etc*
- *New cells are formed when old cells divide in two*
- *Cytoplasm and the nucleus divides in two during cell division*

Specific content points

10	Science/Biology	Cell division	Know that new cells (daughter cells) are formed when old cells (parent cells) divide into two
10	Science/Biology	Cell division	Understand that the cytoplasm and nucleus divide during cell

				division
	10	Science/Biology	Cell division	Understand how cells divide by mitosis during growth [and by meiosis to produce gametes]
	10	Science/Biology	Cell division	Know that the nucleus may divide either by mitosis or meiosis
	10	Science/Biology	Health & disease	Cancer is the uncontrolled division of cells leading to the development of a cancerous growth (tumour)
	10	Science/Biology	Reproduction	Understand that mutation is a source of genetic variation and has a number of causes

02 **Organ Surgery**

Learning aims:

- *to name the major body organs*
- *to know what other organs they are linked to form organ systems*
- *to know where the major body organs are in the body*
- *understand that each organ system is involved in a set of functions*

		Breadth of Study	Organisms and Health	Chemical and electrical signals enable body systems to respond to internal and external changes, in order to maintain the body in an optimal state
Specific content points				
	10	Science/Biology	Cells, tissues and organs	Understand that cells are organised into tissues, tissues into organs, and organs into organ systems
	10	Science/Biology	Humans (and other animals)	Know that smooth muscle (found in the intestine wall) is different

				to skeletal and cardiac muscle. Smooth muscle contracts slowly and steadily, and does not fatigue
	10	Science/Biology	Humans (and other animals)	The digestive system processes food mechanically and chemically: teeth; saliva; stomach and small intestine muscles; gastric juice; bile; pancreatic juice; intestinal juice

02 **Build an Organ**

Learning aims:

- *We can divide ourselves up into*
  - *Cells*
  - *Tissues*
  - *Organs*
- *Our cells are organised into tissues*
- *Our organs are made up of different types of tissue*
- *Each type of tissue has a different job to do*
- *The tissues have specific properties and structures so that they can do these different jobs*

		Breadth of Study	Organisms and Health	Chemical and electrical signals enable body systems to respond to internal and external changes, in order to maintain the body in an optimal state

Specific content points

	10	Science/Biology	Cells, tissues and organs	Understand that cells are organised into tissues, tissues into organs, and organs into organ systems
	10	Science/Biology	Humans (and other animals)	Know that smooth muscle (found in the intestine wall) is different to skeletal and cardiac muscle. Smooth muscle contracts slowly

					and steadily, and does not fatigue	
		10	Science/Biology	Humans (and other animals)	Understand the functions of the heart	
		10	Science/Biology	Humans (and other animals)	Know the structure of neurones and how they form nerves	
		10	Biology	Humans (and other animals)	Cartilage covers the ends of limb bones and helps reduce friction in the joints as bones move over one another	
		10	Biology	Humans (and other animals)	Synovial fluid fills the space between bones and lubricates the surfaces of cartilage to reduce friction	
02	**Patient Journey: IVF**					Careers
			How science works	Data, evidence, theories and explanation	Pupils should be taught that there are some questions that science cannot currently answer, and some that science cannot address	
			How science works	Application and implications of science	Pupils should be taught to consider how and why decisions about science and technology are made, including those that raise ethical issues, and about the social, economic and environmental effects of such decisions.	
			Breadth of Study	Organisms and Health	Chemical and electrical signals enable body systems to respond to internal and external changes, in order to maintain the body in an optimal state	
			Citizenship 1.1	Democracy &	Weighing up what is fair and	

			Justice	unfair in different situations, understanding that justice is fundamental to a democratic society and exploring the role of law in maintaining order and resolving conflict.
		Citizenship 1.2	Rights and responsibilities	Exploring different kinds of rights and obligations and how these affect both individuals and communities
		Citizenship 1.2	Rights and responsibilities	Understanding that individuals, organisations and governments have responsibilities to ensure that rights are balanced, supported and protected
		Citizenship 1.2	Rights and responsibilities	Investigating ways in which rights can compete and conflict, and understanding that hard decisions have to be made to try to balance these
r02	**Ethics: Stem Cells**			
		How science works	Data, evidence, theories and explanation	Pupils should be taught that there are some questions that science cannot currently answer, and some that science cannot address.
		How science works	Application and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments about their benefits, drawbacks and risks.
		How science works	Application and	Pupils should be taught to consider how and why decisions

		implications of science	about science and technology are made, including those that raise ethical issues, and about the social, economic and environmental effects of such decisions.
	Citizenship 1.1	Democracy & Justice	Weighing up what is fair and unfair in different situations, understanding that justice is fundamental to a democratic society and exploring the role of law in maintaining order and resolving conflict.
	Citizenship 1.2	Rights and responsibilities	Exploring different kinds of rights and obligations and how these affect both individuals and communities
	Citizenship 1.2	Rights and responsibilities	Understanding that individuals, organisations and governments have responsibilities to ensure that rights are balanced, supported and protected
	Citizenship 1.2	Rights and responsibilities	Investigating ways in which rights can compete and conflict, and understanding that hard decisions have to be made to try to balance these
	Citizenship 2.1	Critical thinking and enquiry	Students should be able to question and reflect on different ideas, opinions, assumptions, beliefs and values when exploring topical and controversial issues and problems

		Citizenship 2.1	Critical thinking and enquiry	Students should be able to evaluate different viewpoints, exploring connections and relationships between viewpoints and actions in different contexts (from local to global)
		Citizenship 2.2	Advocacy and representation	Students should be able to evaluate critically different ideas and viewpoints including those with which they do not necessarily agree

02 **Genes and Your Cells**

Learning aims:

- *Genes contain the information that is used to tell cells how to work*
- *Every nucleus of every cell in your body has the same genes*
- *Different types of cell use different genes because they do different jobs*

		Breadth of Study	Organisms and Health	The ways in which organisms function are related to the genes in their cells
Specific content points				
	10	Science/Biology	Reproduction	Know that a gene is a section of DNA
	10	Science/Biology	Cells, tissues and organs	Understand that cells are organised into tissues, tissues into organs, and organs into organ systems
	10	Science/Biology	Humans (and other animals)	Know that smooth muscle (found in the intestine wall) is different to skeletal and cardiac muscle. Smooth muscle contracts slowly and steadily, and does not fatigue

	10	Science/Biology	Humans (and other animals)	Understand that as food moves through the digestive system it is processed (digested) into substances which the cells of the body can absorb and use

02 **Troublesome Twins**

Learning aims:

To show that we are all a unique combination of our genes and the environmental factors that affect us. Identical twins are used by scientists to study this 'nature/nurture' effect because they share exactly the same genes.

What made the twins identical at birth? What makes the twins different from one another as they go through life?

- *Their identical genes*
- *The food that their mother ate when she was pregnant is needed to make cells grow by multiplying in number*
- *What makes you similar to your family – your genes and your environment*
- *You share the same environment as your family, where you live, the food you eat etc. it all has an effect on the cells in your body*
- *How does the environment affect our cells? Food, infections, hygiene, smoking, pollution. How does the environment affect us? Cultural and emotional?*
- *Some conditions have a genetic predisposition but they are heavily influenced by the environmental factors e.g. Alcoholism*

		Breadth of Study	Organisms and Health	The ways in which organisms function are related to the genes in their cells.

Specific content points

	10	Science/Biology	Reproduction	Understand how variation arises from genetic causes, environmental causes and a combination of both

02 **Explore a Cell**

Learning aims:

- *To understand that cells are 3 dimensional*
- *To understand that cells are dynamic structures*
- *To understand that a cell has discrete organelles which carry out specific tasks and work together to help the cell perform its function*

Specific content points

	10	Science/Biology	Cells at work	Mitochondria [and chloroplasts] are structure in cells which convert energy from one form to another
	10	Science/Biology	Cells at work	Different types of cells are each specialised to perform a particular biological task
	10	Science/Biology	Cells at work	The structures that make up a cell are organised in a way that depends on the functions of the cell

02 **What is a Cell?**

Learning aims:

- *To understand that a biological cell is an independently functioning unit*
- *To understand that each cell works together as part of a larger structure*

Specific content points

	10	Science/Biology	Cells, tissues and organs	Understand that cells are organised into tissues, tissues into organs, and organs into organ systems

02 **Ethics: Cloning**

		How science works	Data, evidence, theories and	Pupils should be taught that there are some questions that science cannot currently answer, and

	explanation	some that science cannot address.
How science works	Application and implications of science	Pupils should be taught to consider how and why decisions about science and technology are made, including those that raise ethical issues, and about the social, economic and environmental effects of such decisions.
Breadth of Study	Organisms and Health	The ways in which organisms function are related to the genes in their cells
Citizenship 1.1	Democracy & Justice	Weighing up what is fair and unfair in different situations, understanding that justice is fundamental to a democratic society and exploring the role of law in maintaining order and resolving conflict.
Citizenship 1.2	Rights and responsibilities	Exploring different kinds of rights and obligations and how these affect both individuals and communities
Citizenship 1.2	Rights and responsibilities	Understanding that individuals, organisations and governments have responsibilities to ensure that rights are balanced, supported and protected
Citizenship 1.2	Rights and responsibilities	Investigating ways in which rights can compete and conflict, and understanding that hard decisions have to be made to try to balance these

		Citizenship 2.1	Critical thinking and enquiry	Students should be able to question and reflect on different ideas, opinions, assumptions, beliefs and values when exploring topical and controversial issues and problems	
		Citizenship 2.1	Critical thinking and enquiry	Students should be able to evaluate different viewpoints, exploring connections and relationships between viewpoints and actions in different contexts (from local to global)	
		Citizenship 2.2	Advocacy and representation	Students should be able to evaluate critically different ideas and viewpoints including those with which they do not necessarily agree	
Specific content points					
	10	Science/Biology	Chemicals into living things	Identify ethical questions arising from the use of the genome information	
	10	Science/Biology	Reproduction	Understand how variation arises from genetic causes, environmental causes and a combination of both	
	10	Science/Biology	Reproduction	Understand that mutation is a source of genetic variation and has a number of causes	
	10	Science/Biology	Reproduction	Understand the basic principles of cloning	

04 **TB Invaders** Careers

Learning aims:

- *That TB is a lung disease caused by TB bacteria being passed in the air from person to person*
- *That scientists study TB in the laboratory and investigate weak points at which they can target new drugs*

		How science works	Applications and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
Specific content points				
	10	Biology	Health & disease	Bacteria can become resistant to a particular antibiotic

04 **Burns Clinic** Careers

Learning aims:

a. *That you use healthy skin to heal burns*
b. *That you can grow more skin in the laboratory if you want*
c. *That QMUL scientists are trying to improve the skin grown*

		How Science Works	Applications and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
Specific content points				
	10	Biology	Humans (and other animals)	Understand why raised body hair helps us keep warm
	10	Biology	Humans (and other animals)	Know the structures in the skin
	10	Biology	Humans (and other animals)	Understand the roles of skin structures in keeping us warm

04 **Gene Search** Careers

Learning aims:

- *That deafness can be caused by genes in your cells working differently*
- *That scientist use pattern matching techniques to find genes that are working differently*

		How science works	Applications and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
		How science works	Applications and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
Specific content points				
	10	Science/Biology	Reproduction	Understand how variation arises from genetic causes, environmental causes and a combination of both
	10	Science/Biology	Reproduction	Understand and use words like ‘heterozygote’, ‘expressed’, ‘dominant’, ‘recessive’, ‘genotype’, and ‘phenotype’
	10	Science/Biology	Reproduction	Know that paired genes controlling a particular characteristic are called alleles.
	10	Science/Biology	Reproduction	Know that a gene is a section of DNA
	10	Science/Biology	Humans as Organisms	Understand that genetic disorders result from genetic defects and may be inherited

04 **Beyond Brushing** Careers

Learning aims:

- *That bacteria can destroy your tissue including bone tissue*
- *That QMUL scientists are trying to use stem cells to grow bone to repair damage*

How science works	Applications and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
Breadth of Study	Organisms and Health	Chemical and electrical signals enable body systems to respond to internal and external changes, in order to maintain the body in an optimal state.

Specific content points

10	Biology	Humans (and other animals)	Understand the structure of a tooth and its surround
10	Biology	Humans (and other animals)	Know that sugary food creates plaque and how plaque damages teeth
10	Biology	Humans (and other animals)	Know how to avoid tooth decay

04 **Cancer Survivors**

Learning aims:

- *That people can get cancer and survive to live normal lives*
- *That much research has been done to create treatments and now scientists are doing more research to create and improve treatments.*

Science/Biology	Health & disease	Cancer is the uncontrolled division of cells leading to the

					development of a cancerous growth (tumour)	
04	**Patient Journey: Spinal Cord Injury**					Careers
			How science works	Applications and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.	
			How science works	Application and implications of science	Pupils should be taught to consider how and why decisions about science and technology are made, including those that raise ethical issues, and about the social, economic and environmental effects of such decisions.	
			Breadth of Study	Organisms and Health	Chemical and electrical signals enable body systems to respond to internal and external changes, in order to maintain the body in an optimal state.	
Specific content points						
		10	Science/Biology	Humans (and other animals)	Know that stimuli are converted by receptors into signals called nerve impulses, to which the body can respond.	
		10	Science/Biology	Humans (and other animals)	Neurones conduct nerve impulses to muscles which respond by contracting	
		10	Science/Biology	Humans (and other animals)	Nerves are formed from bundles of neurones and are the link	

				between stimulus and response

04 **Bioengineering**				Careers
Learning aims: • *Your body can't replace cartilage tissue if you damage it because adult cartilage cells only make new cartilage tissue very slowly* • *Scientists use tissue engineering to grow body parts to help your body heal*				
		How science works	Applications and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
Specific content points				
	10	Biology	Humans (and other animals)	Cartilage covers the ends of limb bones and helps reduce friction in the joints as bones move over one another
04 **Detecting Cancer**				
Learning aims: • *Cancer cells behave differently to normal cells* • *Scientists create radioactive chemicals to identify where cancer cells are*				
		How science works	Applications and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
Specific content points				
	10	Science/Biology	Health & disease	Cancer is the uncontrolled division of cells leading to the development of a cancerous growth (tumour)

04	**What is Cancer??** *Learning aims:* • *Normal cells become cancer cells when their genes get damaged* • *Normal cells need to accumulate a lot of damage over years before they become cancer cells* • *Cancer cells multiply more than they should and don't die when they should* • *Cancer cells harm you because they move to vulnerable parts of your body where they grow uncontrollably and stop parts of your body from working* *Specific content points*	Science/Biology	Health & disease	Cancer is the uncontrolled division of cells leading to the development of a cancerous growth (tumour)
04	**Ethics: PGD** *(Pre-implantation genetic diagnosis)*	How science works	Data, evidence, theories and explanation	Pupils should be taught that there are some questions that science cannot currently answer, and some that science cannot address.
		How science works	Applications and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
		How science works	Application and implications of science	Pupils should be taught to consider how and why decisions about science and technology are made, including those that raise ethical issues, and about the social, economic and environmental effects of such decisions.
		How science	Applications	Pupils should be taught about the

	works	and implications of science	use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
	Citizenship 1.1	Democracy & Justice	Weighing up what is fair and unfair in different situations, understanding that justice is fundamental to a democratic society and exploring the role of law in maintaining order and resolving conflict.
	Citizenship 1.2	Rights and responsibilities	Exploring different kinds of rights and obligations and how these affect both individuals and communities
	Citizenship 1.2	Rights and responsibilities	Understanding that individuals, organisations and governments have responsibilities to ensure that rights are balanced, supported and protected
	Citizenship 1.2	Rights and responsibilities	Investigating ways in which rights can compete and conflict, and understanding that hard decisions have to be made to try to balance these
	Citizenship 2.1	Critical thinking and enquiry	Students should be able to question and reflect on different ideas, opinions, assumptions, beliefs and values when exploring topical and controversial issues and problems
	Citizenship 2.1	Critical thinking and	Students should be able to evaluate different viewpoints,

			enquiry	exploring connections and relationships between viewpoints and actions in different contexts (from local to global)
		Citizenship 2.2	Advocacy and representation	Students should be able to evaluate critically different ideas and viewpoints including those with which they do not necessarily agree
Specific content points				
	10	Science/Biology	Reproduction	Understand and use words like 'heterozygote', 'expressed', 'dominant', 'recessive', 'genotype', and 'phenotype'

04 **Harlequin Disease**

Learning aims:

- *You get your genes from your parents. Your mum and your dad each give you one copy so you have two copies of every gene*
- *If there is a mistake in your genes then the cells that use that gene might not work properly*
- *You need to have a change in one or both copies of that gene to have a genetic disease*

		How science works	Applications and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
		Breadth of Study	Organisms and Health	The ways in which organisms function are related to the genes in their cells
Specific content points				
	10	Science/Biology	Reproduction	Understand how variation arises from genetic causes, environmental causes and a

					combination of both
		10	Science/Biology	Reproduction	Understand and use words like 'heterozygote', 'expressed', 'dominant', 'recessive', 'genotype', and 'phenotype'
		10	Science/Biology	Reproduction	Know that paired genes controlling a particular characteristic are called alleles.
		10	Science/Biology	Reproduction	Know that a gene is a section of DNA
		10	Science/Biology	Humans as organisms	Understand that genetic disorders result from genetic defects and may be inherited
04	**Microscope**				
			How science works	Applications and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
Specific content points					
		10	Science/Biology	Cells at work	Most cells are too small to be seen with the naked eye
		10	Science/Biology	Cells at work	Light microscopes help us to see the structure of cells

04 **Flu Epidemic**

Learning aims:

- *Viruses infect cells. The flu virus specifically destroys the cells of the lung tissues*
- *If your immune system does not recognise a virus, then your body will not know how to make antibodies to attack it*
- *People can catch flu from birds but they can't give it to other humans unless the flu virus picks up genes from a human virus that let them do that*
- *Flu is mainly spread by touch – transmitting fluids from an infected person to you by touching something they've touched and then touching your mouth, nose or eyes*
- *Vaccines only protect you against the particular type of flu that they are made for*
- *Virus treatments stop the virus replicating or infecting other cells. They make you less likely to die from the flu. These treatments, called antivirals, are only effective if you take then as soon as the symptoms start*

		How science works	Applications and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
		How science works	Application and implications of science	Pupils should be taught to consider how and why decisions about science and technology are made, including those that raise ethical issues, and about the social, economic and environmental effects of such decisions.
Specific content points				
	10	Biology	Health & disease	Immunisation with a vaccine promotes active immunity to a particular infection

04	**Gut Infection** *Learning aims:* • *That the immune cells in your intestines work together to protect your body from infections from your food and drink* • *That you have bacteria in your intestines that are useful to you* • *That scientists study how immune cells work to help them find treatments for disease*				
		How science works	Applications and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.	
		Breadth of Study	Organisms and Health	Chemical and electrical signals enable body systems to respond to internal and external changes, in order to maintain the body in an optimal state.	
04	**Patient Journey: Cystic Fibrosis**				Careers
		Breadth of Study	Organisms and Health	Chemical and electrical signals enable body systems to respond to internal and external changes, in order to maintain the body in an optimal state	
		How science works	Data evidence, theories and explanation	There are some questions that science cannot currently answer, and some that science cannot address	
		How science works	Application and implications of science	Pupils should be taught to consider how and why decisions about science and technology are made, including those that raise ethical issues, and about the	

					social, economic and environmental effects of such decisions
Specific content points					
		10	Science/Biology	Humans (and other animals)	Hair-like cilia sweep mucus from the upper respiratory tract into the pharynx, there it is either swallowed, sneezed out or coughed u
		10	Science/Biology	Humans as organisms	Cystic fibrosis (CF) is an inherited condition
		10	Science/Biology	Humans as organisms	CF affects the pancreas and the bronchioles of the lungs
		10	Science/Biology	Humans as organisms	CF is caused by the mutation of an allele [on chromosome 7]. The allele controls the production of a polypeptide important for the transport of chloride ions across the cell membrane
04	**Ethics: Animal Experimentation**				
			How science works	Data, evidence, theories and explanation	Pupils should be taught that there are some questions that science cannot currently answer, and some that science cannot address.
			How science works	Applications and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
			How science works	Application and implications of	Pupils should be taught to consider how and why decisions about science and technology are

		science	made, including those that raise ethical issues, and about the social, economic and environmental effects of such decisions.
	Citizenship 1.1	Democracy & Justice	Weighing up what is fair and unfair in different situations, understanding that justice is fundamental to a democratic society and exploring the role of law in maintaining order and resolving conflict.
	Citizenship 1.2	Rights and responsibilities	Exploring different kinds of rights and obligations and how these affect both individuals and communities
	Citizenship 1.2	Rights and responsibilities	Understanding that individuals, organisations and governments have responsibilities to ensure that rights are balanced, supported and protected
	Citizenship 1.2	Rights and responsibilities	Investigating ways in which rights can compete and conflict, and understanding that hard decisions have to be made to try to balance these
	Citizenship 2.1	Critical thinking and enquiry	Students should be able to question and reflect on different ideas, opinions, assumptions, beliefs and values when exploring topical and controversial issues and problems
	Citizenship 2.1	Critical	Students should be able to

				thinking and enquiry	evaluate different viewpoints, exploring connections and relationships between viewpoints and actions in different contexts (from local to global)	
			Citizenship 2.2	Advocacy and representation	Students should be able to evaluate critically different ideas and viewpoints including those with which they do not necessarily agree	
04	**Heart Disease**					
Learning aims: • *Scientists find out what the risk factors for heart disease are by studying large numbers of people* • *You must design an experiment to match your hypothesis to make valid conclusions* • *The risk factors for heart disease can weaken or damage your heart and the blood vessels as well as blocking the blood vessels*						
			Breadth of Study	Organisms and Health	Human health is affected by a range of environmental and inherited factors, by the use and misuse of drugs, and by medical treatments	
Specific content points						
		10	Science/Biology	Humans (and other animals)	Understand how different factors (diet, exercise and stress) affect the circulatory system	
		10	Science/Biology	Humans (and other animals)	Recognise the avoidable and unavoidable risks of heart disease	
04	**Patient Journey: Clinical Research**					Careers
			How science works	Data, evidence, theories and	Pupils should be taught that there are some questions that science cannot currently answer, and	

	explanation	some that science cannot address.
How science works	Applications and implications of science	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
How science works	Application and implications of science	Pupils should be taught to consider how and why decisions about science and technology are made, including those that raise ethical issues, and about the social, economic and environmental effects of such decisions.
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