

Centre of the Cell

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

Key Staged 2 - 4

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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.

<i>Key Stage 2</i>	<i>Key Stage 3</i>	<i>Key Stage 4</i>
<p>Zoom Organ Surgery Troublesome Twins</p> <p>Cell to Baby Body Balance TB Invaders Beyond Brushing Cell Turnover Build an Organ What is a Cell Bioengineering Heart Disease</p>	<p>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</p>	<p>Zoom Gene Search Beyond Brushing Mitosis Maker Organ Surgery Troublesome Twins Explore a Cell Ethics: Cloning Harlequin Disease Gun Infection Patient journey: Clinical Research</p>
		<p>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</p> <p>Lab Bench Chaos Body Balance Cell Trumps TB Invaders Build an Organ Troublesome Twins Flu Epidemic Heart Disease</p>

Key stage 2 by unit

(NB: Centre of the Cell games and interactives are designed primarily for students aged 9 – 16 years)

Year	Unit	Game / interactive				
	Sc1.1: Ideas and evidence in science	All				
	Sc1.2: Investigative skills	Gene Search	Harlequin disease	Microscope	Heart Disease	
	Ma2.1: Using and applying number	Zoom	Body Balance			
	Ma2.2: Numbers & the number system	Zoom	Body Balance	Cell Turnover		
	Ma2.4: Solving numerical problems	Zoom	Body Balance			
	Citizenship 1: Developing confidence and responsibility	Ethics sections	Patient journeys	Detecting Cancer	TB Invaders	Gene Search
		Bioengineering	Beyond Brushing			
	Citizenship 2: Preparing to play an active role as citizens	Ethics sections	Patient journey: clinical trial	Patient journey: IVF	Flu Epidemic	
	Citizenship 3: Developing a healthy, safer lifestyle	TB Invaders	Heart Disease	Gut Infection	Beyond Brushing	Troublesome Twins
		Flu Epidemic				
	Careers	Patient journeys	TB Invaders	Burns Clinic	Gene Search	Bioengineering
		Detecting Cancer	Lab Bench Chaos	Beyond Brushing		
<i>DFES Standards:</i>						
4	4A – Moving and growing	Build an Organ	Organ Surgery			
5	5A – Keeping healthy	Build an Organ	Organ Surgery	Troublesome	TB Invaders	Detecting Cancer

				Twins		
		Heart disease				
5	5B – Life cycles	Cell to Baby	Body Balance			
6	6B – Micro-organisms	TB Invaders	Gene Search	Beyond Brushing	Detecting Cancer	Harlequin Disease
		Microscope	Flu epidemic	Heart Disease	Gut Infection	
5	T3:55 – English	All				
6	T2:18 – English	All				

Key stage 3 by unit

Unit	Game / interactive				
<i>1.1 – Scientific thinking</i>	Microscope				
<i>1.2 – Applications and implications of science</i>	Patient journeys	Ethics sections			
<i>3.3 – Organisms, Behaviour and Health</i>	Lab Bench Chaos	Zoom	Body Balance	Cell Trumps	Burns Clinic
<i>3.3a</i> Life processes are supported by the organisation of cells into tissues, organs and body systems	Cell Turnover	Mitosis Maker	Organ Surgery	Build an Organ	Ethics: stem cells
	Genes and Your Cells	Explore a Cell	What is a Cell?	Ethics: cloning	Bioengineering
	Detecting Cancer	What is Cancer??	Microscope	Gut Infection	Ethics: PGD
<i>3.3 – Organisms, Behaviour and Health</i>	Patient journey: IVF	Cell to Baby			
<i>3.3b</i> The human reproductive cycle includes adolescence, fertilisation and foetal development	Troublesome Twins	Heart Disease	Patient journey: IVF	Beyond Brushing	Gut Infection
	TB Invaders	Patient journey: Cystic Fibrosis			
<i>3.3 – Organisms, Behaviour and Health</i>	Gene Search	Harlequin Disease	Cell to Baby	Troublesome Twins	Heart Disease
<i>3.3d</i> All living things show variation,					

can be classified and are interdependent, interacting with each other and their environment	Ethics: cloning				
<i>4 – Curriculum opportunities</i>	Patient journeys	Cancer Survivors	Lab Bench Chaos	Harlequin Disease	TB Invaders
<i>4c</i> Use real-life examples as a basis for finding out about science	Burns Clinic	Gene Search	Beyond Brushing	Flu Epidemic	Bioengineering
	Microscope	Gut Infection			
<i>4 – Curriculum opportunities</i>	All				
<i>4e</i> Experience science outside the school environment, including in the workplace, where possible					
<i>4 – Curriculum opportunities</i>	Lab Bench Chaos	TB Invaders	Burns Clinic	Detecting Cancer	Bioengineering
	Patient journeys				
<i>4i</i> Prepare to specialise in a range of science subjects at key stage 4 and consider career opportunities both within science and in other areas that are provided by science qualifications.					
<i>4 – Curriculum opportunities</i>	Ethics sections	Patient journeys	Flu Epidemic	Heart Disease	Cancer Survivors
	Beyond Brushing				
<i>4j</i> - consider how knowledge and understanding of science informs personal and collective decisions, including those on substance abuse and sexual health.					
Maths 2.3 – Interpreting & Evaluating	Gene Search	Harlequin Disease	Microscope	Heart Disease	Gut Infection
Maths 3.1 – Number & Algebra	Body Balance	Zoom			

Maths 3.3 – Statistics		Heart Disease				
Citizenship 1.1 – Democracy & Justice		Ethics sections				
Citizenship 1.2 – Rights & Responsibilities		Ethics sections	Patient journey: IVF			
Careers		Patient journeys	TB Invaders	Burns Clinic	Gene Search	Bioengineering
		Detecting cancer	Lab Bench Chaos	Beyond Brushing		
<i>DFES Standards</i>						
7	7A – Cells	Cell to Baby	Lab Bench Chaos	Zoom	Body Balance	Cell Trumps
		Cell Turnover	Organ Surgery	Build an Organ	Genes and Your Cells	Explore a Cell
		Microscope	What is a Cell?	Mitosis Maker		
7	7B – Reproduction	Cell to Baby	Troublesome Twins	Heart Disease	Patient Journey: IVF	
7	7D – Variation and Classification	Troublesome Twins	Gene Search	Harlequin Disease	Heart Disease	
8	8B – Respiration	Build an Organ	Heart Disease			
8	8C – Microbes and Disease	Build an Organ	TB Invaders	Burns Clinic	Flu Epidemic	Gut Infection
		Heart Disease				
8	8L – Sound and Hearing	Heart Disease				
9	9A – Inheritance and selection	Cell to Baby	Cell Trumps	Cell Turnover	Genes and Your Cells	Troublesome Twins
		Ethical sections	Gene Search	Beyond Brushing	Cancer Survivors	Harlequin Disease

		Heart Disease	Mitosis Maker	Patient Journey: IVF		
9	9B – Fit & Healthy	Ethical sections	Troublesome Twins	TB Invaders	Gene Search	Beyond Brushing
		Cancer Survivors	Bioengineering	Detecting Cancer	Harlequin Disease	Heart Disease
		Patient journey: Clinical trial	Patient journey: Cystic Fibrosis	Bioengineering		
9	9M – Investigating Scientifically	Heart Disease				

Key Stage 4 by unit

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

Unit	Game / interactive				
<i>Organisms and Health:</i> 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
<i>Organisms and Health:</i> 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		
<i>Organisms and Health:</i> 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				
<i>How science works:</i> 1 – Data evidence, theories and explanation	Patient journeys	Ethics sections			
<i>How science works:</i> 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			
<i>Specific content points</i>						
	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	What is a Cell?	

					Cells	
	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 2

(NB: Centre of the Cell games and interactives are designed primarily for students aged 9 – 16 years)

Scene	Game	Year	Unit	Unit Name	Concept	Other
ALL	ALL		Sc1.1	Ideas and evidence in science	Pupils should be taught that science is about thinking creatively to try to explain how living and non-living things work, and to establish links between causes and effects.	
		5	T3:55	English	Speaking: present a spoken argument, sequencing points logically, defending views with evidence and making use of persuasive language	
		6	T2:18	English	Construct effective arguments	
02	Cell to Baby					
					<i>Learning aims:</i>	
					<ul style="list-style-type: none"> • That you grew from a single cell into you • That you grew by your cells increasing in number 	
					<i>DFES Standards</i>	
		5	5B	Life cycles	Recognise stages in the growth and development of humans, eg baby, child, adolescence, adult	
		5	5B	Life cycles	State that a new life starts when a sperm fertilises an egg	
02	Lab Bench Chaos					Careers
					<i>Learning aims:</i>	

- *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*

02 **Zoom**

Learning aims:

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

Ma2.1	Using & applying number	Make mental estimates of the answers to calculations; check results
Ma2.2	Numbers & the number system	Read, write and order whole numbers, recognising that the position of a digit gives its value; [use correctly the symbols <, >, =; multiply and divide any integer by 10 or 100 and then 1000; order a set of negative integers, explaining methods and reasoning; multiply and divide decimals by 10 or 100].
Ma2.2	Numbers & the number system	Solve simply problems involving ratio and direct proportion
Ma2.4	Solving numerical problems	Estimate answers by approximating and checking that their results are reasonable by thinking about the context of the problem, and where necessary checking accuracy.

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*

		Ma2.1	Using & applying number	Make mental estimates of the answers to calculations; check results
		Ma2.2	Numbers & the number system	Read, write and order whole numbers, recognising that the position of a digit gives its value; [use correctly the symbols <, >, =; multiply and divide any integer by 10 or 100 and then 1000; order a set of negative integers, explaining methods and reasoning; multiply and divide decimals by 10 or 100].
		Ma2.2	Numbers & the number system	Solve simply problems involving ratio and direct proportion
		Ma2.4	Solving numerical problems	Estimate answers by approximating and checking that their results are reasonable by thinking about the context of the problem, and where necessary checking accuracy.
<i>DFES Standards</i>	5	5B	Life cycles	Recognise stages in the growth and development of humans, eg baby, child, adolescence, adult
02	Cell Trumps			
	<i>Learning aims:</i>			
	<ul style="list-style-type: none"> • <i>That you have different cells to do different tasks in your body</i> • <i>That cells work together to create body parts</i> 			
02	Cell Turnover			
	<i>Learning aims:</i>			
	<ul style="list-style-type: none"> • <i>To understand that cells are being produced and are dying inside you all of the time</i> <ul style="list-style-type: none"> ○ <i>To understand that some cells need to replace themselves all the time</i> 			

- *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*

Ma2.2 Numbers & Read, write and order whole numbers, the number recognising that the position of a digit gives system its value; [use correctly the symbols <, >, =; multiply and divide any integer by 10 or 100 and then 1000; order a set of negative integers, explaining methods and reasoning; multiply and divide decimals by 10 or 100].

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*

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*

DFES Standards

4	4A	Moving and growing	Know that humans have muscles attached to their bones
5	5A	Keeping healthy	Know that the muscle in the walls of the heart contracts regularly, pumping blood around the body
5	5A	Keeping healthy	Know that blood vessels carry blood around the body

	5	5A	Keeping healthy	Identify some parts of the body, eg lungs, brain, muscles, through which blood flows
02	Build an Organ			
<i>Learning aims:</i>				
<ul style="list-style-type: none"> • <i>We can divide ourselves up into</i> <ul style="list-style-type: none"> ○ <i>Cells</i> ○ <i>Tissues</i> ○ <i>Organs</i> • <i>Our cells are organised into tissues</i> • <i>Our organs are made up of different types of tissue</i> • <i>Each type of tissue has a different job to do</i> • <i>The tissues have specific properties and structures so that they can do these different jobs</i> 				
<i>DFES Standards</i>				
	4	4A	Moving and growing	Know that humans have muscles attached to their bones
	5	5A	Keeping healthy	Know that the muscle in the walls of the heart contracts regularly, pumping blood around the body
	5	5A	Keeping healthy	Know that blood vessels carry blood around the body
	5	5A	Keeping healthy	Identify some parts of the body, eg lungs, brain, muscles, through which blood flows
02	Patient Journey: IVF			Careers
	Citizenship 1		Pupils should be taught about the range of jobs carried out by people they know, and to understand how they can develop skills to make their own contribution in the future.	
	Citizenship 2		Pupils should be taught to research, discuss and debate topical issues, problems and	

		Citizenship 2	events Why and how rules and laws are made and enforced, why different rules are needed in different situations and how to take part in making and changing rules
02	Ethics: Stem Cells	Citizenship 1 Citizenship 2 Citizenship 2	Pupils should be taught to talk and write about their opinions and explain their views, on issues that affect themselves and society. Pupils should be taught to research, discuss and debate topical issues, problems and events Why and how rules and laws are made and enforced, why different rules are needed in different situations and how to take part in making and changing rules
02	Genes and Your Cells		<p><i>Learning aims:</i></p> <ul style="list-style-type: none"> • <i>Genes contain the information that is used to tell cells how to work</i> • <i>Every nucleus of every cell in your body has the same genes</i> • <i>Different types of cell use different genes because they do different jobs</i>
02	Troublesome Twins		<p><i>Learning aims:</i></p> <p><i>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.</i></p> <p><i>What made the twins identical at birth? What makes the twins different from one another as they go through life?</i></p>

- *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*

Citizenship 3

Pupils should be taught what makes a healthy lifestyle, including the benefits of exercise and healthy eating, what affects mental health, and how to make informed choices

DFES Standards

5	5A	Keeping healthy
5	5A	Keeping healthy

Know that when we exercise, the activity requires an increased blood supply so the heart beat increases and the pulse rate is faster
 Know that substances like tobacco, alcohol and other drugs can affect the way the body functions and these effects can be harmful

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*

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*

02	Ethics: Cloning				
		Citizenship 1			Pupils should be taught to talk and write about their opinions and explain their views, on issues that affect themselves and society.
		Citizenship 2			Pupils should be taught to research, discuss and debate topical issues, problems and events
		Citizenship 2			Why and how rules and laws are made and enforced, why different rules are needed in different situations and how to take part in making and changing rules
04	TB Invaders				Careers
	<i>Learning aims:</i>				
	<ul style="list-style-type: none"> • <i>That TB is a lung disease caused by TB bacteria being passed in the air from person to person</i> • <i>That scientists study TB in the laboratory and investigate weak points at which they can target new drugs</i> 				
		Citizenship 1			Pupils should be taught about the range of jobs carried out by people they know, and to understand how they can develop skills to make their own contribution in the future.
		Citizenship 3			Pupils should be taught that bacteria and viruses can affect health and that following simple, safe routines can reduce their spread
	<i>DFES Standards</i>	5	5A	Keeping Healthy	Know that medicines are also drugs and also affect the way the body functions but these effects are usually beneficial though there may be side effects

	6	6B	Micro-organisms	Recognise that diseases can be passed on by very small organisms
	6	6B	Micro-organisms	Identify some illnesses caused by micro-organisms
04	Burns Clinic			Careers
<i>Learning aims:</i>				
<ul style="list-style-type: none"> a. <i>That you use healthy skin to heal burns</i> b. <i>That you can grow more skin in the laboratory if you want</i> c. <i>That QMUL scientists are trying to improve the skin grown</i> 				
	Citizenship 1			Pupils should be taught about the range of jobs carried out by people they know, and to understand how they can develop skills to make their own contribution in the future.
04	Gene Search			Careers
<i>Learning aims:</i>				
<ul style="list-style-type: none"> • <i>That deafness can be caused by genes in your cells working differently</i> • <i>That scientist use pattern matching techniques to find genes that are working differently</i> 				
		Sc1.2	Investigative skills – considering evidence and evaluating.	Pupils should be taught to use their scientific knowledge and understanding to explain observations, measurements or other data or conclusions.
		Citizenship 1		Pupils should be taught about the range of jobs carried out by people they know, and to understand how they can develop skills to make their own contribution in the future.
<i>DFES Standards</i>	6	6B	Micro-organisms	Realise that scientific ideas about ‘disease’ are based on evidence

04	Beyond Brushing				Careers
<i>Learning aims:</i>					
<ul style="list-style-type: none"> • <i>That bacteria can destroy your tissue including bone tissue</i> • <i>That QMUL scientists are trying to use stem cells to grow bone to repair damage</i> 					
		Citizenship 1	Pupils should be taught about the range of jobs carried out by people they know, and to understand how they can develop skills to make their own contribution in the future.		
		Citizenship 3	Pupils should be taught what makes a healthy lifestyle, including the benefits of exercise and healthy eating, what affects mental health, and how to make informed choices		
		Citizenship 3	Pupils should be taught that bacteria and viruses can affect health and that following simple, safe routines can reduce their spread		
<i>DFES Standards</i>					
		6	6B	Micro-organisms	Explain why cleaning teeth regularly helps prevent tooth decay and gum disease
04	Cancer Survivors				
<i>Learning aims:</i>					
<ul style="list-style-type: none"> • <i>That people can get cancer and survive to live normal lives</i> • <i>That much research has been done to create treatments and now scientists are doing more research to create and improve treatments.</i> 					
04	Patient Journey: Spinal Cord Injury				Careers

				Citizenship 1	Pupils should be taught about the range of jobs carried out by people they know, and to understand how they can develop skills to make their own contribution in the future.
04				Bioengineering	Careers
				<i>Learning aims:</i>	
				<ul style="list-style-type: none"> <i>Your body can't replace cartilage tissue if you damage it because adult cartilage cells only make new cartilage tissue very slowly</i> <i>Scientists use tissue engineering to grow body parts to help your body heal</i> 	
				Citizenship 1	Pupils should be taught about the range of jobs carried out by people they know, and to understand how they can develop skills to make their own contribution in the future.
04				Detecting Cancer	Careers
				<i>Learning aims:</i>	
				<ul style="list-style-type: none"> <i>Cancer cells behave differently to normal cells</i> <i>Scientists create radioactive chemicals to identify where cancer cells are</i> 	
				Citizenship 1	Pupils should be taught about the range of jobs carried out by people they know, and to understand how they can develop skills to make their own contribution in the future.
				<i>DFES Standards</i>	
	5	5A	Keeping Healthy		Know that medicines are also drugs and also affect the way the body functions but these effects are usually beneficial though there may be side effects
	6	6B	Micro-organisms		Realise that scientific ideas about disease are based on evidence

04	What is Cancer??		
<p><i>Learning aims:</i></p> <ul style="list-style-type: none"> • <i>Normal cells become cancer cells when their genes get damaged</i> • <i>Normal cells need to accumulate a lot of damage over years before they become cancer cells</i> • <i>Cancer cells multiply more than they should and don't die when they should</i> • <i>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</i> 			
04	Ethics: PGD <i>(Pre implanation genetic diagnosis)</i>	Citizenship 1	Pupils should be taught to talk and write about their opinions and explain their views, on issues that affect themselves and society.
		Citizenship 2	Pupils should be taught to research, discuss and debate topical issues, problems and events
		Citizenship 2	Why and how rules and laws are made and enforced, why different rules are needed in different situations and how to take part in making and changing rules
04	Harlequin Disease		
<p><i>Learning aims:</i></p> <ul style="list-style-type: none"> • <i>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</i> • <i>If there is a mistake in your genes then the cells that use that gene might not work properly</i> • <i>You need to have a change in one or both copies of that gene to have a genetic disease</i> 			
		Sc1.2	Investigative skills – Pupils should be taught to use their scientific knowledge and understanding to explain observations, measurements or other data or conclusions.

<i>DFES Standards</i>		6	6B	Micro-organisms	Realise that scientific ideas about disease are based on evidence
04	Microscope		Sc1.2	Investigative skills – obtaining and presenting evidence.	Pupils should be taught to use simple equipment and materials appropriately and take action to control risks.
			Sc1.2	Investigative skills – considering evidence and evaluating.	Pupils should be taught to use observations, measurements or other data to draw conclusions.
			Sc1.2	Investigative skills – considering evidence and evaluating.	Pupils should be taught to use their scientific knowledge and understanding to explain observations, measurements or other data or conclusions.
<i>DFES Standards</i>		6	6B	Micro-organisms	Realise that scientific ideas about disease are based on evidence
04	Flu Epidemic	<p><i>Learning aims:</i></p> <ul style="list-style-type: none"> • <i>Viruses infect cells. The flu virus specifically destroys the cells of the lung tissues</i> • <i>If your immune system does not recognise a virus, then your body will not know how to make antibodies to attack it</i> • <i>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</i> • <i>Flu is mainly spread by touch – transmitting fluids from an infected person to you by touching something they've touched and then</i> 			

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 them as soon as the symptoms start*

Citizenship 2

Why and how rules and laws are made and enforced, why different rules are needed in different situations and how to take part in making and changing rules

Citizenship 3

Pupils should be taught that bacteria and viruses can affect health and that following simple, safe routines can reduce their spread

DFES Standards

6 6B

Micro-organisms

Recognise that diseases can be passed on by very small organisms

6 6B

Micro-organisms

Identify some illnesses caused by micro-organisms

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*

Citizenship 3

Pupils should be taught that bacteria and viruses can affect health and that following simple, safe routines can reduce their spread

DFES Standards

6 6B

Micro-organisms

Recognise that diseases can be passed on by very small organisms

04 **Patient Journey: Cystic Fibrosis**

Careers

		Citizenship 1		Pupils should be taught about the range of jobs carried out by people they know, and to understand how they can develop skills to make their own contribution in the future.
04	Ethics: Animal Experimentation	Citizenship 1		Pupils should be taught to talk and write about their opinions and explain their views, on issues that affect themselves and society.
		Citizenship 2		Pupils should be taught to research, discuss and debate topical issues, problems and events
		Citizenship 2		Why and how rules and laws are made and enforced, why different rules are needed in different situations and how to take part in making and changing rules
04	Heart Disease			
				<i>Learning aims:</i>
				<ul style="list-style-type: none"> • <i>Scientists find out what the risk factors for heart disease are by studying large numbers of people</i> • <i>You must design an experiment to match your hypothesis to make valid conclusions</i> • <i>The risk factors for heart disease can weaken or damage your heart and the blood vessels as well as blocking the blood vessels</i>
		Sc1.1	Ideas and evidence in science	Pupils should be taught that it is important to test ideas using evidence from observation and measurement.
		Sc1.2	Investigative skills – planning	Pupils should be taught to make a fair test or comparison by changing one factor and observing or measuring the effect while keeping other factors the same.
		Citizenship 3		Pupils should be taught what makes a

				healthy lifestyle, including the benefits of exercise and healthy eating, what affects mental health, and how to make informed choices
<i>DFES Standards</i>				
	5	5A	Keeping Healthy	Know how a scientific idea can be tested and the evidence used to support the idea
	5	5A	Keeping healthy	Know that substances like tobacco, alcohol and other drugs can affect the way the body functions and these effects can be harmful
	6	6B	Micro-organisms	Realise that scientific ideas about disease are based on evidence
04				
			Patient Journey: Clinical Research	
			Citizenship 1	Pupils should be taught about the range of jobs carried out by people they know, and to understand how they can develop skills to make their own contribution in the future.
			Citizenship 2	Why and how rules and laws are made and enforced, why different rules are needed in different situations and how to take part in making and changing rules
				Careers

Key Stage 3

Scene	Game	Learning Aims	Year	Unit	Unit Name	Concept	Other
ALL	ALL			4	Curriculum opportunities	The curriculum should provide opportunities for pupils to experience science outside the school environment, including in the workplace, where possible.	
		<i>DFES Standards</i>	7	7A	Cells	Understand, use and spell words relating to scientific enquiry, eg variable, sample size, evaluate, magnification	
			7	7A	Cells	Identify key points from a text	
			7	7B	Reproduction	Collaborate with others to share information and ideas, and solve problems	
			7	7B	Reproduction	Answer questions using relevant evidence or reasons	
			8	8B	Respiration	Summarise and make connections between ideas	
			9	9B	Fit & healthy	Locate information within a text and identify key points.	
02	Cell to Baby						
		<i>Learning aims:</i>					
		<ul style="list-style-type: none"> • <i>That you grew from a single cell into you</i> • <i>That you grew by your cells increasing in number</i> 					

		3.3	Organisms, Behaviour and Health	Life processes are supported by the organisation of cells into tissues, organs and body systems
<i>DFES Standards</i>				
	7	7A	Cells	Know that living things are made of microscopic units called cells
	7	7A	Cells	Explain that growth of living things occurs by cells dividing to make new cells, and these cells increasing in size
	7	7A	Cells	Understand that cells make new cells by dividing
	7	7A	Cells	Understand that growth occurs when new cells are made and increase in size
	7	7A	Cells	Know that cell division and increased cell size lead to growth of the body
	7	7B	Reproduction	Know that fertilisation involves the fusion of the nuclei of sperm and egg
	7	7B	Reproduction	Know that the fertilised egg divides into 2, 4, 8 etc cells as it passes down the oviduct
	9	9A	Inheritance and selection	Know that during fertilisation genetic information from male and female parents is combined
02	Lab Bench Chaos			Careers
<i>Learning aims:</i>				
<ul style="list-style-type: none"> • <i>That cells need warmth, humidity, correct pH and food to make new cells</i> • <i>That scientists mimic the conditions found inside the human body (warmth, humidity, pH, food) in order to grow cells for their experiments</i> 				

	3.3	Organisms, Behaviour and Health	Life processes are supported by the organisation of cells into tissues, organs and body systems	
	4	Curriculum opportunities	The curriculum should provide opportunities for pupils to use real-life examples as a basis for finding out about science.	
	4	Curriculum opportunities	The curriculum should provide opportunities for pupils to prepare to specialise in a range of science subjects at key stage 4 and consider career opportunities both within science and in other areas that are provided by science qualifications.	
<i>DFES Standards</i>	7	7A	Cells	Know that living things are made of microscopic units called cells
02 Zoom <i>Learning aims:</i> <ul style="list-style-type: none"> • <i>How small cells are</i> • <i>How big one million million is</i> 				
		Ma3.1	Number & Algebra	Applications of ratio and proportion
<i>DFES Standards</i>	7	7A	Cells	Know that living things are made of microscopic units called cells
	7	7A	Cells	Explain that growth of living things occurs by cells dividing to make new cells, and

these cells increasing in size

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*

		Ma3.1	Number & Algebra	Applications of ratio and proportion
<i>DFES Standards</i>	7	7A	Cells	Explain that growth of living things occurs by cells dividing to make new cells, and these cells increasing in size
	7	7A	Cells	Understand that cells make new cells by dividing
	7	7A	Cells	Understand that growth occurs when new cells are made and increase in size
	7	7A	Cells	Know that cell division and increased cell size lead to growth of the body

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*

		3.3	Organisms, Behaviour and Health	Life processes are supported by the organisation of cells into tissues, organs and body systems
<i>DFES Standards</i>	7	7A	Cells	Know that humans have different types of

<i>DFES Standards</i>				cells and these cells carry out specialised functions
	7	7A	Cells	Identify specialised features in different types of cell, and relate these to the function of a cell
	7	7A	Cells	Know that we are made up of different types of tissue
	7	7A	Cells	Name some examples of tissues
	7	7A	Cells	Know that tissue is made up from very small units
	7	7A	Cells	Know that cells form tissues [and tissues form organs]
	7	7A	Cells	Know that sperm and egg cells are specially adapted for their functions, eg tail for propulsion, strengthened head that contains chemicals to aid penetration and break-down of the outer layers of the egg / enlarged cell with food reserves
	9	9A	Inheritance and selection	Understand how sperm and egg cells are specialised
02	Cell Turnover			
<i>Learning aims:</i>				
<ul style="list-style-type: none"> • <i>To understand that cells are being produced and are dying inside you all of the time</i> <ul style="list-style-type: none"> ○ <i>To understand that some cells need to replace themselves all the time</i> ○ <i>To understand that some cells change their rate of production to respond to the body's needs</i> ○ <i>To understand that some cells never replace themselves; if you lose these cells you are permanently damaged</i> 				
	3.3		Organisms, Behaviour and	Life processes are supported by the organisation of cells into tissues, organs and body systems

Health

DFES Standards

7	7A	Cells	Know that we are made up of different types of tissue
7	7A	Cells	Know that tissue is made up from very small units
7	7A	Cells	Know that cells form tissues [and tissues form organs]
7	7A	Cells	Explain that growth of living things occurs by cells dividing to make new cells, and these cells increasing in size

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*

7	7A	Cells	Explain that growth of living things occurs by cells dividing to make new cells, and these cells increasing in size
7	7A	Cells	Understand that cells make new cells by dividing
7	7A	Cells	Understand that growth occurs when new cells are made and increase in size
7	7A	Cells	Know that cells have nuclei containing the information that is transferred from one generation to the next
7	7A	Cells	Represent the process of cell division as a sequence that begins with the division of the

	9	9A	Inheritance and selection	nucleus Know that cells have nuclei which contain information that is transferred from one generation to the next
02 Organ Surgery <i>Learning aims:</i> <ul style="list-style-type: none"> • 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 				
		3.3	Organisms, Behaviour and Health	Life processes are supported by the organisation of cells into tissues, organs and body systems
<i>DFES Standards</i>				
	7	7A	Cells	Know that we are made up of different types of tissue
	7	7A	Cells	Name some examples of tissues
	7	7A	Cells	Know that cells form tissues [and tissues form organs]
	7	7A	Cells	Identify, locate and describe the functions of a range of organs
02 Build an Organ <i>Learning aims:</i> <ul style="list-style-type: none"> • We can divide ourselves up into <ul style="list-style-type: none"> ○ 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*

		3.3	Organisms, Behaviour and Health	Life processes are supported by the organisation of cells into tissues, organs and body systems	
<i>DFES Standards</i>					
		7	7A	Cells	Know that we are made up of different types of tissue
		7	7A	Cells	Know that tissue is made up from very small units
		7	7A	Cells	Know that humans have different types of cells and these cells carry out specialised functions
		7	7A	Cells	Identify specialised features in different types of cell, and relate these to the function of a cell
		7	7A	Cells	Name some examples of tissues
		7	7A	Cells	Know that cells form tissues [and tissues form organs]
		8	8B	Respiration	Blood is a transport medium
		8	8C	Microbes and Disease	Identify natural barriers against infection [ie skin]
		9	9B	Fit & healthy	Describe how a joint, eg knee, functions
02	Patient Journey: IVF				Careers
			1.2	Applications and	Exploring how the creative application of scientific ideas can bring about

	implications of science	technological developments and consequent changes in the way people think and behave.
1.2	Applications and implications of science	Examining the ethical and moral implications of using and applying science.
4	Curriculum opportunities	The curriculum should provide opportunities for pupils to use real-life examples as a basis for finding out about science.
4	Curriculum opportunities	The curriculum should provide opportunities for pupils to prepare to specialise in a range of science subjects at key stage 4 and consider career opportunities both within science and in other areas that are provided by science qualifications.
4	Curriculum opportunities	The curriculum should provide opportunities for pupils to consider how knowledge and understanding of science informs personal and collective decisions, including those on substance abuse and sexual health.
Citizenship 1.2		Exploring different kinds of rights and obligations and how these affect both individuals and communities
Citizenship 1.2		Understanding that individuals, organisations and governments have responsibilities to ensure that rights are balance, supported and protected

DFES Standards

Citizenship 1.2

Investigating ways in which rights can compete and conflict, and understanding that hard decisions have to be made to try to balance these

7	7B	Reproduction	Pupils will learn to understand, use and spell: the names of the reproductive organs, eg 'ovary', 'testis', 'oviduct', 'uterus'; specialised terms, eg 'menstruation', 'ovulation', 'fertilisation', 'placenta', 'mammary glands', 'sperm', 'gestation'; words with similar but distinct meanings, eg 'hereditary/inherited', 'baby/foetus', 'puberty/adolescence'; words with different meanings in scientific and everyday contexts, eg 'cell', 'fuse'; words relating to scientific enquiry, eg 'reliability', 'sample size', 'national data'.
7	7B	Reproduction	State that a new life starts when a sperm fertilised an egg
7	7B	Reproduction	State that human young are fertilised internally and develop in the uterus
7	7B	Reproduction	Explain that an advantage of internal development over external is that there is a greater chance of eggs surviving to become independent young
7	7B	Reproduction	Describe fertilisation in terms of the fusion of cells
7	7B	Reproduction	Know that fertilisation involves the fusion of the nuclei of sperm and egg.
7	7B	Reproduction	Know that fertilisation involves the

				combination of characteristics of both parents
	9	9A	Inheritance and selection	Know that during fertilisation genetic information from male and female is combined
	9	9A	Inheritance and selection	Understand that the fusion of male and female sex=cell nuclei in both animals and plants produces a new individual that is genetically unique
02	Ethics: Stem Cells			
		1.2	Applications and implications of science	Exploring how the creative application of scientific ideas can bring about technological developments and consequent changes in the way people think and behave.
		1.2	Applications and implications of science	Examining the ethical and moral implications of using and applying science.
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to consider how knowledge and understanding of science informs personal and collective decisions, including those on substance abuse and sexual health.
		Citizenship 1.1		Participating actively in different kinds of decision-making and voting in order to influence public life
		Citizenship 1.1		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	Exploring different kinds of rights and obligations and how these affect both individuals and communities
			Citizenship 1.2	Understanding that individuals, organisations and governments have responsibilities to ensure that rights are balance, supported and protected
			Citizenship 1.2	Investigating ways in which rights can compete and conflict, and understanding that hard decisions have to be made to try to balance these
<i>DFES Standards</i>				
	9	9B	Fit & healthy	Recognise that there are ethical issues involved in scientific research, e.g. not subjecting people to harmful experiences
02	Genes and Your Cells			
<i>Learning aims:</i>				
<ul style="list-style-type: none"> • <i>Genes contain the information that is used to tell cells how to work</i> • <i>Every nucleus of every cell in your body has the same genes</i> • <i>Different types of cell use different genes because they do different jobs</i> 				
<i>DFES Standards</i>				
	7	7A	Cells	Know that we are made up of different types of tissue
	7	7A	Cells	Name some examples of tissues
	7	7A	Cells	Know that tissue is made up from very small units

	7	7A	Cells	Know that humans have different types of cells and these cells carry out specialised functions
	7	7A	Cells	Identify specialised features in different types of cell, and relate these to the function of a cell
	9	9A	Inheritance and selection	Understand that genes are instructions that control the characteristics that develop
02	Troublesome Twins			
<i>Learning aims:</i>				
<i>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.</i>				
<i>What made the twins identical at birth? What makes the twins different from one another as they go through life?</i>				
<ul style="list-style-type: none"> • <i>Their identical genes</i> • <i>The food that their mother ate when she was pregnant is needed to make cells grow by multiplying in number</i> • <i>What makes you similar to your family – your genes and your environment</i> • <i>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</i> • <i>How does the environment affect our cells? Food, infections, hygiene, smoking, pollution. How does the environment affect us? Cultural and emotional?</i> • <i>Some conditions have a genetic predisposition but they are heavily influenced by the environmental factors e.g. Alcoholism</i> 				
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to consider how knowledge and understanding of science informs personal and collective decisions, including those on substance abuse and sexual health.
<i>DFES Standards</i>	7	7B	Reproduction	Understand that sperm and egg each contain

				half the inherited information needed and relate this to the concept of identical and non-identical twins
	7	7D	Variation and classification	Suggest ways in which environmental difference may result in variation, eg height, weight
	9	9A	Inheritance and selection	Identify some characteristics that are influenced by environmental factors
	9	9A	Inheritance and selection	Explain why individuals with the same genetic information may vary
	9	9A	Inheritance and selection	Consider whether identical twins really are identical and how any differences between them arise
	9	9B	Fit & healthy	Identify factors that can affect fitness and health, relating these to scientific knowledge and understanding

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*

		3.3	Organisms, Behaviour and Health	Life processes are supported by the organisation of cells into tissues, organs and body systems
<i>DFES Standards</i>	7	7A	Cells	Identify that cells have a cytoplasm, cell membrane and a nucleus
	7	7A	Cells	Relate parts of model cells to diagrams and

7	7A	Cells	pictures of cells Know that cells have a cell surface membrane which keeps the cell together and controls what enters and leaves
7	7A	Cells	Know that cells have a cytoplasm which occupies most of the cell
7	7A	Cells	Cell models are useful to appreciate the 3D structure of cells but have limitations, ie present a static rather than dynamic model of the cell (NB: Explore a Cell is dynamic)
7	7A	Cells	Know that cells have nuclei containing the information that is transferred from one generation to the next
7	7A	Cells	Know that humans have different types of cells and these cells carry out specialised functions
7	7A	Cells	Identify specialised features in different types of cell, and relate these to the function of a 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*

3.3	Organisms, Behaviour and Health	Life processes are supported by the organisation of cells into tissues, organs and body systems
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DFES Standards

7	7A	Cells	Know that we are made up of different types of tissue
7	7A	Cells	Know that tissue is made up from very small units

02

Ethics: Cloning

	1.2	Applications and implications of science	Exploring how the creative application of scientific ideas can bring about technological developments and consequent changes in the way people think and behave.
	1.2	Applications and implications of science	Examining the ethical and moral implications of using and applying science.
	4	Curriculum opportunities	The curriculum should provide opportunities for pupils to consider how knowledge and understanding of science informs personal and collective decisions, including those on substance abuse and sexual health.
Citizenship 1.1			Participating actively in different kinds of decision-making and voting in order to influence public life
Citizenship 1.1			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			Exploring different kinds of rights and obligations and how these affect both

<i>DFES Standards</i>		Citizenship 1.2		individuals and communities Understanding that individuals, organisations and governments have responsibilities to ensure that rights are balance, supported and protected	
		Citizenship 1.2		Investigating ways in which rights can compete and conflict, and understanding that hard decisions have to be made to try to balance these	
		9	9A	Inheritance and selection	Identify ethical issues relating to cloning of animals
		9	9A	Inheritance and selection	Understand why clones are genetically identical
		9	9B	Fit & healthy	Recognise that there are ethical issues involved in scientific research, e.g. not subjecting people to harmful experiences
04	TB Invaders			Careers	
<i>Learning aims:</i>					
<ul style="list-style-type: none"> • <i>That TB is a lung disease caused by TB bacteria being passed in the air from person to person</i> • <i>That scientists study TB in the laboratory and investigate weak points at which they can target new drugs</i> 					
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to use real-life examples as a basis for finding out about science.	
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to prepare to specialise in a range of science subjects at key stage 4 and consider career opportunities both within science and in	

		8	8C	Microbes and Disease	other areas that are provided by science qualifications. Recognise that micro-organisms can cause infections	
		8	8C	Microbes and Disease	Describe a range of mechanisms by which micro-organisms enter the body, e.g. droplet/air-borne	
04	Burns Clinic					Careers
	<i>Learning aims:</i>					
	<ul style="list-style-type: none"> • <i>That you use healthy skin to heal burns</i> • <i>That you can grow more skin in the laboratory if you want</i> • <i>That QMUL scientists are trying to improve the skin grown</i> 					
			4	Curriculum opportunities	The curriculum should provide opportunities for pupils to use real-life examples as a basis for finding out about science.	
			4	Curriculum opportunities	The curriculum should provide opportunities for pupils to prepare to specialise in a range of science subjects at key stage 4 and consider career opportunities both within science and in other areas that are provided by science qualifications.	
		8	8C	Microbes and Disease	Identify natural barriers to infection [ie skin]	
04	Gene Search					Careers
	<i>Learning aims:</i>					
	<ul style="list-style-type: none"> • <i>That deafness can be caused by genes in your cells working differently</i> • <i>That scientist use pattern matching techniques to find genes that are working differently</i> 					

	4	Curriculum opportunities	The curriculum should provide opportunities for pupils to use real-life examples as a basis for finding out about science
	4	Curriculum opportunities	The curriculum should provide opportunities for pupils to prepare to specialise in a range of science subjects at key stage 4 and consider career opportunities both within science and in other areas that are provided by science qualifications
	Ma2.3	Interpreting & Evaluating	Pupils should be able to look at data to find patterns and exceptions
7	7D	Variation and classification	Suggest reasons why differences and similarities exist within families
	9	9A	Inheritance and selection
	9	9A	Inheritance and selection
	9	9A	Inheritance and selection
	9	9A	Inheritance and selection
	9	9A	Inheritance and selection
	9	9A	Inheritance and selection
	9	9A	Inheritance
	9	9A	Inheritance

			and selection Fit & healthy	parents may vary Identify trends in quantitative data	
4	Beyond Brushing	9	9B		Careers
<i>Learning aims:</i>					
<ul style="list-style-type: none"> • <i>That bacteria can destroy your tissue including bone tissue</i> • <i>That QMUL scientists are trying to use stem cells to grow bone to repair damage</i> 					
			4	Curriculum opportunities	The curriculum should provide opportunities for pupils to use real-life examples as a basis for finding out about science.
			4	Curriculum opportunities	The curriculum should provide opportunities for pupils to prepare to specialise in a range of science subjects at key stage 4 and consider career opportunities both within science and in other areas that are provided by science qualifications.
			4	Curriculum opportunities	The curriculum should provide opportunities for pupils to consider how knowledge and understanding of science informs personal and collective decisions, including those on substance abuse and sexual health.
<i>DFES Standards</i>					
		9	9A	Inheritance and selection	Identify some characteristics that are influenced by environmental factors
		9	9B	Fit & healthy	Identify factors that can affect fitness and health, relating these to scientific knowledge and understanding

04	Cancer Survivors				
<i>Learning aims:</i>					
<ul style="list-style-type: none"> • <i>That people can get cancer and survive to live normal lives</i> • <i>That much research has been done to create treatments and now scientists are doing more research to create and improve treatments.</i> 					
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to use real-life examples as a basis for finding out about science.	
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to consider how knowledge and understanding of science informs personal and collective decisions, including those on substance abuse and sexual health.	
		9	9A	Inheritance and selection	Identify some characteristics that are influenced by environmental factors
04	Patient Journey: Spinal Cord Injury				Careers
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to use real-life examples as a basis for finding out about science.	
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to prepare to specialise in a range of science subjects at key stage 4 and consider career opportunities both within science and in	

		4	Curriculum opportunities	<p>other areas that are provided by science qualifications.</p> <p>The curriculum should provide opportunities for pupils to consider how knowledge and understanding of science informs personal and collective decisions, including those on substance abuse and sexual health.</p>	
04	Bioengineering				Careers
	<i>Learning aims:</i>				
	<ul style="list-style-type: none"> <i>Your body can't replace cartilage tissue if you damage it because adult cartilage cells only make new cartilage tissue very slowly</i> <i>Scientists use tissue engineering to grow body parts to help your body heal</i> 				
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to use real-life examples as a basis for finding out about science.	
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to prepare to specialise in a range of science subjects at key stage 4 and consider career opportunities both within science and in other areas that are provided by science qualifications.	
	<i>DFES Standards</i>				
		9	9B	Fit & healthy	Describe how a joint, eg knee, functions
04	Detecting Cancer				Careers
	<i>Learning aims:</i>				
	<ul style="list-style-type: none"> <i>Cancer cells behave differently to normal cells</i> <i>Scientists create radioactive chemicals to identify where cancer cells are</i> 				

<i>DFES Standards</i>		9	9B	Fit & healthy	Describe the tale of different scientists in a medical development
04	What is Cancer??				
<i>Learning aims:</i>					
<ul style="list-style-type: none"> • <i>Normal cells become cancer cells when their genes get damaged</i> • <i>Normal cells need to accumulate a lot of damage over years before they become cancer cells</i> • <i>Cancer cells multiply more than they should and don't die when they should</i> • <i>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</i> 					
04	Ethics: PGD <i>(Pre-implanation genetic diagnosis)</i>	1.2		Applications and implications of science	Exploring how the creative application of scientific ideas can bring about technological developments and consequent changes in the way people think and behave.
		1.2		Applications and implications of science	Examining the ethical and moral implications of using and applying science.
		4		Curriculum opportunities	The curriculum should provide opportunities for pupils to consider how knowledge and understanding of science informs personal and collective decisions, including those on substance abuse and sexual health.
				Citizenship 1.1	Participating actively in different kinds of decision-making and voting in order to

					influence public life
				Citizenship 1.1	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	Exploring different kinds of rights and obligations and how these affect both individuals and communities
				Citizenship 1.2	Understanding that individuals, organisations and governments have responsibilities to ensure that rights are balance, supported and protected
				Citizenship 1.2	Investigating ways in which rights can compete and conflict, and understanding that hard decisions have to be made to try to balance these
	<i>DFES Standards</i>				
		9	9B	Fit & healthy	Recognise that there are ethical issues involved in scientific research, e.g. not subjecting people to harmful experiences
04	Harlequin Disease				
	<i>Learning aims:</i>				
	<ul style="list-style-type: none"> <i>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</i> <i>If there is a mistake in your genes then the cells that use that gene might not work properly</i> <i>You need to have a change in one or both copies of that gene to have a genetic disease</i> 				
			4	Curriculum opportunities	The curriculum should provide opportunities for pupils to use real-life

<i>DFES Standards</i>		Ma2.3	Interpreting & Evaluating	examples as a basis for finding out about science. Pupils should be able to look at data to find patterns and exceptions
	7	7D	Variation and classification	Suggest reasons why differences and similarities exist within families
	9	9A	Inheritance and selection	Understand that some characteristics are inherited and identify some
	9	9A	Inheritance and selection	Know that cells have nuclei which contain information that is transferred from one generation to the next
	9	9A	Inheritance and selection	Understand how offspring inherit characteristics from their parents
	9	9A	Inheritance and selection	Relate characteristics to genetic information passed from both parents
	9	9A	Inheritance and selection	Explain why individuals from the same parents may vary
	9	9A	Inheritance and selection	Know that offspring are similar but not identical to their parents
	9	9A	Inheritance and selection	Identify some inherited characteristics
	9	9B	Fit & healthy	Identify factors that can affect fitness and health, relating these to scientific knowledge and understanding
04	Microscope			
		1.1	Scientific thinking	Critically analysing and evaluating evidence from observations and experiments.
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to use real-life

				examples as a basis for finding out about science.
		Ma2.3	Interpreting & Evaluating	Pupils should be able to look at data to find patterns and exceptions
<i>DFES Standards</i>	7	7A	Cells	Describe cells seen down a microscope
	7	7A	Cells	Focus a microscope
	7	7A	Cells	Describe how objects appear under low magnification
04	Flu Epidemic			
	<i>Learning aims:</i>			
	<ul style="list-style-type: none"> • <i>Viruses infect cells. The flu virus specifically destroys the cells of the lung tissues</i> • <i>If your immune system does not recognise a virus, then your body will not know how to make antibodies to attack it</i> • <i>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</i> • <i>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</i> • <i>Vaccines only protect you against the particular type of flu that they are made for</i> • <i>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 them as soon as the symptoms start</i> 			
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to consider how knowledge and understanding of science informs personal and collective decisions, including those on substance abuse and sexual health.
<i>DFES Standards</i>	8	8C	Microbes and Disease	Recognise that micro-organisms can cause infections
	8	8C	Microbes and Disease	Describe the contributions of different scientists in dealing with an outbreak of

	8	8C	Microbes and Disease	disease Understand how scientists today tackle the spread of infectious disease
	8	8C	Microbes and Disease	State that antibiotics are effective against bacteria but ineffective against viral infections
	8	8C	Microbes and Disease	Explain that immunisation protects the body against some diseases because antibodies are made more quickly in response to infection
04	Gut Infection			
<i>Learning aims:</i>				
<ul style="list-style-type: none"> • <i>That the immune cells in your intestines work together to protect your body from infections from your food and drink</i> • <i>That you have bacteria in your intestines that are useful to you</i> • <i>That scientists study how immune cells work to help them find treatments for disease</i> 				
<i>DFES Standards</i>		Ma2.3	Interpreting & Evaluating	Pupils should be able to look at data to find patterns and exceptions
	8	8C	Microbes and Disease	Describe antibody action, eg marking infected micro-organisms, entangling micro-organisms
04	Patient Journey: Cystic Fibrosis			
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to use real-life examples as a basis for finding out about science.
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to prepare to specialise in a range of science subjects at
				Careers

				key stage 4 and consider career opportunities both within science and in other areas that are provided by science qualifications.
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to consider how knowledge and understanding of science informs personal and collective decisions, including those on substance abuse and sexual health.
<i>DFES Standards</i>		9	9B	Fit & healthy
				Identify factors that can affect fitness and health, relating these to scientific knowledge and understanding
04	Ethics: Animal Experimentation			
		1.2	Applications and implications of science	Exploring how the creative application of scientific ideas can bring about technological developments and consequent changes in the way people think and behave.
		1.2	Applications and implications of science	Examining the ethical and moral implications of using and applying science.
		4	Curriculum opportunities	The curriculum should provide opportunities for pupils to consider how knowledge and understanding of science informs personal and collective decisions, including those on substance abuse and sexual health.

				Citizenship 1.1	Participating actively in different kinds of decision-making and voting in order to influence public life
				Citizenship 1.1	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	Exploring different kinds of rights and obligations and how these affect both individuals and communities
				Citizenship 1.2	Understanding that individuals, organisations and governments have responsibilities to ensure that rights are balance, supported and protected
				Citizenship 1.2	Investigating ways in which rights can compete and conflict, and understanding that hard decisions have to be made to try to balance these
<i>DFES Standards</i>	9	9B	Fit & healthy		Recognise that there are ethical issues involved in scientific research, e.g. not subjecting people to harmful experiences

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*

4

Curriculum opportunities

The curriculum should provide opportunities for pupils to consider how

DFES Standards

			knowledge and understanding of science informs personal and collective decisions, including those on substance abuse and sexual health.
	Ma2.3	Interpreting & Evaluating	Pupils should be able to look at data to find patterns and exceptions
	Ma2.3	Interpreting & Evaluating	Pupils should be able to relate findings to the original context, identifying whether they support or refute conjectures
	Ma3.1	Statistics	Experimental and theoretical probabilities, including those based on equally likely outcomes.
7	7B	Reproduction	Understand the importance of sample size in obtaining reliable evidence
7	7D	Variation and classification	Frame questions that can be investigated
7	7D	Variation and classification	Choose a sufficiently large sample size to be confident in their conclusions
7	7D	Variation and classification	Interpret graphs and draw conclusions from them
7	7D	Variation and classification	Interpret their graphs and say how strong they think an association or correlation is
8	8B	Respiration	Use controls for comparisons
8	8B	Respiration	Recognise that theories change when they are not supported by evidence
8	8C	Microbes	Consider the number of measurements

		8	8L	and Disease Sound and Hearing	needed for reliable data Decide on appropriate measurements to answer a question
		8	8L	Sound and Hearing	Identify factors which need to be controlled if they are to make a fair test
		8	8L	Sound and Hearing	Look critically at results and decide how strongly they support a relationship
		9	9A	Inheritance and selection	Be able to decide which observations and measurements to make
		9	9A	Inheritance and selection	Identify some characteristics that are influenced by environmental factors
		9	9B	Fit & healthy	Identify factors that can affect fitness and health, relating these to scientific knowledge and understanding
		9	9B	Fit & healthy	Describe how diet and lack of exercise can worsen heart and circulation conditions
		9	9M	Investigating Scientifically	Evaluate a conclusion by considering how good the model and data were
		9	9M	Investigating Scientifically	Consider the limitations of the evidence
04	Patient Journey: Clinical Research				Careers
			1.2	Applications and implications of science	Exploring how the creative application of scientific ideas can bring about technological developments and consequent changes in the way people think and behave.
			1.2	Applications and implications	Examining the ethical and moral implications of using and applying science.

			of science	
	4	Curriculum opportunities	The curriculum should provide opportunities for pupils to use real-life examples as a basis for finding out about science.	
	4	Curriculum opportunities	The curriculum should provide opportunities for pupils to prepare to specialise in a range of science subjects at key stage 4 and consider career opportunities both within science and in other areas that are provided by science qualifications.	
	4	Curriculum opportunities	The curriculum should provide opportunities for pupils to consider how knowledge and understanding of science informs personal and collective decisions, including those on substance abuse and sexual health.	
<i>DFES Standards</i>	9	9B	Fit & healthy	Describe the tale of different scientists in a medical development

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	
			10	Science/Biology	Cells at work	All living things are made of cells	
02	Cell to Baby						
		<i>Learning aims:</i>					
		<ul style="list-style-type: none"> • <i>That you grew from a single cell into you</i> • <i>That you grew by your cells increasing in number</i> 					
		<i>Specific content points</i>	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
		<i>Learning aims:</i>					

- *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 **Zoom**

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	Know that smooth muscle (found

			other animals)	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				
<i>Learning aims:</i>				
<ul style="list-style-type: none"> • <i>To understand that cells are being produced and are dying inside you all of the time</i> <ul style="list-style-type: none"> ○ <i>To understand that some cells need to replace themselves all the time</i> ○ <i>To understand that some cells change their rate of production to respond to the body's needs</i> ○ <i>To understand that some cells never replace themselves; if you lose these cells you are permanently damaged</i> 				
<i>Specific content points</i>				
	10	Science/Biology	Health & disease	Cancer is the uncontrolled division of cells leading to the development of a cancerous growth (tumour)
02 Mitosis Maker				
<i>Learning aims:</i>				
<ul style="list-style-type: none"> • <i>Cell have a cycle – growth, rest, copy DNA, divide, growth, etc</i> • <i>New cells are formed when old cells divide in two</i> • <i>Cytoplasm and the nucleus divides in two during cell division</i> 				
<i>Specific content points</i>				
	10	Science/Biology	Cell division	Know that new cells (daughter

10	Science/Biology	Cell division	cells) are formed when old cells (parent cells) divide into two 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**

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

Pupils should be taught to consider how and why decisions about science and technology are

Careers

	science	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 & 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

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 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.
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	Understanding that individuals,

		responsibilities	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	
<i>Specific content points</i>	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*

<i>Specific content points</i>		Breadth of Study	Organisms and Health	The ways in which organisms function are related to the genes in their cells.
	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?			
	<i>Learning aims:</i>			
	<ul style="list-style-type: none"> To understand that a biological cell is an independently functioning unit To understand that each cell works together as part of a larger structure 			
	<i>Specific content points</i>			
	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 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	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	Students should be able to

			representation	evaluate critically different ideas and viewpoints including those with which they do not necessarily agree
<i>Specific content points</i>	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
	<i>Learning aims:</i>			
	<ul style="list-style-type: none"> • 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	Pupils should be taught about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
<i>Specific content points</i>	10	Biology	Health & disease	Bacteria can become resistant to a particular antibiotic
04	Burns Clinic			Careers

Learning aims:

- d. That you use healthy skin to heal burns*
- e. That you can grow more skin in the laboratory if you want*
- f. 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.
<i>Specific content points</i>	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.
<i>Specific content points</i>	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
<i>Learning aims:</i>				
<ul style="list-style-type: none"> • <i>That bacteria can destroy your tissue including bone tissue</i> • <i>That QMUL scientists are trying to use stem cells to grow bone to repair damage</i> 				
		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.
	<i>Specific content points</i>	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				
	<i>Learning aims:</i>				
	<ul style="list-style-type: none"> • <i>That people can get cancer and survive to live normal lives</i> • <i>That much research has been done to create treatments and now scientists are doing more research to create and improve treatments.</i> 				
			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	Application	Pupils should be taught to

		works	and implications of science	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.
<i>Specific content points</i>	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

Pupils should be taught about the use of contemporary scientific and technological developments

			science	and their benefits, drawbacks and risks.
<i>Specific content points</i>	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			
<i>Learning aims:</i>				
<ul style="list-style-type: none"> • <i>Cancer cells behave differently to normal cells</i> • <i>Scientists create radioactive chemicals to identify where cancer cells are</i> 				
		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.
<i>Specific content points</i>	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??			
<i>Learning aims:</i>				
<ul style="list-style-type: none"> • <i>Normal cells become cancer cells when their genes get damaged</i> • <i>Normal cells need to accumulate a lot of damage over years before they become cancer cells</i> • <i>Cancer cells multiply more than they should and don't die when they should</i> • <i>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</i> 				

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 <i>(Pre-implantation genetic diagnosis)</i>	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 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.
		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
<i>Specific content points</i>	10	Science/Biology	Reproduction	Understand and use words like 'heterozygote', 'expressed', 'dominant', 'recessive', 'genotype', and 'phenotype'
04	Harlequin Disease			
<i>Learning aims:</i>				
<ul style="list-style-type: none"> • <i>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</i> • <i>If there is a mistake in your genes then the cells that use that gene might not work properly</i> • <i>You need to have a change in one or both copies of that gene to have a genetic disease</i> 				
		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
<i>Specific content points</i>	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

				<p>‘heterozygote’, ‘expressed’, ‘dominant’, ‘recessive’, ‘genotype’, and ‘phenotype’</p> <p>Know that paired genes controlling a particular characteristic are called alleles.</p> <p>Know that a gene is a section of DNA</p> <p>Understand that genetic disorders result from genetic defects and may be inherited</p>
10		Science/Biology	Reproduction	
10		Science/Biology	Reproduction	
10		Science/Biology	Humans as organisms	
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.
	<i>Specific content points</i>			
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			
	<i>Learning aims:</i>			
	<ul style="list-style-type: none"> • <i>Viruses infect cells. The flu virus specifically destroys the cells of the lung tissues</i> • <i>If your immune system does not recognise a virus, then your body will not know how to make antibodies to attack it</i> • <i>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</i> • <i>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</i> • <i>Vaccines only protect you against the particular type of flu that they are made for</i> • <i>Virus treatments stop the virus replicating or infecting other cells. They make you less likely to die from the flu. These treatments, called</i> 			

antivirals, are only effective if you take them 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.
<i>Specific content points</i>	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	Organisms and	Chemical and electrical signals

		Study	Health	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	
	<i>Specific content points</i>				
		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 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.
			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
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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

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*

Specific content points

	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
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 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

How science works	Application and implications of science	risks. 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.
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