

# **Centre of the Cell**

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

**Key Stage 2**

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

## 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		
DFES Standards:						
4	4A – Moving and growing	Build an Organ	Organ Surgery			
5	5A – Keeping healthy	Build an Organ	Organ Surgery	Troublesome Twins	TB Invaders	Detecting Cancer
		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 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.	
DFES Standards		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"> <li>• That you grew from a single cell into you</li> <li>• That you grew by your cells increasing in number</li> </ul>						
DFES Standards		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	
Learning aims:			
<ul style="list-style-type: none"><li>• That cells need warmth, humidity, correct pH and food to make new cells</li><li>• That scientists mimic the conditions found inside the human body (warmth, humidity, pH, food) in order to grow cells for their experiments</li></ul>			
02	Zoom		
Learning aims:			
<ul style="list-style-type: none"><li>• How small cells are</li><li>• How big one million million is</li></ul>			
	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.

*DFES Standards*

5	5B	Life cycles	Recognise stages in the growth and development of humans, eg baby, child, adolescence, adult
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02	<b>Cell Trumps</b>	<p><i>Learning aims:</i></p> <ul style="list-style-type: none"> <li>• <i>That you have different cells to do different tasks in your body</i></li> <li>• <i>That cells work together to create body parts</i></li> </ul>
02	<b>Cell Turnover</b>	<p><i>Learning aims:</i></p> <ul style="list-style-type: none"> <li>• <i>To understand that cells are being produced and are dying inside you all of the time</i> <ul style="list-style-type: none"> <li>○ <i>To understand that some cells need to replace themselves all the time</i></li> <li>○ <i>To understand that some cells change their rate of production to respond to the body's needs</i></li> <li>○ <i>To understand that some cells never replace themselves; if you lose these cells you are permanently damaged</i></li> </ul> </li> </ul>
	Ma2.2	<p>Numbers &amp; the number system</p> <p>Read, write and order whole numbers, recognising that the position of a digit gives its value; [use correctly the symbols &lt;, &gt;, =; 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].</p>
02	<b>Mitosis Maker</b>	<p><i>Learning aims:</i></p> <ul style="list-style-type: none"> <li>• <i>Cell have a cycle – growth, rest, copy DNA, divide, growth, etc</i></li> <li>• <i>New cells are formed when old cells divide in two</i></li> <li>• <i>Cytoplasm and the nucleus divides in two during cell division</i></li> </ul>

<b>02 Organ Surgery</b> <i>Learning aims:</i> <ul style="list-style-type: none"> <li>to name the major body organs</li> <li>to know what other organs they are linked to form organ systems</li> <li>to know where the major body organs are in the body</li> <li>understand that each organ system is involved in a set of functions</li> </ul>				
<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
<b>02 Build an Organ</b> <i>Learning aims:</i> <ul style="list-style-type: none"> <li>We can divide ourselves up into               <ul style="list-style-type: none"> <li>Cells</li> <li>Tissues</li> <li>Organs</li> </ul> </li> <li>Our cells are organised into tissues</li> <li>Our organs are made up of different types of tissue</li> <li>Each type of tissue has a different job to do</li> <li>The tissues have specific properties and structures so that they can do these different jobs</li> </ul>				
<i>DFES Standards</i>				
	4	4A	Moving and growing	Know that humans have muscles attached to their bones
	5	5A	Keeping	Know that the muscle in the walls of the

			healthy	heart contracts regularly, pumping blood around the body
		5	5A	Keeping healthy
		5	5A	Keeping healthy
				Identify some parts of the body, eg lungs, brain, muscles, through which blood flows
02	<b>Patient Journey: IVF</b>			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 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
02	<b>Ethics: Stem Cells</b>			
			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
02	<b>Genes and Your Cells</b>			

*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*

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*

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

Know that when we exercise, the activity requires an increased blood supply so the heart beat increases and the pulse rate is faster

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
02	<b>Explore a Cell</b>	
	<i>Learning aims:</i>	
	<ul style="list-style-type: none"> <li><i>To understand that cells are 3 dimensional</i></li> <li><i>To understand that cells are dynamic structures</i></li> <li><i>To understand that a cell has discrete organelles which carry out specific tasks and work together to help the cell perform its function</i></li> </ul>	
02	<b>What is a Cell?</b>	
	<i>Learning aims:</i>	
	<ul style="list-style-type: none"> <li><i>To understand that a biological cell is an independently functioning unit</i></li> <li><i>To understand that each cell works together as part of a larger structure</i></li> </ul>	
02	<b>Ethics: Cloning</b>	
	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
Learning aims:					
<ul style="list-style-type: none"><li>That TB is a lung disease caused by TB bacteria being passed in the air from person to person</li><li>That scientists study TB in the laboratory and investigate weak points at which they can target new drugs</li></ul>					
DFES Standards	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	
	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
Learning aims:					
<ul style="list-style-type: none"><li>a. That you use healthy skin to heal burns</li><li>b. That you can grow more skin in the laboratory if you want</li><li>c. That QMUL scientists are trying to improve the skin grown</li></ul>					
	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	<b>Gene Search</b>	Careers
Learning aims:		
<ul style="list-style-type: none"> <li>That deafness can be caused by genes in your cells working differently</li> <li>That scientist use pattern matching techniques to find genes that are working differently</li> </ul>		
	Sc1.2	Investigative skills – considering evidence and evaluating.
	Citizenship 1	Pupils should be taught to use their scientific knowledge and understanding to explain observations, measurements or other data or conclusions.
		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.
DFES Standards	6	6B
	Micro-organisms	Realise that scientific ideas about ‘disease’ are based on evidence
04	<b>Beyond Brushing</b>	Careers
Learning aims:		
<ul style="list-style-type: none"> <li>That bacteria can destroy your tissue including bone tissue</li> <li>That QMUL scientists are trying to use stem cells to grow bone to repair damage</li> </ul>		
	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

DFES Standards				
	6	6B	Micro-organisms	Explain why cleaning teeth regularly helps prevent tooth decay and gum disease
04	<b>Cancer Survivors</b> <i>Learning aims:</i> <ul style="list-style-type: none"><li>• That people can get cancer and survive to live normal lives</li><li>• That much research has been done to create treatments and now scientists are doing more research to create and improve treatments.</li></ul>			
04	<b>Patient Journey: Spinal Cord Injury</b>  Citizenship 1		Careers  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	<b>Bioengineering</b> <i>Learning aims:</i> <ul style="list-style-type: none"><li>• Your body can't replace cartilage tissue if you damage it because adult cartilage cells only make new cartilage tissue very slowly</li><li>• Scientists use tissue engineering to grow body parts to help your body heal</li></ul>  Citizenship 1			Careers  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	<b>Detecting Cancer</b>				Careers
<i>Learning aims:</i>					
<ul style="list-style-type: none"><li>• <i>Cancer cells behave differently to normal cells</i></li><li>• <i>Scientists create radioactive chemicals to identify where cancer cells are</i></li></ul>					
		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.
DFES Standards		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	<b>What is Cancer?</b>				
<i>Learning aims:</i>					
<ul style="list-style-type: none"><li>• <i>Normal cells become cancer cells when their genes get damaged</i></li><li>• <i>Normal cells need to accumulate a lot of damage over years before they become cancer cells</i></li><li>• <i>Cancer cells multiply more than they should and don't die when they should</i></li><li>• <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></li></ul>					
04	<b>Ethics: PGD</b> (Pre implanation genetic diagnosis)	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	<b>Harlequin Disease</b>			
<i>Learning aims:</i> <ul style="list-style-type: none"> <li><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></li> <li><i>If there is a mistake in your genes then the cells that use that gene might not work properly</i></li> <li><i>You need to have a change in one or both copies of that gene to have a genetic disease</i></li> </ul>				
			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	<b>Microscope</b>			
			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 – Pupils should be taught to use their scientific knowledge and understanding to

			considering evidence and evaluating.	explain observations, measurements or other data or conclusions.		
DFES Standards			6	6B	Micro-organisms	Realise that scientific ideas about disease are based on evidence
04	Flu Epidemic					
Learning aims:						
<ul style="list-style-type: none"><li>Viruses infect cells. The flu virus specifically destroys the cells of the lung tissues</li><li>If your immune system does not recognise a virus, then your body will not know how to make antibodies to attack it</li><li>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</li><li>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</li><li>Vaccines only protect you against the particular type of flu that they are made for</li><li>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</li></ul>						
			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	<b>Gut Infection</b>				
<i>Learning aims:</i> <ul style="list-style-type: none"> <li>• <i>That the immune cells in your intestines work together to protect your body from infections from your food and drink</i></li> <li>• <i>That you have bacteria in your intestines that are useful to you</i></li> <li>• <i>That scientists study how immune cells work to help them find treatments for disease</i></li> </ul>					
<i>DFES Standards</i>		Citizenship 3			Pupils should be taught that bacteria and viruses can affect health and that following simple, safe routines can reduce their spread
		6	6B	Micro-organisms	Recognise that diseases can be passed on by very small organisms
04	<b>Patient Journey: Cystic Fibrosis</b>				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	<b>Ethics: Animal Experimentation</b>				
		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				
Learning aims:					
<ul style="list-style-type: none"><li>Scientists find out what the risk factors for heart disease are by studying large numbers of people</li><li>You must design an experiment to match your hypothesis to make valid conclusions</li><li>The risk factors for heart disease can weaken or damage your heart and the blood vessels as well as blocking the blood vessels</li></ul>					
DFES Standards		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	
	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			Careers
		Citizenship 1		Pupils should be taught about the range of jobs carried out by people they know, and to	

## Citizenship 2

understand how they can develop skills to make their own contribution in the future. 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