

## Activity 1: Cell structure to function

### Basic

nucleus	location of chromosomes that contain genes coding for the production of polypeptides
nuclear envelope	double membrane surrounding the nuclear material (DNA)
gene	length of DNA, which is a sequence of bases, coding for a polypeptide
messenger RNA (mRNA)	molecule that carries the coded information of DNA to the ribosome in the cytoplasm for polypeptide synthesis
polypeptide	a chain of amino acids in a specific sequence
nuclear pores	complex channels that allow particular substances to be transported across the nuclear envelope
80S ribosome	cell structure that is the site of polypeptide synthesis in the cytoplasm
rough endoplasmic reticulum (RER)	membranous cell structure that has 80S ribosomes on its external surface
Golgi body	cell structure that processes and packages proteins in membrane bound sacs
cell surface membrane	the membrane separating the cytoplasm and nucleus of the cell from the external environment
mitochondrion	cell structure carrying out aerobic respiration to provide energy to the cell

### Challenge

glycoprotein	protein that has a carbohydrate group attached, for example a chain of monosaccharides (single sugar units)
transport vesicle	membrane-bound sac that transports proteins to the Golgi body
Golgi (secretory) vesicle	membrane-bound sac that transports proteins to the cell surface membrane for release by exocytosis
microtubules	small tubular cell structures made of protein
antibody	protein molecule consisting of four polypeptides, two short chains and two longer chains
ATP molecule	energy currency of the cell mainly produced in the mitochondria

## Activity 2: Plasma cell structure to function

nucleus	location of chromosomes that contain genes coding for the production of light and heavy chain polypeptides
gene	specific sequence of bases coding for a polypeptide that will form an antibody molecule
RNA polymerase	enzyme that catalyses the synthesis of mRNA in the nucleus
nuclear pores	allow the exit from the nucleus of mRNA carrying the coded information for the light and heavy chain polypeptides
mRNA coding for light or heavy chain	carries the coded information copied from the gene to the 80S ribosome
80S ribosome	binds to mRNA for the synthesis of the light or heavy chain polypeptides on the external surface of RER
rough endoplasmic reticulum	light and heavy chain polypeptides pass into the lumen (inside space) of the tubular RER to begin formation of antibody molecules
transport vesicle	transports antibody molecules to the Golgi body from the RER
Golgi body	final processing and packaging of antibody molecules into Golgi vesicles
Golgi vesicle	contains antibody molecules for release from cell surface membrane
cell surface membrane	Golgi vesicles arrive and fuse with the cell surface membrane to release antibody molecules
antibody	(glyco)protein produced and secreted by a plasma cell
mitochondrion	produces ATP required for the synthesis and secretion of antibody molecules
microtubules	cell structures that guide transport vesicles and Golgi vesicles through the cytoplasm

### Activity 3: Production and secretion of antibody molecules

#### Basic

*Read the statements, cut them out and mix them up, then try and place them in the correct sequence.*

Genes coding for the light and heavy chains of an antibody molecule are switched on and messenger RNA molecules are synthesised using RNA polymerase.
The mRNA leaves the nucleus via nuclear pores to bind to 80S ribosomes on the external surface of the rough endoplasmic reticulum.
Light and heavy chain polypeptides pass into the lumen of the RER and antibody molecules are formed.
The antibodies are transported inside vesicles from the RER to the Golgi body.
Microtubules guide the transport vesicles to the Golgi body.
At the Golgi body, final processing and packaging of the antibodies occurs and the Golgi vesicles that form move towards the cell surface membrane, guided by microtubules.
Golgi vesicles fuse with the cell surface membrane and antibody molecules are secreted out of the cell into the circulatory system.

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#### Challenge

*Cut out the statements and rearrange them in the correct sequence.*

At the Golgi body, final processing and packaging of the antibodies occurs and the Golgi vesicles that form move towards the cell surface membrane, guided by microtubules.
Microtubules guide the transport vesicles to the Golgi body.
The mRNA leaves the nucleus via nuclear pores to bind to 80S ribosomes on the external surface of the rough endoplasmic reticulum.
Golgi vesicles fuse with the cell surface membrane and antibody molecules are secreted out of the cell into the circulatory system.
Light and heavy chain polypeptides pass into the lumen of the RER and antibody molecules are formed.
Genes coding for the light and heavy chains of an antibody molecule are switched on and messenger RNA molecules are synthesised using RNA polymerase.
The antibodies are transported inside vesicles from the RER to the Golgi body.

#### Activity 4: Antibody production and secretion by plasma cells

Complete the passage by writing in the most appropriate term in the gaps 1 to 15.

.....<sup>1</sup> coding for the light and .....<sup>2</sup> chains of an antibody molecule are switched on and .....<sup>3</sup> molecules are synthesised. These leave the nucleus via .....<sup>4</sup> and enters the .....<sup>5</sup>, to bind to .....<sup>6</sup> on the external surface of the .....<sup>7</sup>. The light and heavy chain .....<sup>8</sup> that are synthesised pass into the .....<sup>9</sup> of the RER, where antibody molecules are formed. Transport vesicles from the RER carry the .....<sup>10</sup> to the .....<sup>11</sup>. Here, the molecules are packaged into .....<sup>12</sup>. These then move towards the .....<sup>13</sup>, guided by .....<sup>14</sup>, and fuse, releasing their contents to enter the .....<sup>15</sup>.

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#### Challenge

Complete the passage using the most appropriate term.

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#### Basic

Complete the following passage using the terms from the list.

cell surface membrane	messenger RNA	microtubules
nuclear pores	heavy	circulatory system
polypeptides	Golgi vesicles	lumen
genes	80S ribosomes	cytoplasm
rough endoplasmic reticulum	antibodies	Golgi body

### **Answers**

1. genes
2. heavy
3. messenger RNA / mRNA
4. nuclear pores
5. cytoplasm
6. 80S ribosomes
7. rough endoplasmic reticulum
8. polypeptides
9. lumen
10. antibodies
11. Golgi body
12. Golgi vesicles
13. cell surface membrane
14. microtubules
15. circulatory system