

19 A human muscle cell contains 46 chromosomes.

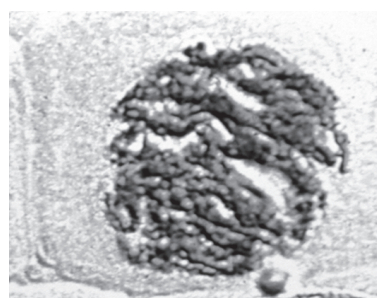
How many centromeres will be present in a cell during the stages of the mitotic cell cycle?

	early prophase	metaphase	anaphase
A	46	46	92
B	46	92	92
C	46	46	46
D	92	46	46

21 The photomicrographs show stages of mitosis.



1



2



3



4



5

What is the correct order for the stages of mitosis?

A 2 → 3 → 5 → 1 → 4

B 2 → 4 → 1 → 5 → 3

C 3 → 2 → 5 → 4 → 1

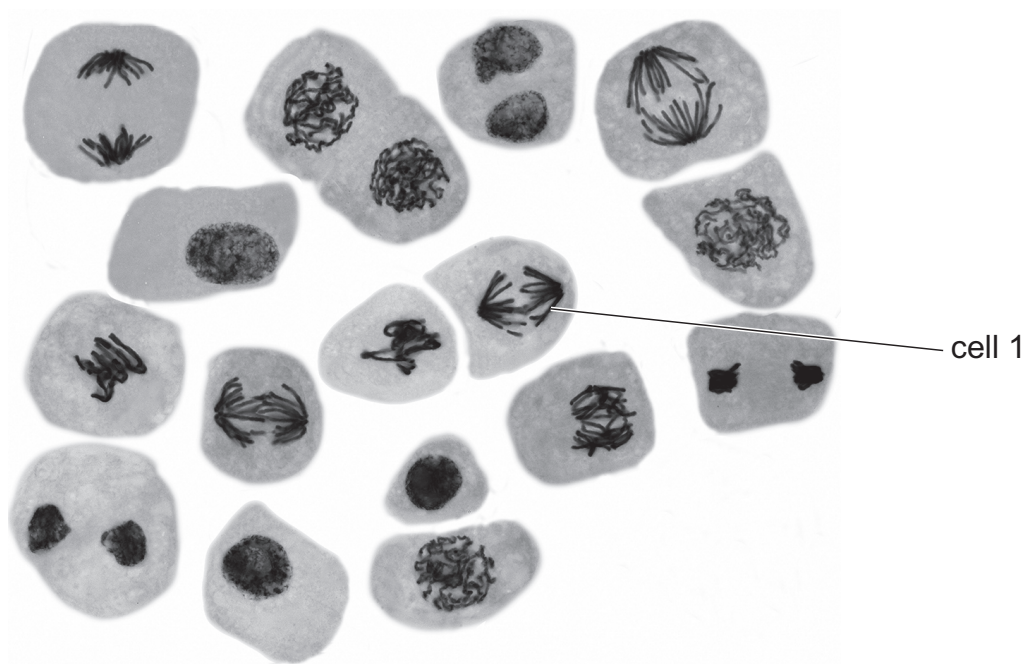
D 5 → 1 → 4 → 3 → 2

22 Which events listed are part of mitosis?

- 1 interphase
- 2 prophase
- 3 cytokinesis

A 1, 2 and 3 **B** 1 and 2 only **C** 1 only **D** 2 only

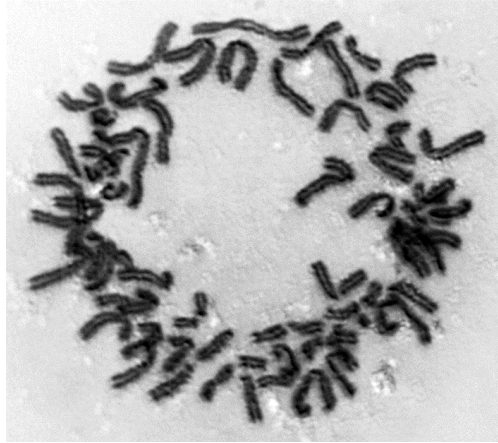
23 The photomicrograph shows 17 cells in different stages of the mitotic cell cycle.



Which row is correct for this photomicrograph?

	the role of a centromere in cell 1	the proportion of the cells in the photomicrograph in telophase
A	attaches daughter chromosomes to spindle fibres	> 0.2
B	holds sister chromatids together	> 0.2
C	attaches daughter chromosomes to spindle fibres	< 0.2
D	holds sister chromatids together	< 0.2

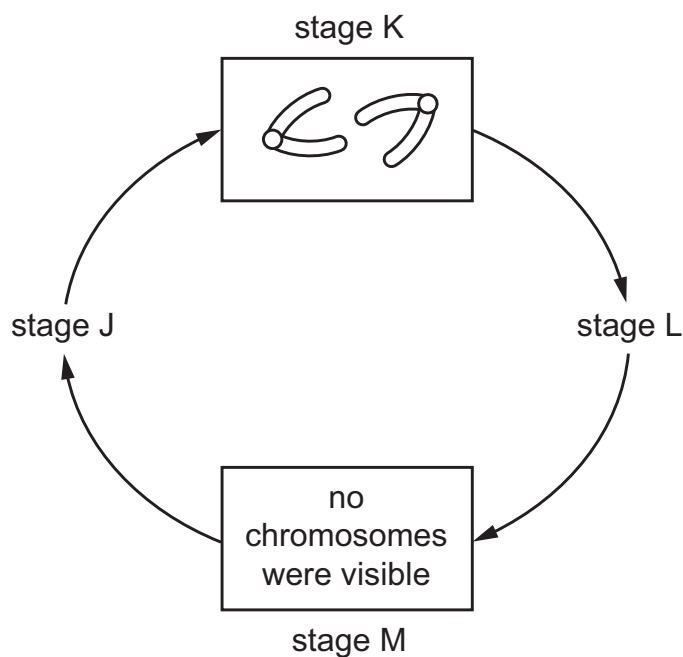
23 The photomicrograph shows a stage of the cell cycle.



Which stage is shown in the photomicrograph?

- A** anaphase
- B** interphase
- C** metaphase
- D** telophase

21 A student made a drawing of two chromosomes at stage K of a mitotic cell cycle.



Which row shows the possible events that occur in stages J, L and M?

	J	L	M
A	spindle attachment	cytokinesis	DNA replication
B	chromosome condensation	spindle attachment	cytokinesis
C	DNA replication	chromosome condensation	spindle attachment
D	cytokinesis	DNA replication	chromosome condensation

- 1 The wall of the small intestine is highly folded to form villi. Between the villi are infoldings known as crypts of Lieberkühn.

Fig. 1.1 is a diagram of a section through a single villus and a crypt of Lieberkühn.

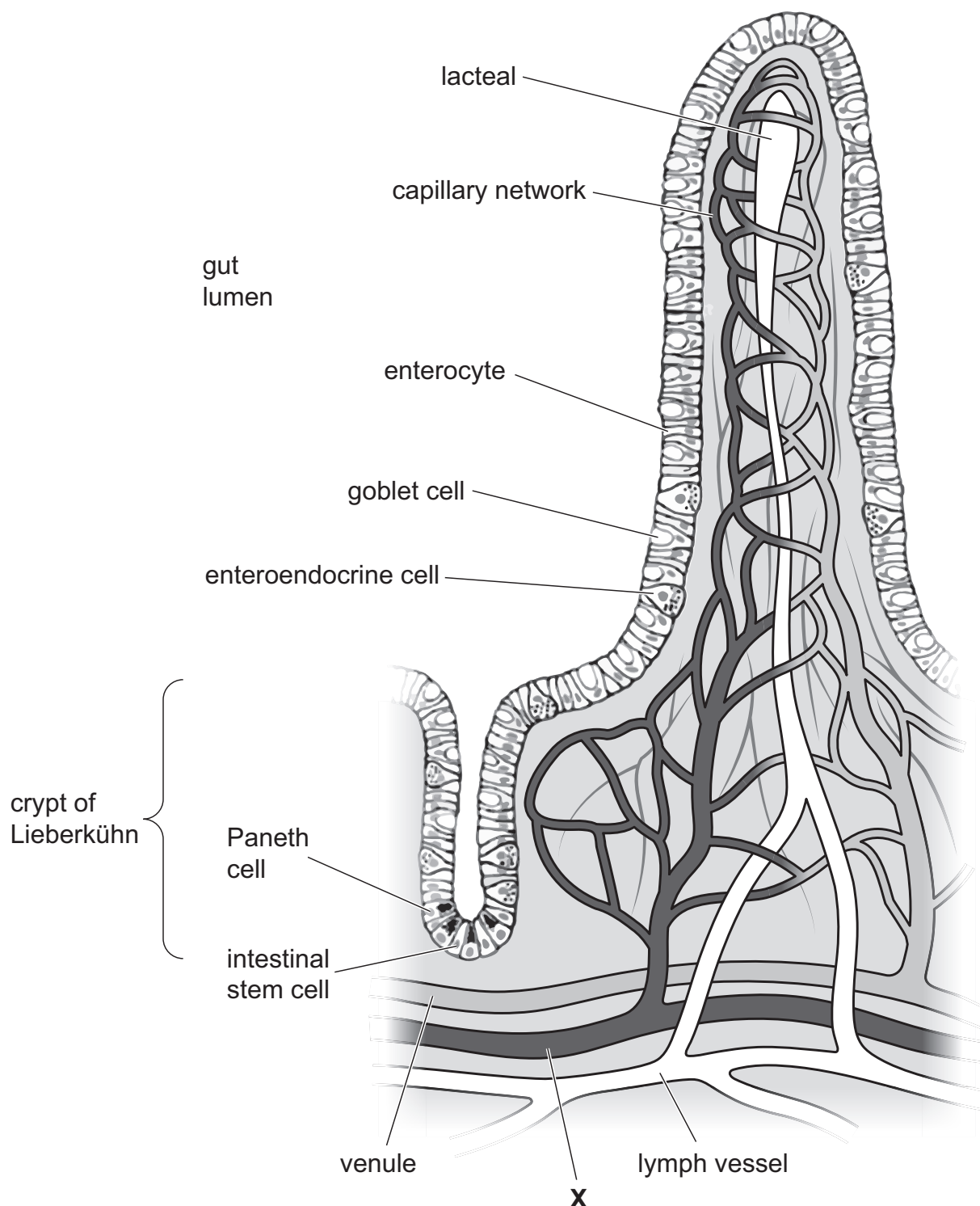


Fig. 1.1

Fig. 1.1 shows that the epithelium of the villus contains mainly goblet cells and cells known as enterocytes. Both cell types have microvilli on the apical surface (surface facing the gut lumen).

Goblet cells are involved in the production of mucus.

Enterocytes are adapted for the absorption of the soluble products of digestion. These products enter the circulatory system.

(a) A student incorrectly stated that an enterocyte has many **cilia** on its apical surface.

Explain the difference between a cilium and a microvillus.

[2]

(b) Suggest **one** role of the mucus produced by the goblet cells of the villus.

[1]

(c) In Fig. 1.1, blood vessel **X** delivers blood to the capillary network of the villus, where tissue fluid is formed. Some of the fluid passes back into the capillaries and then into the venule.

(i) Blood vessel **X** receives blood from an artery.

Name the type of blood vessel represented by **X**.

[1]

(ii) Describe the formation of tissue fluid in the capillary network of the villus.

[2]

- (d) In response to the presence of compounds in the gut lumen, enteroendocrine cells synthesise and release peptides (short chains of amino acids) that are cell-signalling molecules. One of these cell-signalling molecules is known as GLP-1.

GLP-1 initiates a number of responses in different body cells. Some of these responses include:

- the increase in release of the hormone insulin from cells in the pancreas
- the decrease in release of acid from cells in the stomach.

Outline, **in sequence**, the main stages involved in the process of cell signalling by GLP-1.

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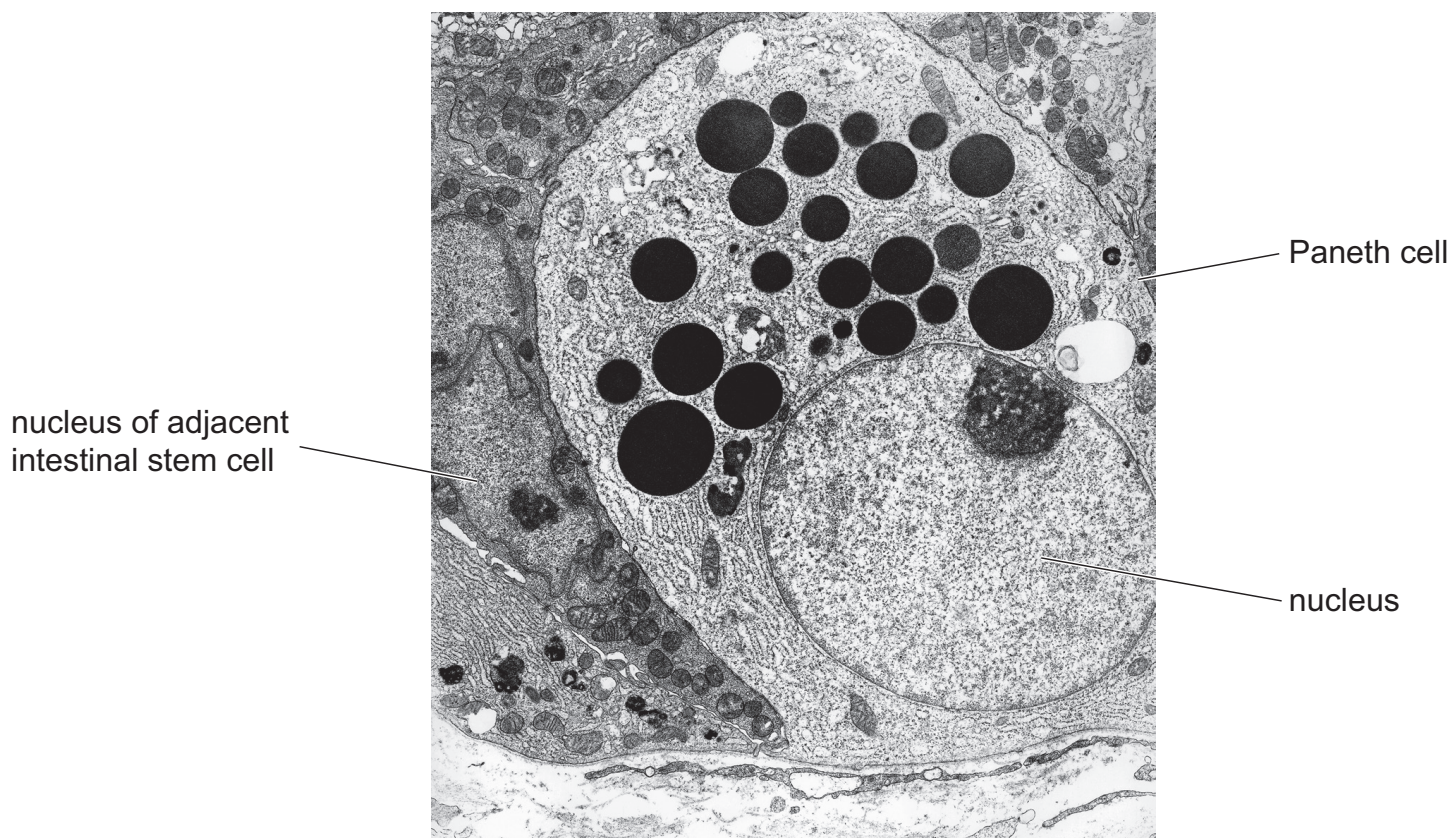
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..... [3]

- (e) Paneth cells, which are secretory cells, are located between intestinal stem cells at the base of the crypt of Lieberkühn, as shown in Fig. 1.1.

A Paneth cell has a very different appearance to an intestinal stem cell.

Fig. 1.2 is a transmission electron micrograph of a Paneth cell.



(i) Paneth cells are formed following the mitotic division of an intestinal stem cell during a cell cycle.

Complete the cell cycle shown in Fig. 1.3 by naming, **in sequence**, the stages of mitosis.

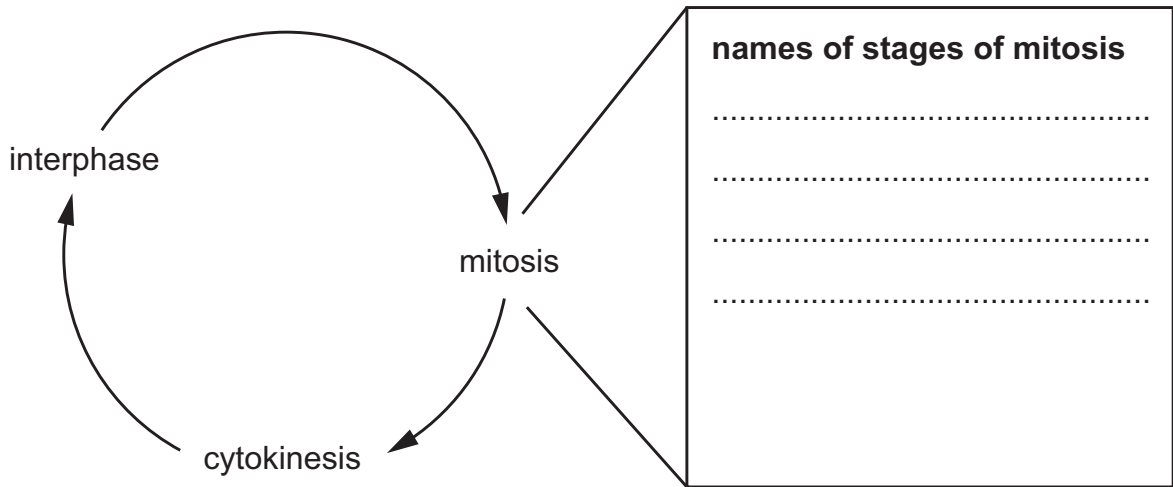


Fig. 1.3

[1]

(ii) One of the functions of a Paneth cell is to synthesise and secrete peptides and proteins that act against pathogens in the gut lumen.

State **and** explain the evidence, **visible in Fig. 1.2**, which suggests that a Paneth cell:

- is a secretory cell
- synthesises many peptides and proteins.

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(iii) Explain why a Paneth cell has a very different appearance to an intestinal stem cell.

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