



GCSE

3400U20-1

**TUESDAY, 16 MAY 2023 – MORNING**

## **BIOLOGY – Unit 2:**

**Variation, Homeostasis and Micro-organisms  
FOUNDATION TIER**

**1 hour 45 minutes plus your additional time allowance**

**Surname** \_\_\_\_\_

**First name(s)** \_\_\_\_\_

**Centre Number** \_\_\_\_\_

**Candidate Number** 0 \_\_\_\_\_



## **ADDITIONAL MATERIALS**

**In addition to this paper you may require a calculator and a ruler.**

## **ITEMS INCLUDED WITH QUESTION PAPER**

**A separate Diagram booklet.**

**The Diagram Booklet MUST be handed in to the invigilators and sent for marking.**

## **INSTRUCTIONS TO CANDIDATES**

**Use black ink, black ball-point pen or your usual method.**

**Write your name, centre number and candidate number in the spaces provided on the front cover.**

**Answer ALL questions.**

**Write your answers in the spaces provided in this booklet. If you run out of space, use the additional pages at the back of the booklet, taking care to number the question(s) correctly.**

## **INFORMATION FOR CANDIDATES**

**The number of marks is given in brackets at the end of each question or part-question.**

**Question 7(b) is a quality of extended response (QER) question where your writing skills will be assessed.**

**(Turn over)**

<b>For Examiner's use only</b>		
<b>Question</b>	<b>Maximum Mark</b>	<b>Mark Awarded</b>
<b>1.</b>	<b>7</b>	
<b>2.</b>	<b>6</b>	
<b>3.</b>	<b>9</b>	
<b>4.</b>	<b>10</b>	
<b>5.</b>	<b>6</b>	
<b>6.</b>	<b>14</b>	
<b>7.</b>	<b>8</b>	
<b>8.</b>	<b>11</b>	
<b>9.</b>	<b>9</b>	
<b>Total</b>	<b>80</b>	

Answer ALL questions.

1 (a) Use some of the words from the box below to **COMPLETE THE SENTENCES** about the nervous system. [4 marks]

<b>cornea</b>	<b>light</b>
<b>chemical</b>	<b>retina</b>
<b>electrical</b>	<b>receptor</b>

Sense organs contain groups of

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cells which respond to stimuli. In the eye, cells in the

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respond to the stimulus of

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and send

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impulses to the brain along neurones.

(Turn over)



1 (b) **IMAGE 1.1** in the separate diagram booklet shows how the eye closes automatically (blinks) when something which may be harmful approaches.

Select the scientific term (**A**, **B** or **C**) for this type of action from the list below. [1 mark]

**A** a release action

**B** a relax action

**C** a reflex action

Answer letter = \_\_\_\_\_

(c) Apart from happening automatically, state **TWO** other properties of actions such as blinking. [2 marks]

1. \_\_\_\_\_

2. \_\_\_\_\_

7



2 **IMAGE 2.1** in the separate diagram booklet shows a parsley plant (**Petroselinum sp.**) growing on a windowsill.

The plant is showing a response to light called positive phototropism.

(a)(i) State which **ONE** of arrows **A, B, C** or **D** on **IMAGE 2.1** shows the main direction of light. [1 mark]

Answer letter = \_\_\_\_\_

(ii) UNDERLINE the name of the plant hormone involved in the response. [1 mark]

insulin

amylase

auxin



**2 (b) IMAGES 2.2 AND 2.3** in the separate diagram booklet show an investigation into the effect of gravity on the growth of a seedling which has been placed horizontally on a laboratory bench.

**(i) COMPLETE IMAGE 2.3** by drawing **THE ROOT** as you would expect to see it at **DAY 4**.  
[2 marks]

**(ii) I. State the name of the response of the root to gravity.** [1 mark]

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**II. Explain why this response is important to the seedling.** [1 mark]

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**3 (a) IMAGE 3.1** in the separate diagram booklet shows part of a DNA molecule.

**(i) COMPLETE THE LABELS ON IMAGE 3.1** by choosing words from the box. [3 marks]

<b>phosphate</b>	<b>salt</b>	
<b>base</b>	<b>sugar</b>	<b>amino acid</b>

**(ii) The shape of DNA is described as a twisted ladder. State the scientific term for this shape.**  
[1 mark]

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- 3 (b) The DNA of an individual can be analysed as a genetic profile.

**UNDERLINE** which one of the following correctly states how the DNA must first be treated in order to produce the bands in a genetic profile. [1 mark]

**Cut it into small pieces.**

**Place it in acid conditions.**

**Expose it to very low temperatures.**

- (c) **IMAGE 3.2** in the separate diagram booklet shows the DNA profiles of people involved in a paternity test.

- (i) In this baby's profile, three of the bands have come from the mother and three from the father.

**DRAW CIRCLES around the THREE BANDS in the BABY'S PROFILE in IMAGE 3.2 which have come from the MOTHER. [1 mark]**



**3 (c)(ii)**

**Use the DNA profiles to conclude which man (A, B or C) is the baby's father.**

**Explain how you obtained your answer.  
[2 marks]**

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**(iii) Apart from paternity testing state ONE other use for DNA profiling. [1 mark]**

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- 4 In the 1980s young terrapins (*Trachemys scripta*) from North America were sold in pet shops throughout the UK. When the terrapins became adults, many people no longer wanted them and released them into local ponds. The animals can live for up to 50 years.

After release, adult terrapins eat native animals including invertebrates and vertebrates such as frogs and fish. In some ponds, native species have been reduced or lost completely. Since 1992 a law has banned the import of terrapins into the UK.

**USE IMAGES 4.1 AND 4.2, AND TABLE 4.3 IN THE SEPARATE DIAGRAM BOOKLET, AND THE INFORMATION ON THIS PAGE TO ANSWER THE QUESTIONS ON PAGE 11 AND 12.**



**4 (a) Complete the classification of the terrapin.  
[3 marks]**

**Kingdom** \_\_\_\_\_

**Phylum**      **Chordates (Vertebrates)**

**Class**          **Reptiles**

**Genus** \_\_\_\_\_

**Species** \_\_\_\_\_

**(b)(i) Calculate the increase in body length PER YEAR for an adult terrapin in the TEN YEARS between 2 years old and 12 years old.  
[2 marks]**

**Increase in  
body length = \_\_\_\_\_ mm/year**

**(Turn over)**



4 (b)(ii)

**Suggest ONE reason why some people did not want to keep the terrapins when they became too big. [1 mark]**

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(c) **COMPLETE TABLE 4.4 in the separate diagram booklet by writing true or false for each of the statements. One row has been done for you. [3 marks]**

(d) **In the USA, these terrapins are called red-eared sliders and in Welsh they are called terapin clustgoch.**

**State how scientists from different countries ensure that they are all talking about the same species. [1 mark]**

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10



**5** **IMAGE 5.1** in the separate diagram booklet shows a koala (***Phascolarctos cinereus***). These animals live in trees in Australia. Their chromosome number is 16.

**(a)(i)** **COMPLETE TABLE 5.2** in the separate diagram booklet about cell division in the koala. [3 marks]

**(ii)** **State:**

**I.** **ONE function of mitosis; [1 mark]**

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**II.** **the scientific name for the daughter cells produced by meiosis. [1 mark]**

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- 5 (b) Another Australian animal, the grey kangaroo (***Macropus giganteus***) shown in IMAGE 5.3 in the separate diagram booklet, also has 16 chromosomes but its appearance is very different from the koala.

UNDERLINE which ONE of the following statements explains what causes the appearance of these two species to be different. [1 mark]

**They live in different habitats.**

**The genes on their chromosomes are different.**

**Their diet consists of different types of plants.**

6



**6 Mair investigated four antibiotics (A, B, C and D) to compare how effective they were at killing bacteria. A diagram of the experiment is given in IMAGE 6.1 in the separate diagram booklet.**

- **She set up four agar plates with bacteria growing on them.**
- **She placed a filter paper disc containing a different antibiotic in the centre of each plate.**
- **She put the plates in an incubator.**
- **After three days, she measured the diameter of the clear zone where bacteria had been killed.**
- **She calculated the area of the clear zone.**

**(a) Mair used aseptic techniques to set up the agar plates.**

**(i) Explain why it was necessary for her to use STERILISED forceps to place the filter paper discs on the agar. [1 mark]**

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6 (a)(ii)

Describe how she would have made sure that no bacteria from the environment could enter the agar plates after the filter paper discs were placed on the agar. [1 mark]

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(b) **CIRCLE** the most suitable temperature for the incubator in a SCHOOL laboratory from the choice below. [1 mark]

10 °C

25 °C

37 °C

60 °C

(Turn over)



6 (c) **TABLE 6.2** in the separate diagram booklet shows Mair's results.

(i) The **RADIUS** of the clear zone for antibiotic **C** was 11 mm.

**COMPLETE TABLE 6.2** by calculating the area of the clear zone for antibiotic **C**, using the formula below, where  $r$  = radius.

$$\text{Area of circle} = \pi r^2 \quad (\pi = 3.14)$$

Give your answer to the **NEAREST WHOLE NUMBER**. [3 marks]

Space for working



6 (c) (ii)

Use the data in TABLE 6.2 to complete BAR CHART 6.3 in the separate diagram booklet by: [3 marks]

- I. adding the scale for the area of the clear zone.
- II. drawing bars for antibiotics A, B and C and labelling your bars.

(c)(iii) FROM BAR CHART 6.3, state which ONE of the antibiotics was the most effective and explain the reason for your choice. [3 marks]

Antibiotic \_\_\_\_\_

Reason:

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**6 (d)(i)**

**State how Mair could check that her results were reproducible. [1 mark]**

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**(d)(ii) Suggest ONE way in which the investigation could be extended to give more information about the effects of antibiotics on the growth of bacteria. [1 mark]**

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<b>14</b>



**7 IMAGE 7.1** in the separate diagram booklet shows a section through the skin.

**(a) Complete labels A and B on IMAGE 7.1. [2 marks]**

**TABLE 7.2** in the separate diagram booklet shows some features of the skin at two air temperatures.

**(b) Using the information in TABLE 7.2, describe the changes in the skin which occur as the air temperature increases. Explain how each of these changes helps to cool the body. [6 marks QER]**

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**continue answer on the next page**

**(Turn over)**







**8 IMAGE 8.1** in the separate diagram booklet shows a section through a human kidney.

**(a) DRAW ARROWS ON IMAGE 8.1** to label the following parts: [2 marks]

**(i) the medulla;**

**(ii) the renal artery.**

**(b) TABLE 8.2** in the separate diagram booklet shows the results of an investigation on a patient in a hospital.

**(i) I. COMPLETE TABLE 8.2** in the separate diagram booklet to show which substance(s) would be present in the urine of this patient. One row has been done for you. [1 mark]

**II. State which ONE of the substances is a waste product.** [1 mark]

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**III. Doctors suggested that this patient had diabetes. From TABLE 8.2, state the evidence to support this suggestion.** [1 mark]

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8 (b)(ii)

**Describe the chemical tests which could be carried out to confirm whether or not the urine contained glucose and protein. For each test state the colours you would expect FOR THE RESULTS SHOWN IN TABLE 8.2.**

**I. glucose test [3 marks]**

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**II. protein test [2 marks]**

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8 (b)(iii)

**COMPLETE THE RISK ASSESSMENT** below which shows one hazard linked to these tests.  
[1 mark]

**Hazard:**            **Chemical reagent is an irritant**

**Risk:**

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**Control measure:**

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**9 IMAGE 9.1** in the separate diagram booklet shows the structure of the human immunodeficiency virus (HIV).

In some of the people who have an HIV infection, the virus can lead to the disease AIDS, which can be fatal.

**(a) State TWO ways, visible in IMAGE 9.1, in which the structure of HIV is different from other viruses. [1 mark]**

1. \_\_\_\_\_  
\_\_\_\_\_

2. \_\_\_\_\_  
\_\_\_\_\_



**9 (b) State how HIV is spread from ONE person to another and one measure which can be taken to reduce the spread. [2 marks]**

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**9 (c) In 2000, the United Nations set a target that 90% of people with HIV should be receiving treatment. This treatment should be effective at reducing the number of people developing AIDS.**

**By 2010, 97% of people with HIV in the UK were being treated with the anti-viral drug, HAART.**

**GRAPH 9.2 in the separate diagram booklet shows the results from investigations on the effectiveness of HAART.**

**USING THE INFORMATION PROVIDED ON THIS PAGE AND GRAPH 9.2, give the evidence that by 2010 the UK had met the UN target by**

**(i) providing treatment to enough people;  
[1 mark]**

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**(ii) providing treatment which was effective.  
[1 mark]**

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- 9 (d) **GRAPH 9.3** in the separate diagram booklet shows the percentages of people in different age groups in the UK who were known to be infected with HIV in 2017. The total number of infected people was 101 610.

From the information given calculate

- (i) **THE PERCENTAGE** of people in the 25–34 age group, [1 mark]

\_\_\_\_\_ %

- (ii) the **NUMBER** of people in the 35–49 age group. [2 marks]

\_\_\_\_\_ people.



**9 (d)(iii)**

**Most campaigns which encourage people to take treatment for HIV infections are targeted at those under 35. Some charities, however, say it would be more effective to target campaigns at older age groups.**

**Using the information in GRAPH 9.3, state ONE piece of evidence which supports the point of view of some charities. [1 mark]**

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<b>9</b>

**END OF PAPER**

**(Turn over)**



<b>Question number</b>	<b>Additional page, if required. Write the question numbers in the left-hand margin.</b>











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## **BIOLOGY – Unit 2:**

**Variation, Homeostasis and Micro-organisms  
FOUNDATION TIER**

**1 hour 45 minutes plus your additional time allowance**

## **DIAGRAM BOOKLET**

**This Diagram Booklet MUST be handed in to the invigilators and sent for marking.**

**Surname** \_\_\_\_\_

**First name(s)** \_\_\_\_\_

**Centre Number** \_\_\_\_\_

**Candidate Number**   0   \_\_\_\_\_



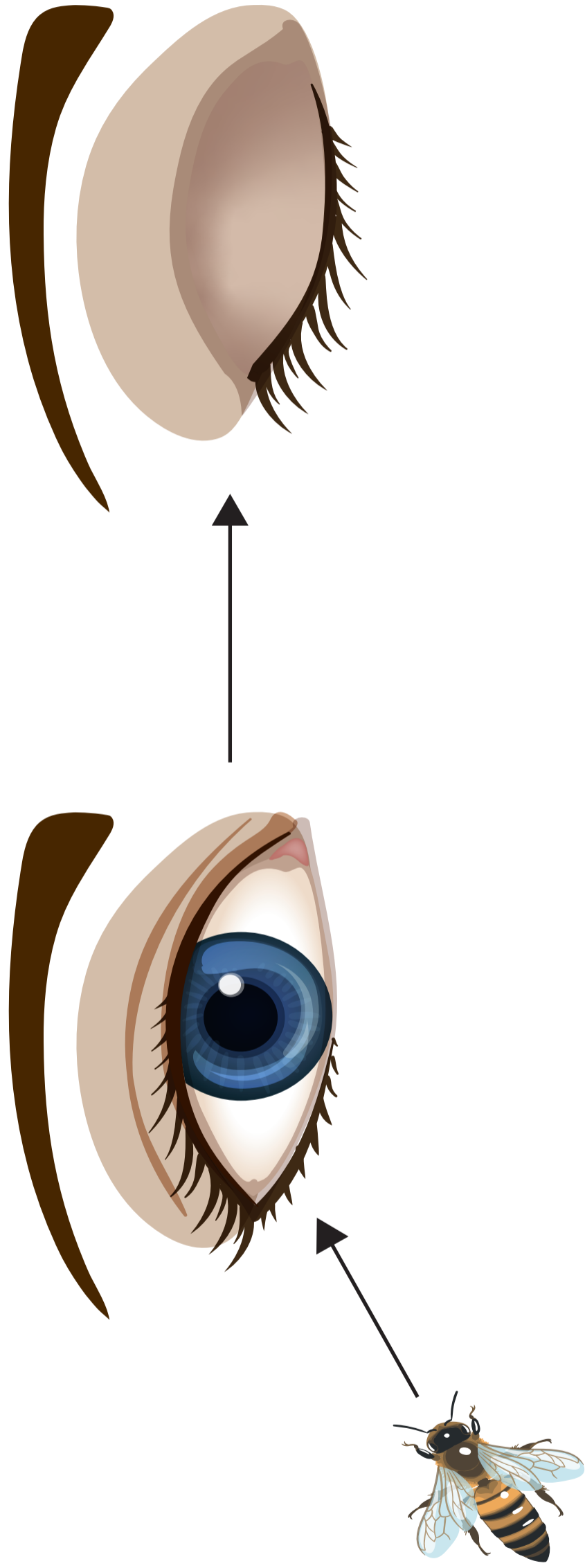


IMAGE 1.1



3

IMAGE 2.1

A



D



B



C



IMAGE 2.2

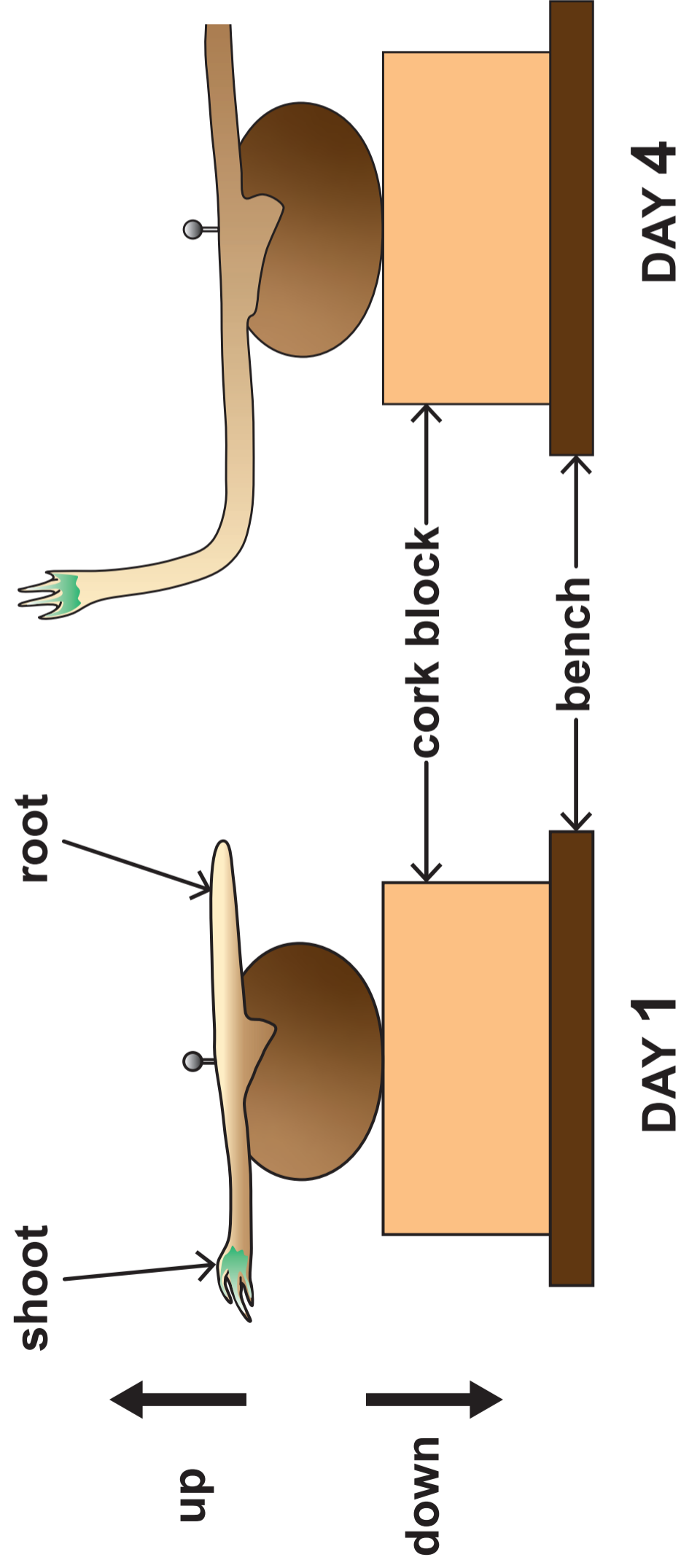
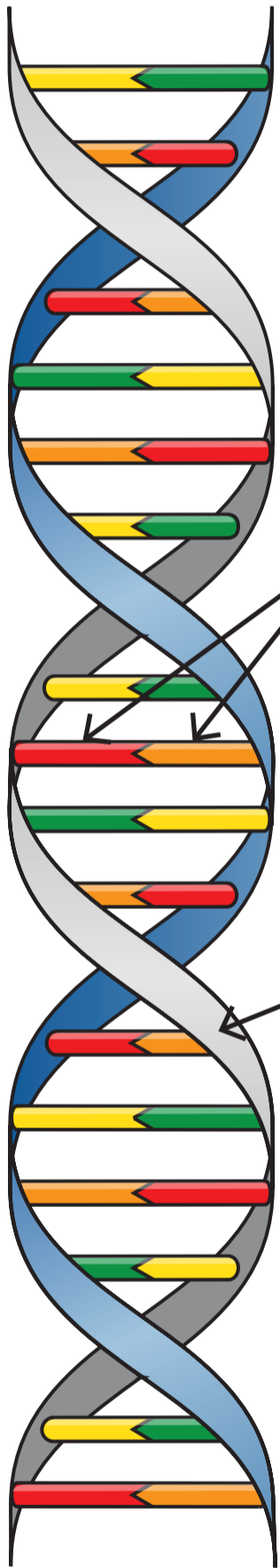


IMAGE 2.3



IMAGE 3.1

phosphate	salt	base
sugar	amino acid	



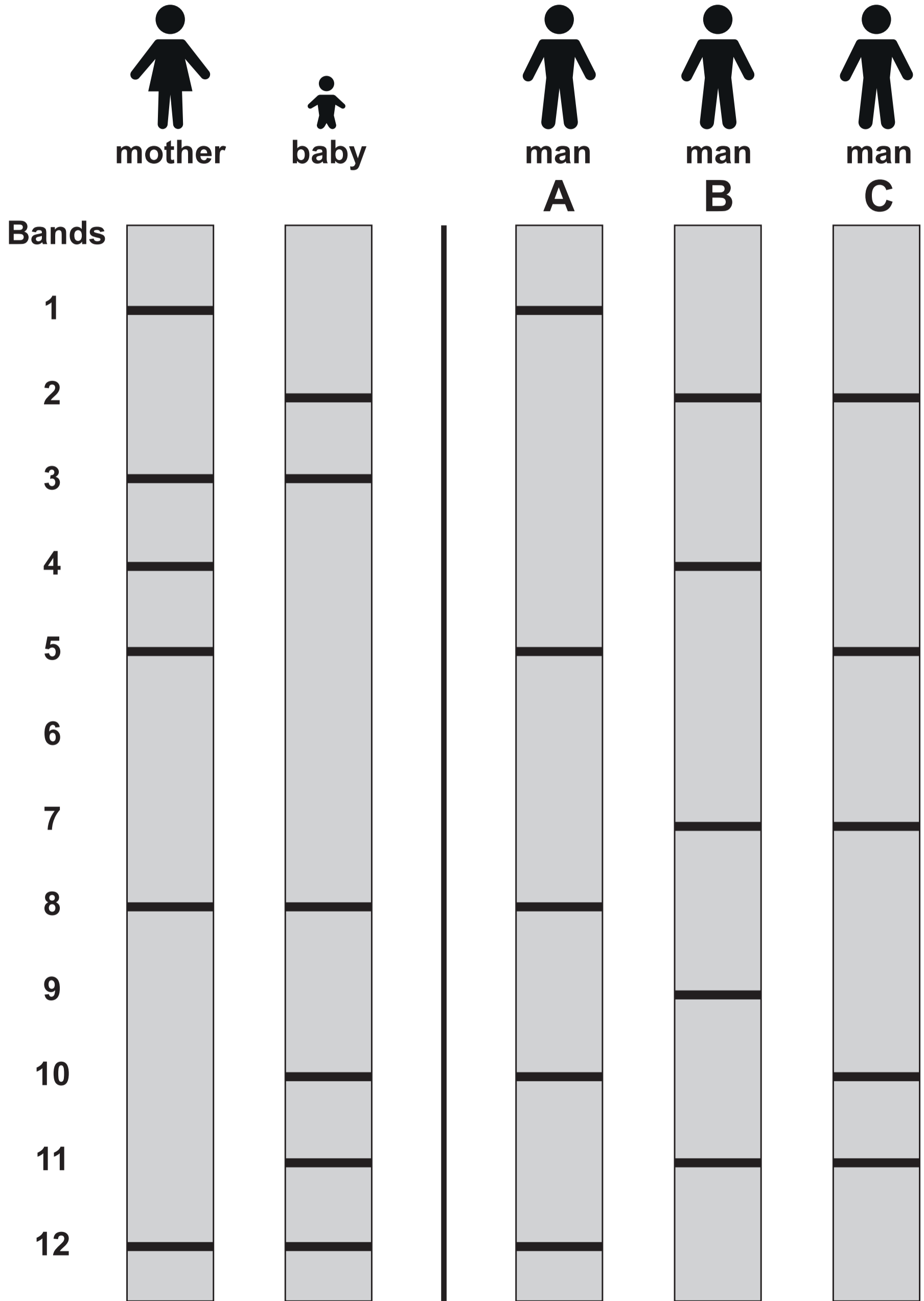
\_\_\_\_\_ pair

long strand of \_\_\_\_\_

and \_\_\_\_\_ molecules



IMAGE 3.2





**IMAGE 4.1****Young terrapin****IMAGE 4.2****Adult terrapin****TABLE 4.3**

<b>Terrapin age</b>	<b>Body length (mm)</b>
<b>3 months</b>	<b>25</b>
<b>2 years</b>	<b>50</b>
<b>12 years</b>	<b>300</b>



**TABLE 4.4**

<b>Statement about terrapins in the UK</b>	<b>True / False</b>
They can live for over 60 years.	<b>False</b>
They do not eat animals with backbones.	_____
They have reduced the biodiversity in ponds.	_____
They cannot be brought into the country legally.	_____
They are an alien species.	_____



**IMAGE 5.1****TABLE 5.2**

	<b>Number</b>
<b>Number of CHROMOSOMES in one body cell.</b>	<b>16</b>
<b>Number of CELLS produced from one cell by MITOSIS.</b>	_____
<b>Number of CHROMOSOMES in each new cell produced by MITOSIS.</b>	_____
<b>Number of CHROMOSOMES in each new cell produced by MEIOSIS.</b>	_____



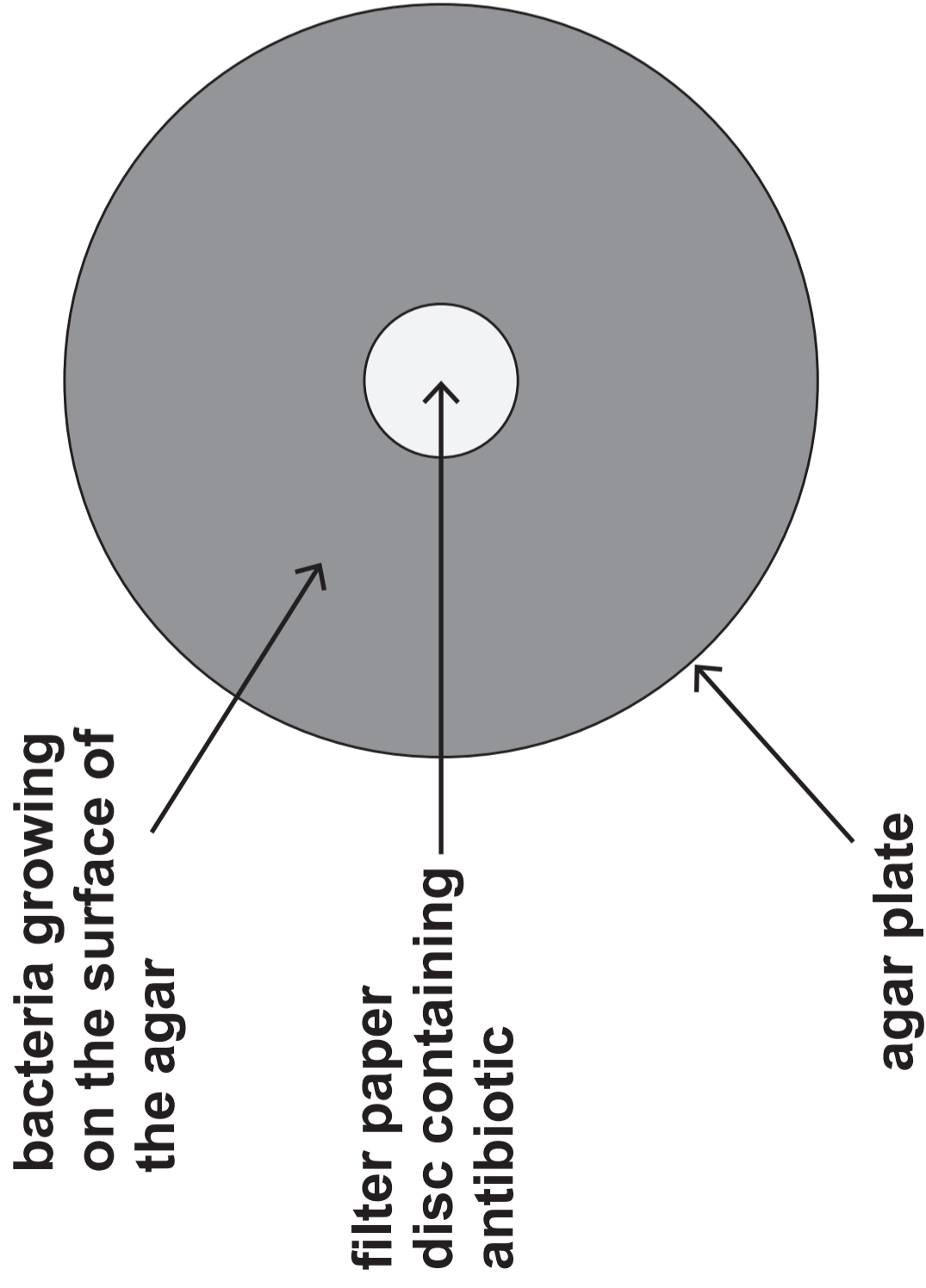
**IMAGE 5.3**





**IMAGE 6.1**

**AGAR PLATE AT START  
OF THE INVESTIGATION**



**AGAR PLATE AT THREE DAYS**

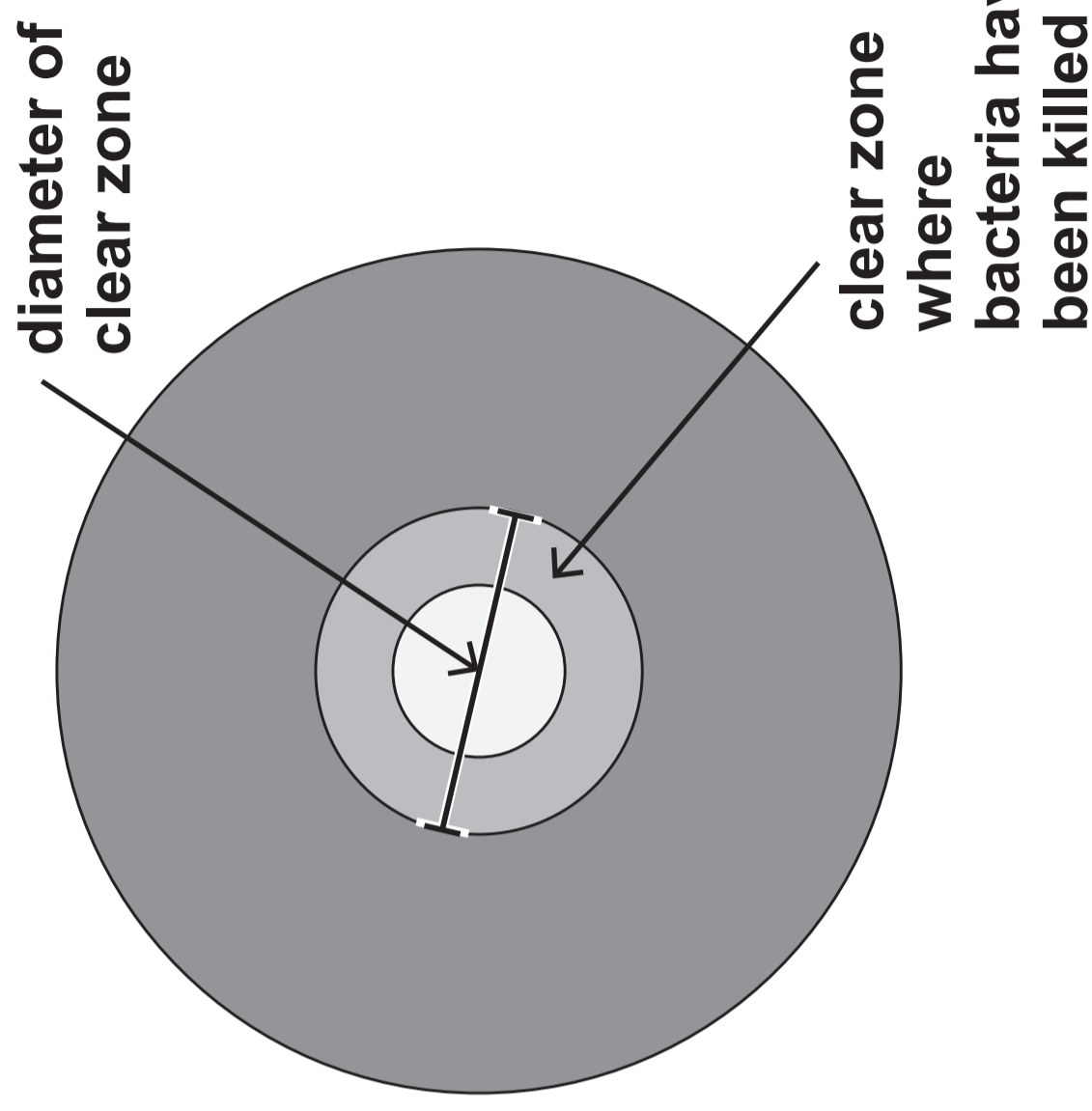
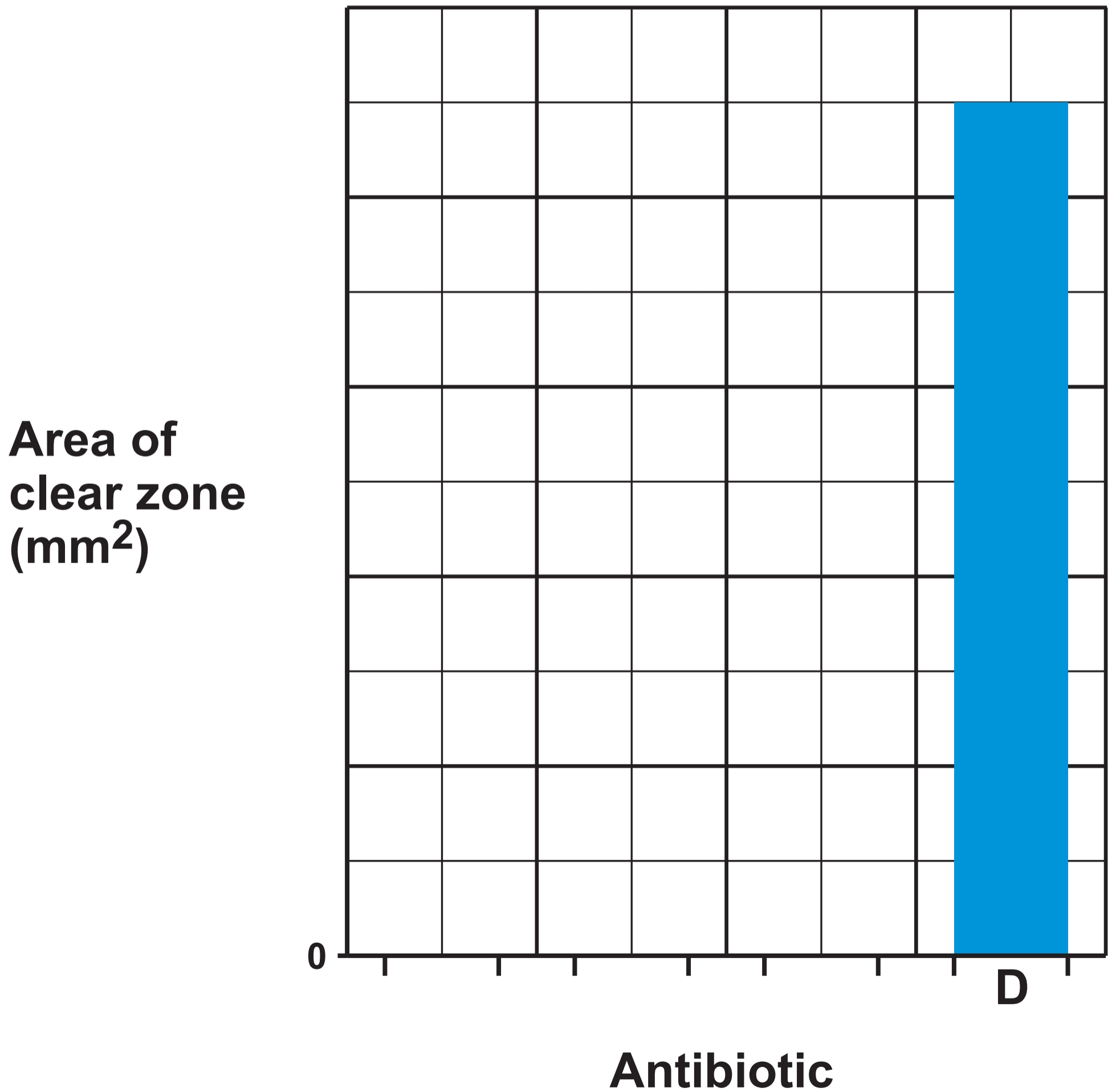




TABLE 6.2

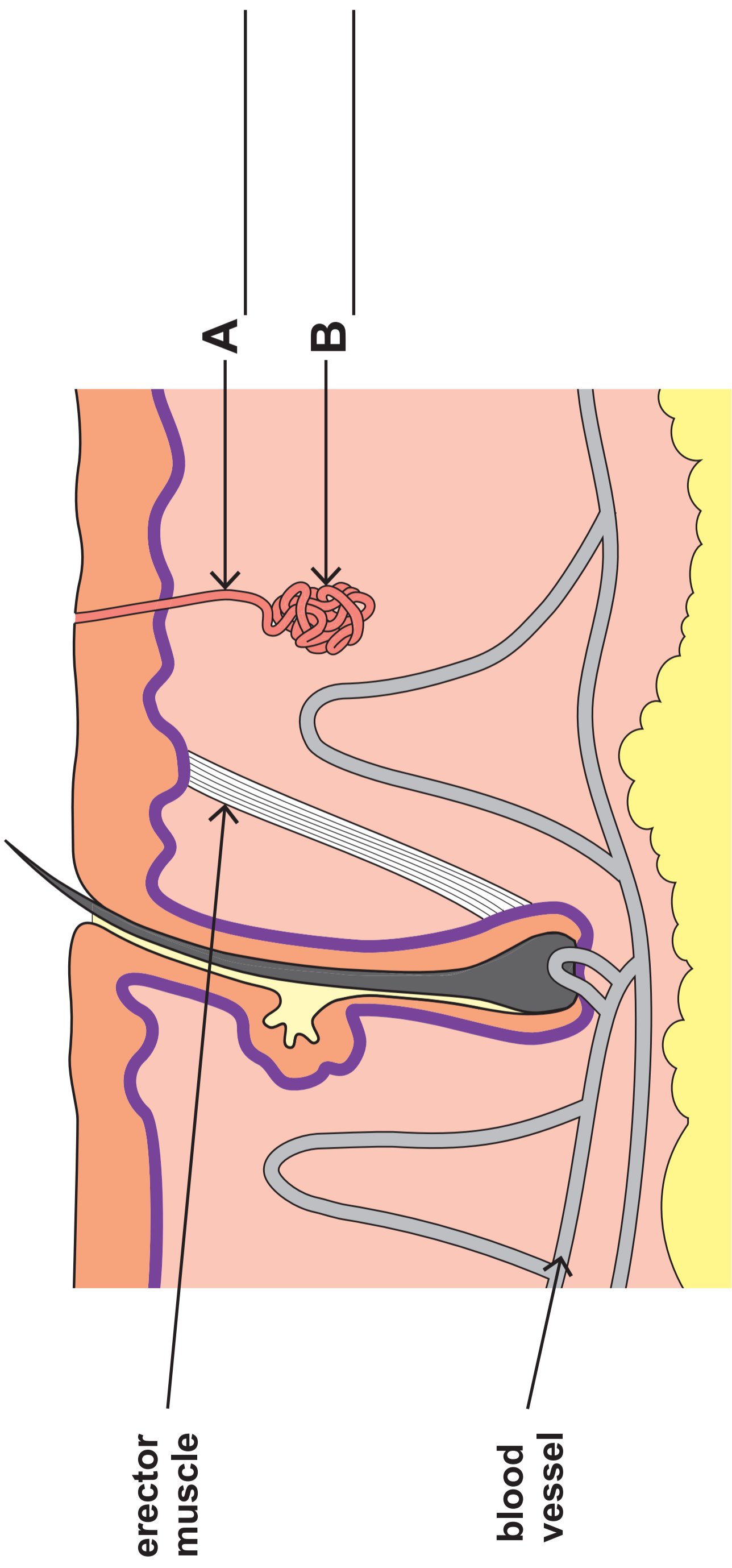
	Antbiotic <b>A</b>	Antbiotic <b>B</b>	Antbiotic <b>C</b>	Antbiotic <b>D</b>
Area of clear zone on agar plate (mm <sup>2</sup> )	270	360		450

BAR CHART 6.3





**IMAGE 7.1**



**erector  
muscle**

**blood  
vessel**

**A**

**B**

**13**

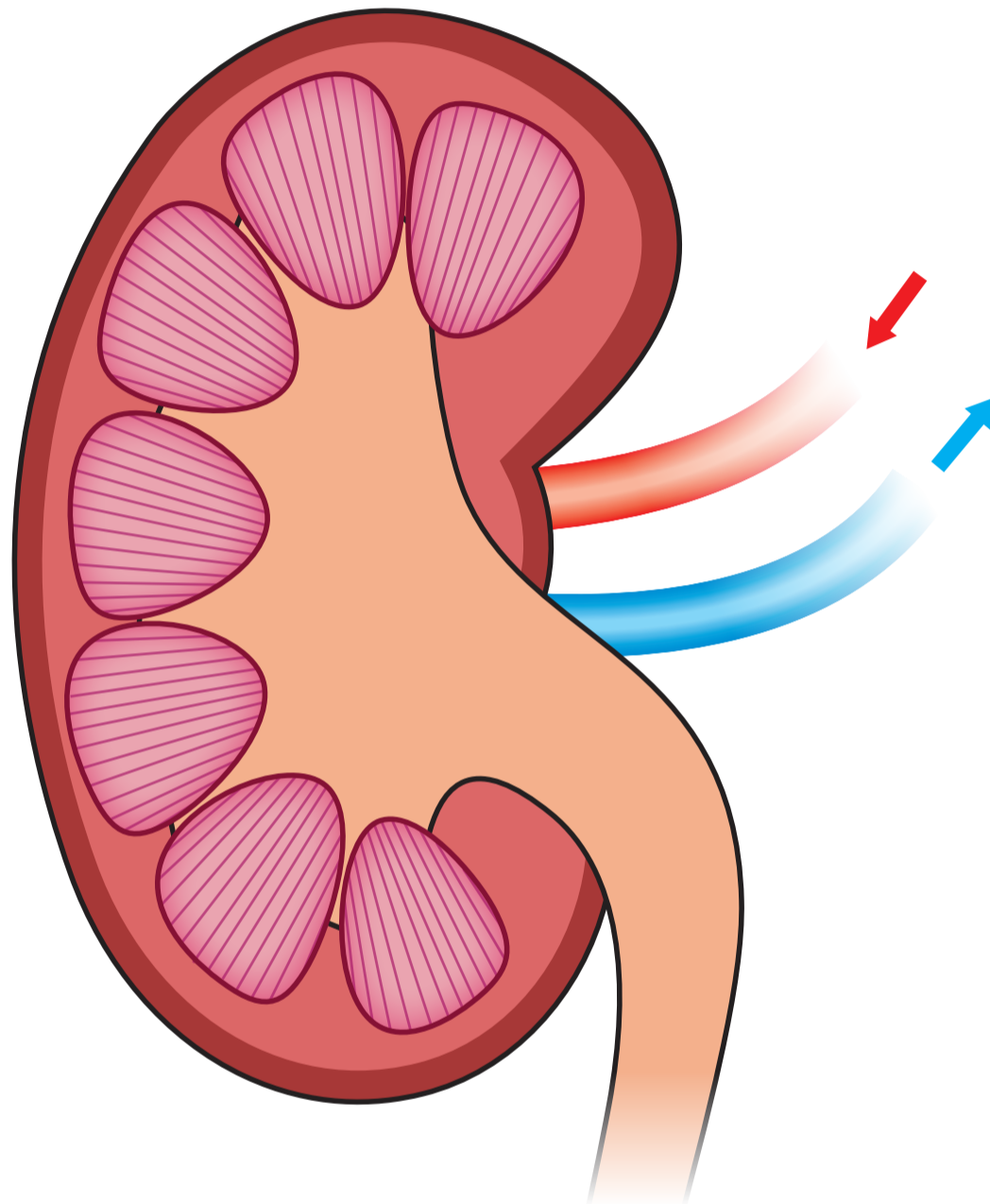


**TABLE 7.2**

	<b>Air temperature</b>	
	<b>8 °C</b>	<b>28 °C</b>
<b>Volume of sweat produced per day (cm<sup>3</sup>)</b>	<b>800</b>	<b>1600</b>
<b>Diameter of blood vessel (mm)</b>	<b>0.005</b>	<b>0.1</b>
<b>Erector muscle</b>	<b>contracted</b>	<b>relaxed</b>



IMAGE 8.1





**TABLE 8.2**

<b>Substance</b>	<b>Concentration in blood entering kidney (au)</b>	<b>Concentration in blood leaving kidney (au)</b>	<b>Present in urine (✓ or X)</b>
<b>glucose</b>	<b>145</b>	<b>32</b>	<b>✓</b>
<b>protein</b>	<b>120</b>	<b>120</b>	<b>_____</b>
<b>urea</b>	<b>93</b>	<b>0</b>	<b>_____</b>



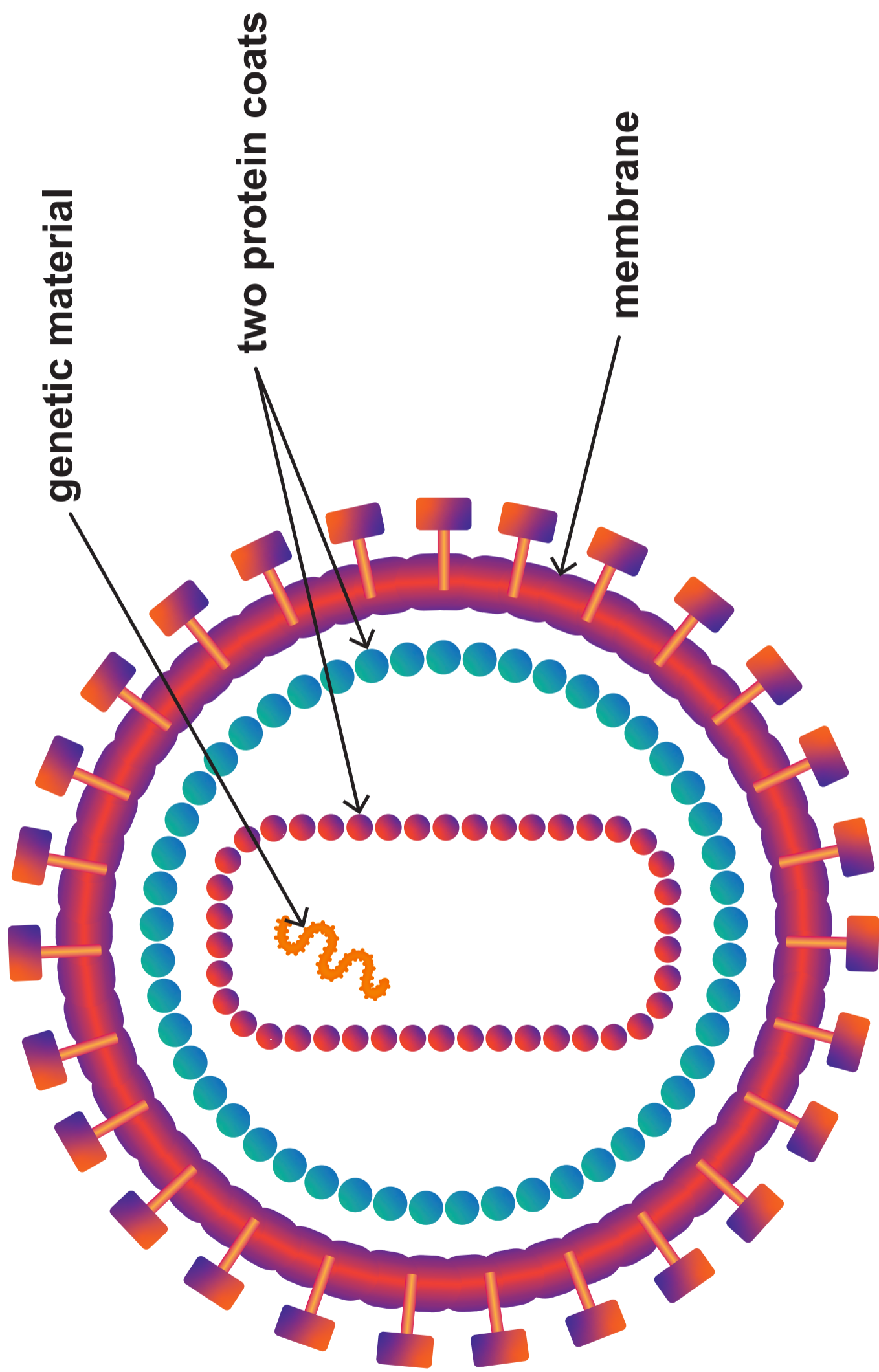
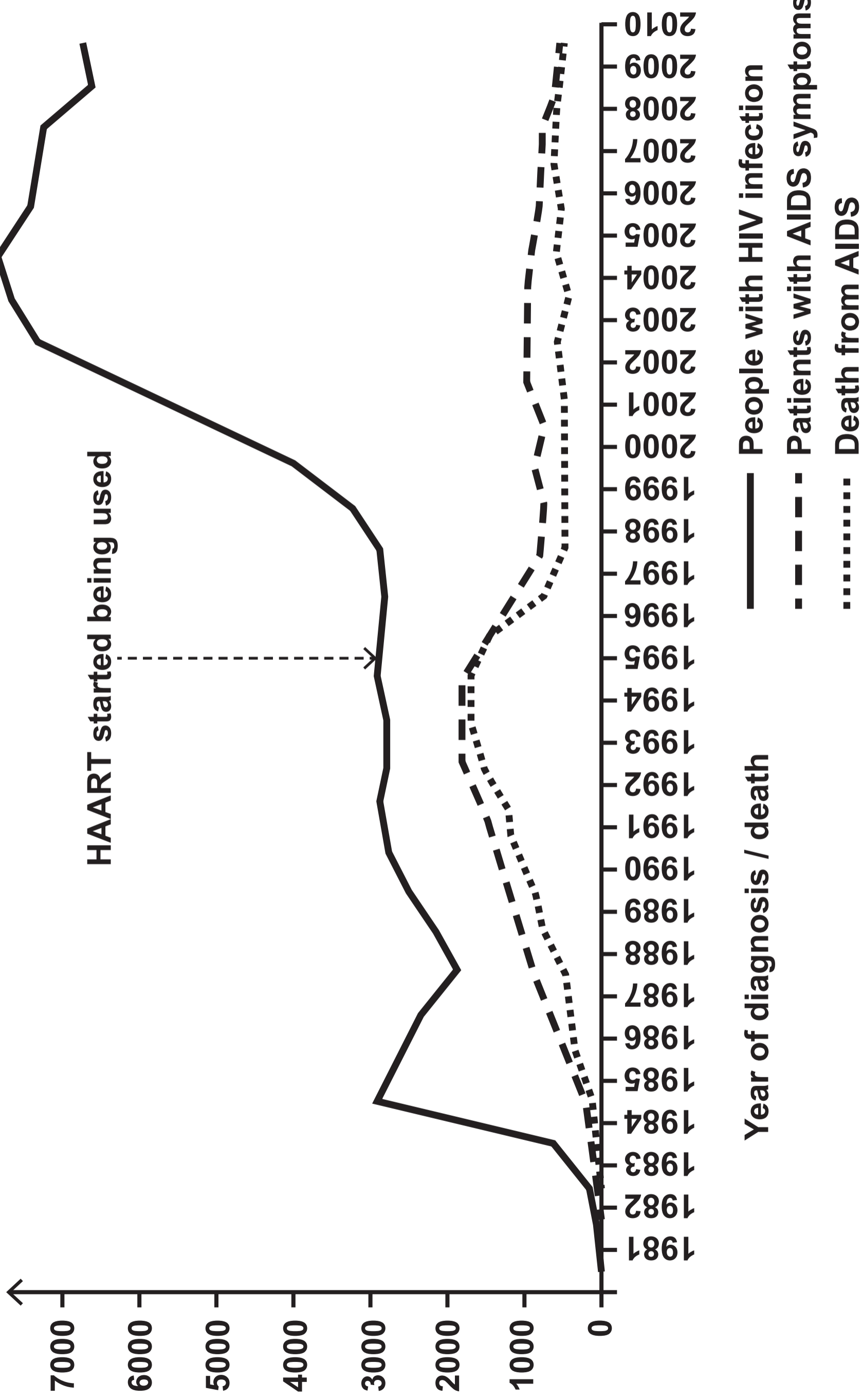


IMAGE 9.1



**GRAPH 9.2**

**Number of people**





GRAPH 9.3

## People infected with HIV in the UK

