Biology Building Work 2025

The aims of this building work are:

Objective 1: *To identify and review key areas of your Y12 exam to improve your A-level outcomes.*

Objective 2: *To review command words that will support you answering A-level Biology questions to the highest standard.*

Objective 3: *To continue wider reading and associated skills*

This work has three parts:

1. **Reviewing your Y12 exam** and improving key topics.
2. **Literacy activity** – identifying command words that will support you answering A-level Biology questions to the highest standard.
3. A **wider reading task**

1. Reviewing your Y12 exam

All students should be reviewing the key areas of improvement, following analysis of their Y12 exam paper.

Please add your key 5 areas of the specification below, your action and the date of completion.

Actions should include: reviewing on UpLearn, Kerboodle or using BioRach (on Youtube) and could include practising exam questions.

If you are resitting the exam in September you should complete the above and then practise questions using the relevant sections of the *Intervention Booklet* that you have been given.

Topic	Specification Point(s)	Action	Date

2. Literacy Activity

Identifying command words will support you answering A-level Biology questions to the highest standard. OCR issues the following guidance on each Assessment Objective.

AO1: Demonstrating Knowledge & Understanding

- **Define / State** – Give precise meanings.
- **Name / Identify / List** – Provide facts or items.
- **Describe** – Set out characteristics/details.
- **Outline** – Summarise main points.
- **Give** – Provide a short answer without explanation.

AO2: Applying Knowledge & Understanding

- **Apply / Use** – Put knowledge into context.
- **Calculate** – Work out numerical answers, showing workings.
- **Determine / Find** – Obtain a result or answer.
- **Complete / Construct / Draw** – Add or build diagrams, tables, equations.
- **Convert** – Change items into another format (e.g., g → moles).

AO3: Analysis, Interpretation & Evaluation

- **Analyse** – Break down information, examine relationships, interpret.
- **Compare / Contrast** – Identify similarities and differences.
- **Explain** – Provide reasons or describe mechanisms.
- **Deduce** – Infer from given information or data.
- **Interpret** – Translate information into meaning.
- **Discuss** – Balanced account including different viewpoints.
- **Evaluate** – Make a judgement based on evidence and criteria.
- **Suggest** – Propose ideas, hypotheses, or methods.
- **Predict** – Forecast likely outcomes based on understanding.
- **Justify** – Provide reasons or evidence supporting a decision.

Why This Matters

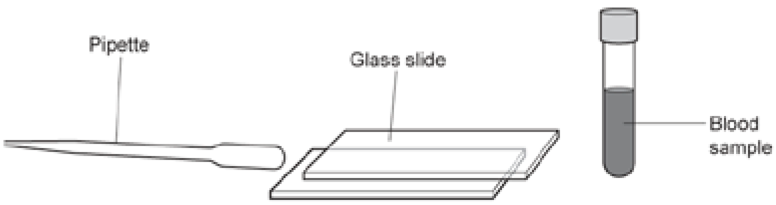
1. **Decoding Questions**: You must grasp what each command word is asking—e.g., "Explain" vs. "Describe."
2. **Mark Scheme Alignment**: OCR's grading rubric is structured around these command words—responding accurately improves marks.
3. **Skill Development**: Understanding and practicing responses builds progression from recall (AO1), through application (AO2), to analysis and critical thinking (AO3).

Complete the following questions, paying attention to the command word in the question.

AO1: Demonstrating Knowledge & Understanding

- **Describe** – Set out characteristics/details.

1. This is some equipment that could be used when preparing a blood smear.



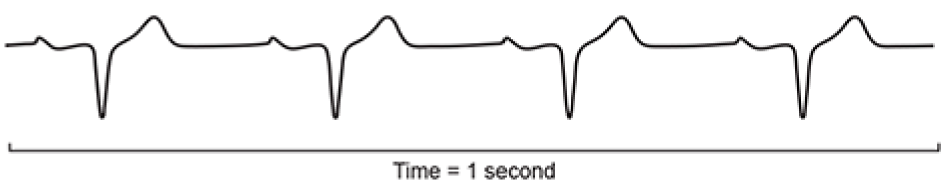
Describe how to use the equipment to prepare a blood smear that could then be stained and viewed under a microscope.

[3]

2. Describe the bond between the two glucose monomers in maltose.

[2]

3. Birds have hearts with a similar structure to mammalian hearts. An electrocardiogram (ECG) trace from a bird and an ECG trace from a human have many differences.
The ECG trace below is from a bird.



Describe how the ECG trace from a bird is different from a normal ECG trace from a human.

[2]

AO2: Applying Knowledge & Understanding

- **Calculate** – Work out numerical answers, showing workings.
- **Complete / Construct / Draw** – Add or build diagrams, tables, equations.

5. The formation of tissue fluid has many similarities with the process of ultrafiltration in the kidneys. The table shows the factors involved in formation of tissue fluid and its return to the blood.

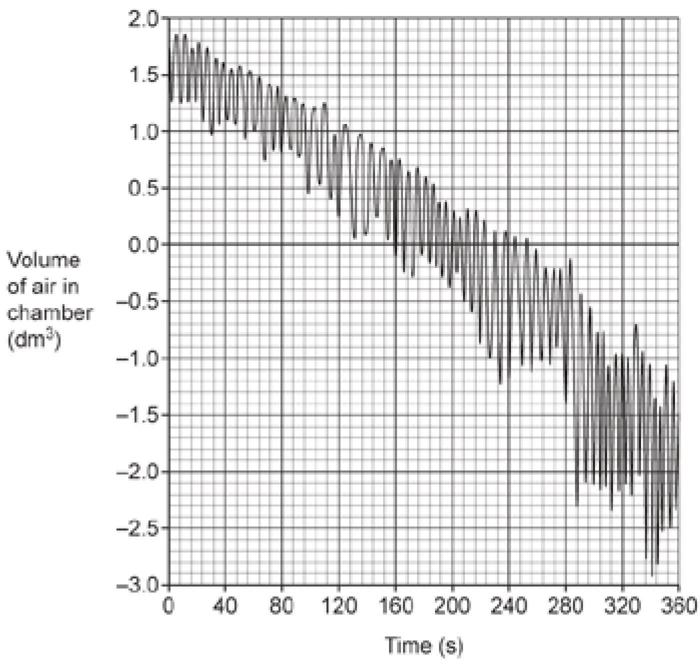
Location	Hydrostatic pressure (kPa)		Oncotic pressure (kPa)	
	Blood	**Tissue Fluid**	**Blood**	**Tissue Fluid**
Arteriole end	4.5	1.1	−3.3	−1.2
Venule end	1.7	1.1	−3.3	−1.2

i. The net pressure at the arteriole end is +1.3 kPa.

Calculate the net pressure at the venule end.

Net pressure at venule end = ... kPa**[2]**

6. A student investigated ventilation and heart rate in a resting subject.
The subject breathed in and out through a spirometer.
The spirometer chamber was filled with room air. Soda lime was present to absorb carbon dioxide.
The results are shown in this graph



i. The downward slope of the spirometer trace in the graph is due to oxygen consumption.

The subject exhales the same volume of air as they inhale.
State why the trace slopes downwards.

____

____

[1]

ii. The subject had a mass of 75 kg.

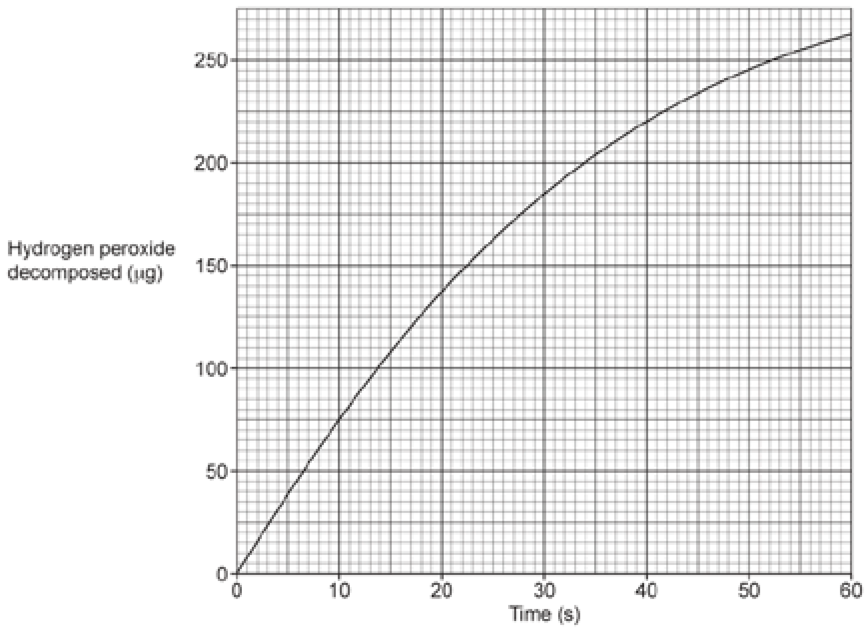
Calculate the subject's oxygen consumption in $cm^3\ kg^{-1}$ during the first 2 minutes of the experiment.

Give your answer to **2** significant figures.

Oxygen consumption = ... $cm^3\ kg^{-1}$ **[2]**

7. Hydrogen peroxide is a highly reactive chemical.
Catalase is an intracellular enzyme that catalyses the breakdown of hydrogen peroxide.

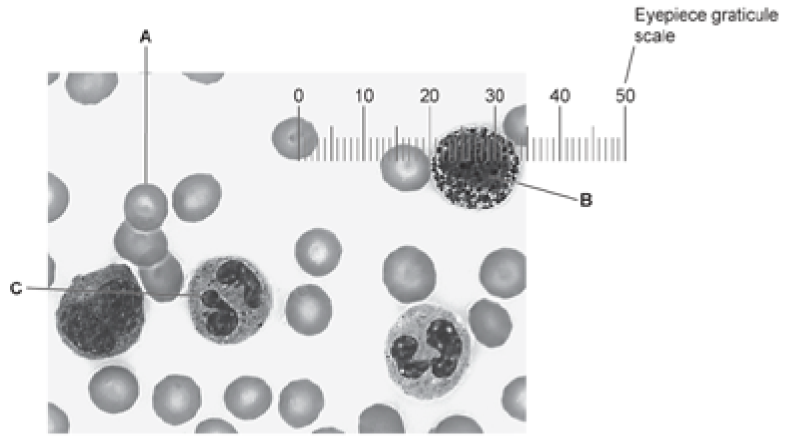
i. The graph shows a graph of decomposition of hydrogen peroxide against time for catalase.



Calculate the rate of the enzyme catalysed reaction **at 30 s**.

Rate = ... Units = ...**[3]**

8. This is a light micrograph of a human blood smear.



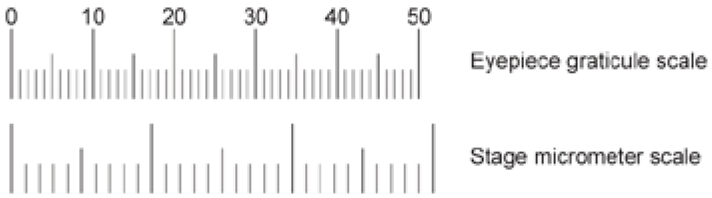
i. The cell labelled **A** is sometimes known as a red blood cell. Name cell **A**.

[1]

ii. In the space below, draw a labelled diagram of cell **C**.

[4]

iii. The image was taken using a × 40 objective lens. The eyepiece graticule scale for the × 40 objective lens was calibrated using the stage micrometer shown below.



Each of the three large divisions on the stage micrometer scale measured exactly 0.01 mm.

Calculate the diameter of cell **B**.

Give your answer in µm to **2** significant figures.

Diameter = ... µm [3]

AO3: Analysis, Interpretation & Evaluation

- **Compare / Contrast** – Identify similarities and differences.
- **Evaluate** – Make a judgement based on evidence and criteria

9. Compare prophase in mitosis with prophase in meiosis.

[4]

10. Fig. 16 shows pressure changes during the cardiac cycle.

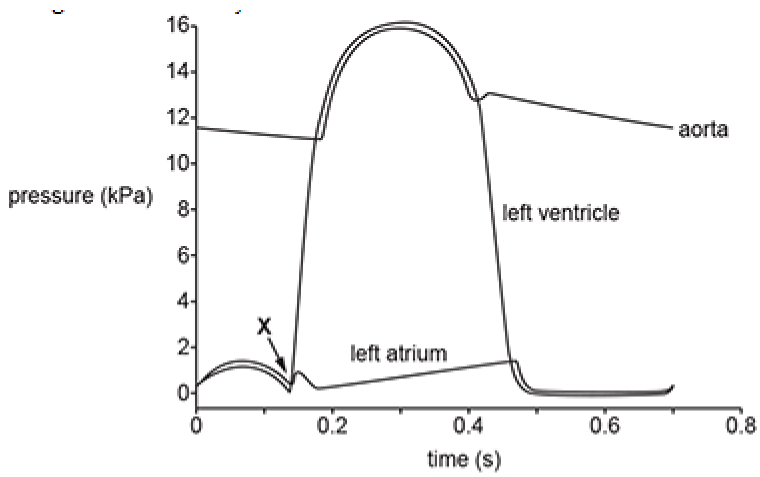


Fig. 16

i. Using Fig. 16, compare the changes in pressure in the left ventricle with the changes in pressure in the left atrium.

11. Male infertility is associated with low motility (ability to move) of sperm cells.

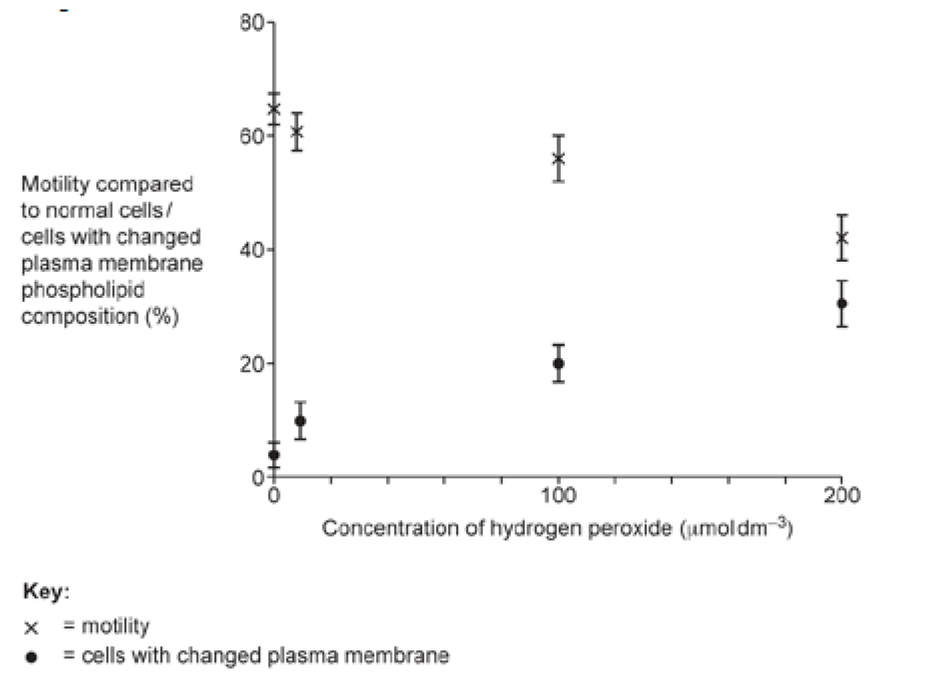
i. Scientists investigate the effect of hydrogen peroxide on sperm cells. This is the method that they use:

- incubate sperm cells with different concentrations of hydrogen peroxide for two hours

- measure the motility of the cells compared with normal sperm cells
- measure the percentage of cells that have changes in the composition of phospholipids in the plasma membrane.

They use sperm samples from 10 different men attending a fertility clinic and calculate mean values.

Their results are shown in the figure below



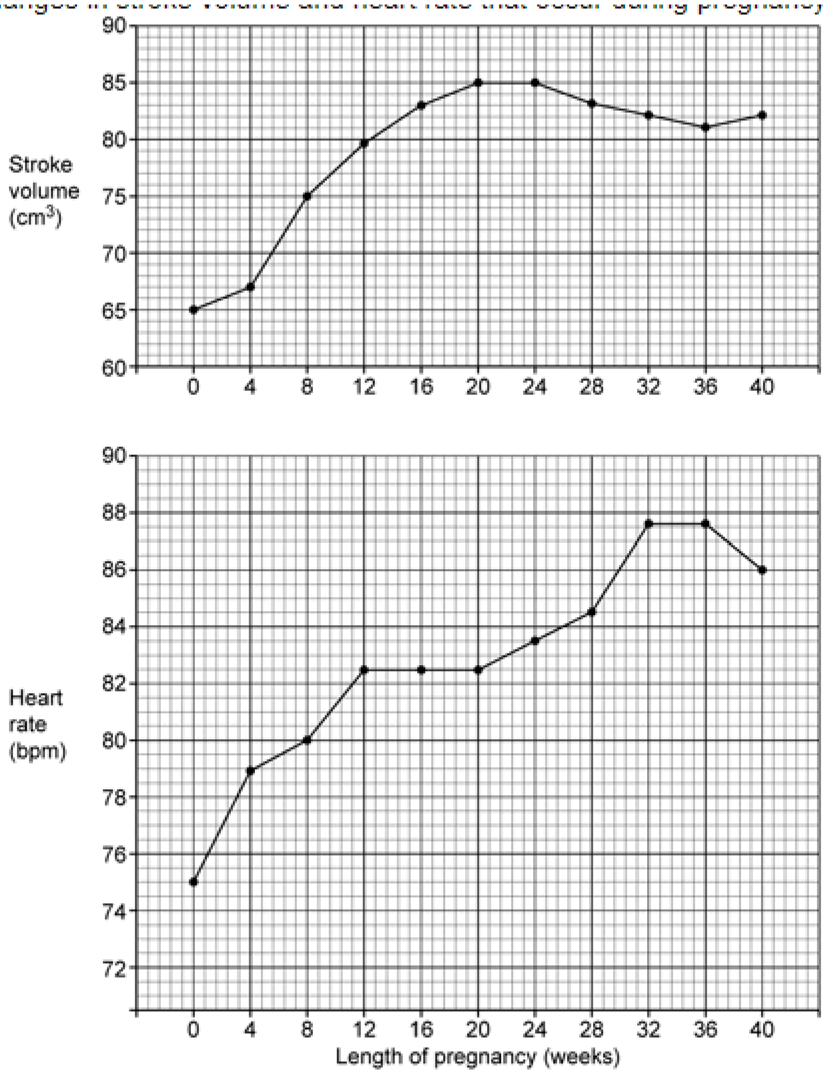
The scientists conclude that hydrogen peroxide causes changes in the plasma membrane of sperm cells that reduces their motility.

Evaluate this conclusion.

……
……
……
……
……
……

[3]

12. During pregnancy the mother's body undergoes several physiological changes to support the developing fetus. These changes affect every organ system in the body.
Changes to the heart and circulatory system begin in the first few weeks of pregnancy.
The figures below shows the changes in stroke volume and heart rate that occur during pregnancy.



i. Use the data in the figures to calculate the cardiac output in week 20.

Cardiac output = ... Unit .... **[3]**

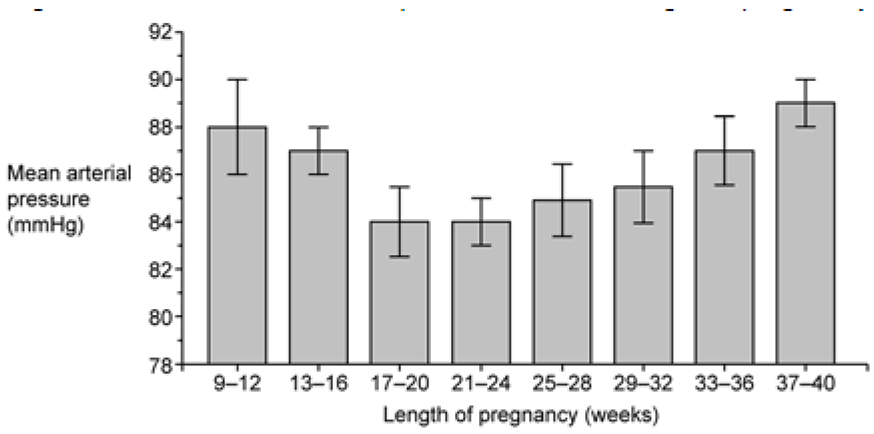
ii. Suggest an advantage of the increase in cardiac output.

____

____

[1]

iii. The figure below shows how blood pressure varies throughout pregnancy.



A student looked at the data in all the figures and drew the following conclusion:

‘As cardiac output increased blood pressure dropped so there must have been a decrease in vascular resistance.’

Evaluate this conclusion.

[3]

13. Fig. 2.1 shows the number of worker bees of *B. pratorum* and *B. terrestris* observed at one location over a year.

Table 2.1 shows some differences in the food collecting behaviour of worker bees of these species.

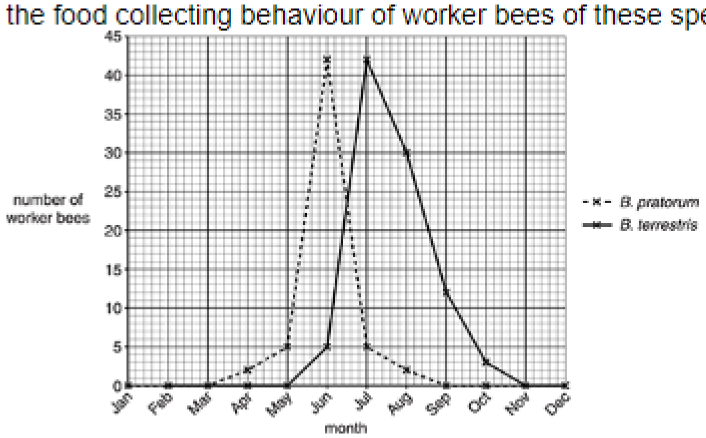


Fig. 2.1

Species of bumble bee	Mean depth of flower visited (mm)	Visits to flowers when nectar only collected (%)	Visits to flowers when pollen only collected (%)	Visits to flowers when both nectar and pollen collected (%)
Bombus pratorum	7.4	23	10	67
Bombus terrestris	6.3	80	11	9

Table 2.1

i. *B. pratorum* and *B. terrestris* both live in Britain. They can often be found in the same location, as their geographical distributions overlap.

Use Fig. 2.1 and Table 2.1 to evaluate the extent to which the two species may compete.

[4]

3. Wider Reading Task

How are you feeling? Touch signals and touch receptors

Neuroscientist Catherine McCrohan describes some of the different types of touch receptors that are located in the skin, how touch signals are conveyed in the nervous system, and some of the ways we use this information

Biological Sciences Review Volume 27, 2014/ 2015 Issue 3 Catherine McCrohan

Some people live without sight, or hearing, or a sense of smell. But can you imagine a world without touch? Our sense of touch allows us to collect information about objects with which we come into contact. This process involves conversion of mechanical signals into the electrical signals that are used by our nervous system.

Touch may include light through to heavy pressure. It tells us about the weight and texture of an object — whether smooth or rough—and whether the object is moving—for example, vibrating. We use all this information to guide a multitude of activities, including the skilled movements of a violinist or surgeon.

Closely associated with the sense of touch are sensations relating to pain and temperature, which are also detected through our skin but do not require mechanical deformation of the skin. Our ability to perceive mechanical changes depends on the fact that our skin is flexible and will deform when it comes into contact with an object. Specialised nerve receptor cells called mechanoreceptors, located beneath the surface of the skin, pick up changes in the amount of bending or stretching of the skin.

Skin receptors

Our skin has many functions, including protecting the underlying tissues from damage and water loss. The skin consists of an outer layer—the epidermis—and an inner layer—the dermis. The dermis contains millions of mechanoreceptors, often named after the scientist who first described them (see Figure 1). Each receptor consists of the ending of a **nerve fibre,** which originates from a nerve cell (neurone) located in the central nervous system. Many of these endings are associated with specialised structures that allow them to respond preferentially to different types of touch stimuli.

For example, Meissner's corpuscles are found near the skin surface under ridges of skin such as those on our fingertips. Each Meissner's corpuscle responds to light touch over a small area of skin only a few millimetres across. This area of skin is called the **receptive field** of the receptor. These mechanoreceptors respond best to brief touch stimuli, such as a light pin prick. They also respond to rough textures, movement of an object or slow vibrations. Merkel's discs, on the other hand, respond to long-lasting touch. These are found in the skin, at the boundary between the dermis and epidermis (see Figure 1), and they record information about the amount of steady pressure applied to the skin and hence the weight of an object.

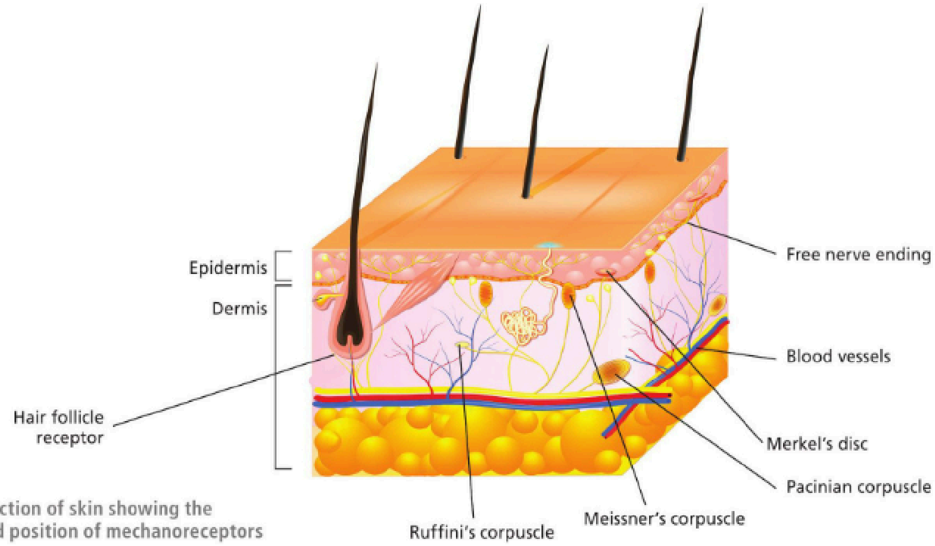


Figure 1 Section of skin showing the structure and position of mechanoreceptors

Figure 1 Section of skin showing the structure and position of mechanoreceptors

Receptors on hair follicles respond to movement of the hair, as would occur during a light caress. By combining information from different types of mechanoreceptor, the brain is able to identify objects simply by touch.

Different parts of your body have different sensitivity to touch and also vary hugely in a twopoint discrimination test. This test is a measure of the ability to tell apart two stimuli applied close together on the skin. Your fingertips can distinguish two points more than about 2.5 mm apart. On your back, the two points must be more than 35mm apart before you can identify them as two separate stimuli. The reasons for this difference include the fact that the skin on the fingers has a much higher density of touch receptors than other parts of the body. In addition, more of the receptors have a small receptive field. Less overlap of receptive fields of adjacent receptors means better two-point discrimination.

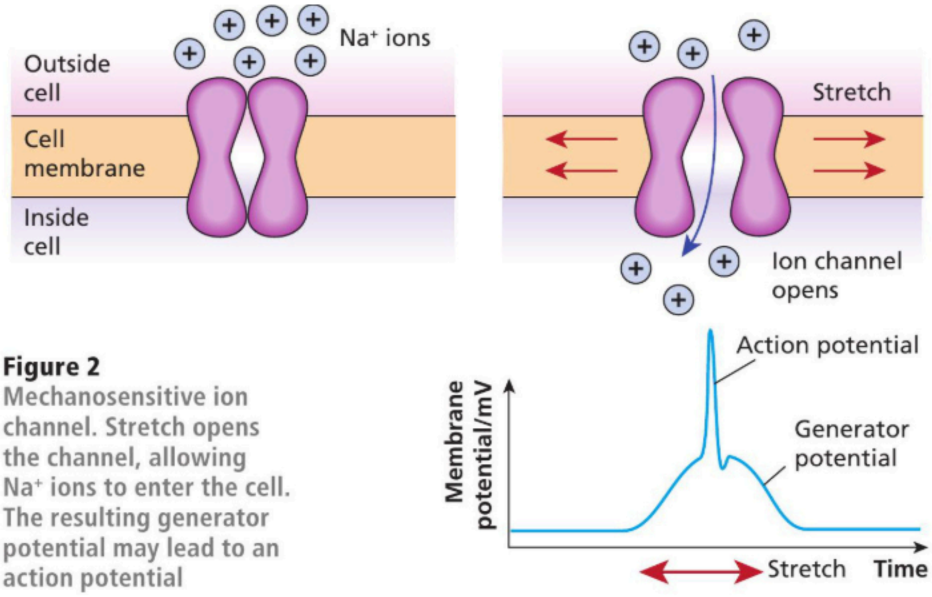


Figure 2
Mechanosensitive ion channel. Stretch opens the channel, allowing Na^+ ions to enter the cell. The resulting generator potential may lead to an action potential

Converting mechanical energy into electrical energy

One of the main ways by which the nervous system transmits information is in the form of electrical signals (action potentials). These electrical impulses travel long distances along nerves, and information is conveyed by the number, frequency and pattern of the electrical impulses. The challenge for all our senses, whether smell, vision, hearing or touch, is to turn one form of energy into electrical signals that can be interpreted by the brain. This process is called **transduction.**

In the case of touch, mechanical energy exerted on the skin is converted into an electrical signal in the nerve ending of the mechanoreceptor. How does this work? Embedded in the cell membrane of the nerve ending are specialised proteins called **mechanosensitive ion channels** (see Figure 2). When the membrane is stretched or distorted, the ion channels open. This allows positively charged ions such as sodium ions to move across the membrane. Sodium ions enter the cell from the outside where they are more concentrated, leading to a change in the electrical charge—**membrane potential**—across the membrane. The inside of the cell becomes more positively charged. This change in membrane potential is called the **generator potential** and, if it is large enough, it triggers an action potential. Action potentials are then transmitted along the nerve fibre to the central nervous system. When the stimulus is removed, the membrane protein reverts to its original shape and the ion channel closes. The ion channel protein can be thought of as a transducer, converting mechanical stretch into an electrical signal.

Good vibrations: the Pacinian corpuscle

The Pacinian corpuscle is the best understood of all the mechanoreceptors, probably because it is the largest and therefore the easiest to study. It is about 2mm long, and when cut in sections and viewed under a microscope, it looks a bit like an onion (see Figure 3). The nerve ending is surrounded by layers of connective tissue, separated by a viscous fluid. Pacinian corpuscles are found deep in the dermis and are especially sensitive to vibrations.

In contrast to the Meissner's corpuscles they have a large receptive field. Each Pacinian corpuscle responds to stimuli over an area of skin that may be several centimetres across. When stimulated with continuous pressure, the receptor responds at first but then stops responding very quickly—a process called adaptation. However, when it is stimulated with a vibrating stimulus, it responds repeatedly. This makes the corpuscle highly selective for high frequency vibrations as opposed to steady pressure. It is the layers of tissue around the nerve ending that make it respond in this way. The fluid between the layers absorbs the mechanical energy by allowing the layers to slip past each other. As a consequence, only the onset of the stimulus gets through to distort the nerve cell membrane and induce a generator potential (see Box 1).

Exploiting our understanding of touch

Our sense of touch is being exploited in the field of **haptic technology.** Carefully controlled mechanical stimuli can be applied to a person's skin to give the sensation of an object—a 'virtual object'. This approach helps scientists to understand what it is about an object that we are most sensitive to, and also to develop systems that can reproduce the function of our own mechanoreceptors. Their findings provide the basis for new biomedical devices.

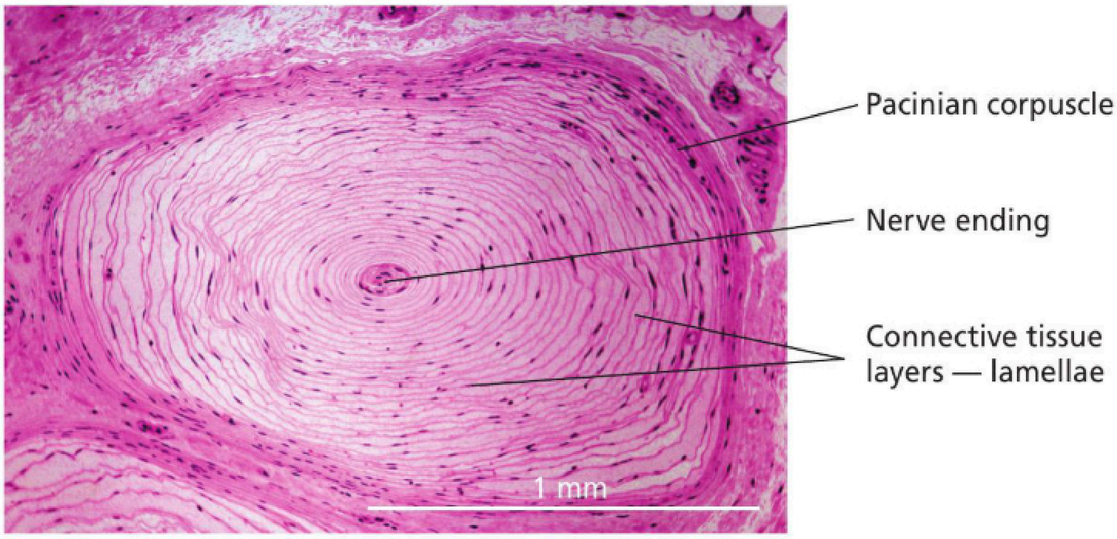


Figure 3 Onion-like appearance of a Pacinian corpuscle

Robotic surgery is one area in which haptic technology is being applied. Robotic devices are increasingly used to perform the most delicate manipulations during an operation, providing better outcomes for patients. The surgeon has control using his own hands to guide the surgical tools, via a computer console, or even remotely from another location. Recovery times for the patient are often faster because the miniaturised capabilities of the robotic tools mean small incisions, low blood loss, and low associated damage and pain.

Robots can be used in a wide range of procedures, including heart, abdominal and brain surgery. During these procedures, it important that the robot—and the surgeon—receives information about the forces and mechanical resistance between the tool and the tissue being manipulated. That way the pressure exerted by the tool itself can be adjusted appropriately. This is where haptic technology comes in. Devices are being developed that use extremely sensitive force sensors at the working end of each surgical tool, providing rapid tactile feedback to the computer interface and user. In this way, the fine sensitivity provided previously by the surgeon's own touch receptors in their fingers can be reproduced.

Another way in which our understanding of the sense of touch is being exploited is in improving the function of prosthetic limbs. Neuroscientists at the University of Chicago recently reported progress in research to make an artificial hand that has a realistic sense of touch. In their prototype, sensors in the fingers send signals to electrodes implanted in the brain, which are then interpreted by the wearer to provide information about the weight and texture of an object and how firmly it is being gripped. If successful, this will allow people with artificial limbs to do much more than they can at present, as their prosthesis will better mimic the capabilities of a normal limb.

We will probably never completely replicate our exquisite sense of touch. But the more we understand about how different receptors are tuned to respond to specific types of stimuli, and how the nerves transmit touch signals, the better placed we are to use this knowledge in a huge range of technologies.

Biology Topic: Nervous communication	
Title of Article: How are you feeling? Touch signals and touch receptors	
Source: Biological sciences review	**Date of Publication: 2014/2015**

Summary of Article:

1. *Read the text*
2. *Break it down into sections*
3. *Identify the key points in each section*
4. *Write the summary*
5. *Check the summary against the article*

In your opinion, what are the 3 most important pieces of information you gathered from the article?	
1	
2	
3	

Specification Links
How does this article link to what you studied at GCSE? *(Be clear and specific)*

What key words have been used in this article? Select 5 key words and complete their definitions below.		
Keyword:		**Definition:**
1		
2		
3		
4		
5		

Date Completed: