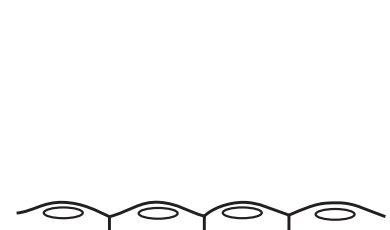
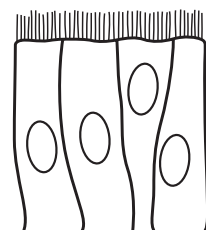


- 34** Two types of epithelial cells, 1 and 2, occur in the mammalian gas exchange system in a healthy human.



1



2

Which row shows the function and distribution of these types of epithelial cells?

	cell type 1	cell type 2
A	absorption in bronchi	secrete mucus in alveoli
B	exchange surface in alveoli	secrete mucus in bronchi
C	absorption in bronchi	move mucus in alveoli
D	exchange surface in alveoli	move mucus in bronchi

- 35** Which tissues would be seen in a photomicrograph of the wall of the trachea?

	elastic fibres	smooth muscle
A	x	✓
B	✓	x
C	✓	✓
D	x	x

key

✓ = present

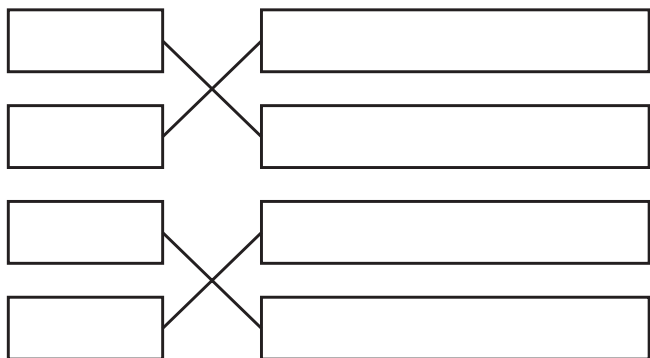
x = **not** present

- 36** The diagram shows parts of the gas exchange system in humans and the associated cells or structures.

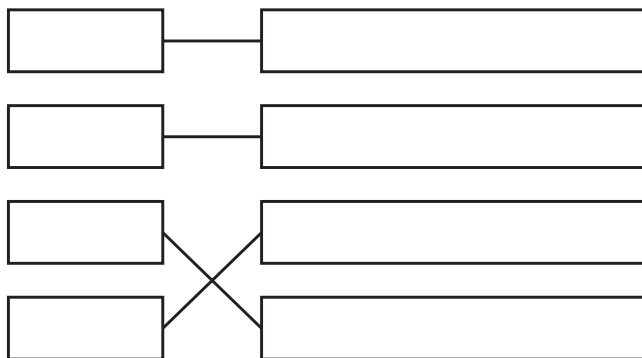
alveolus	ciliated cells
bronchiole	squamous epithelial cells
bronchus	C-shaped rings of cartilage
trachea	ciliated cells and goblet cells

Which diagram shows the lines that correctly match the parts to their cells or structures?

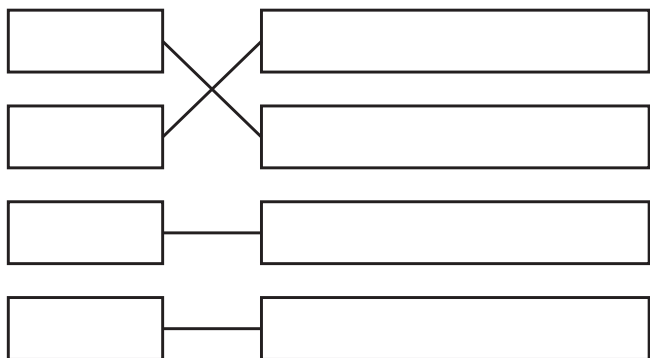
A



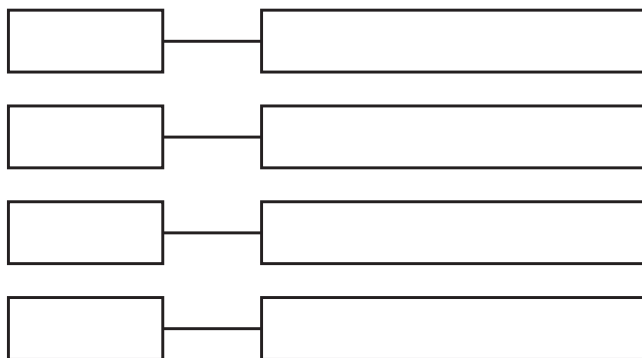
B



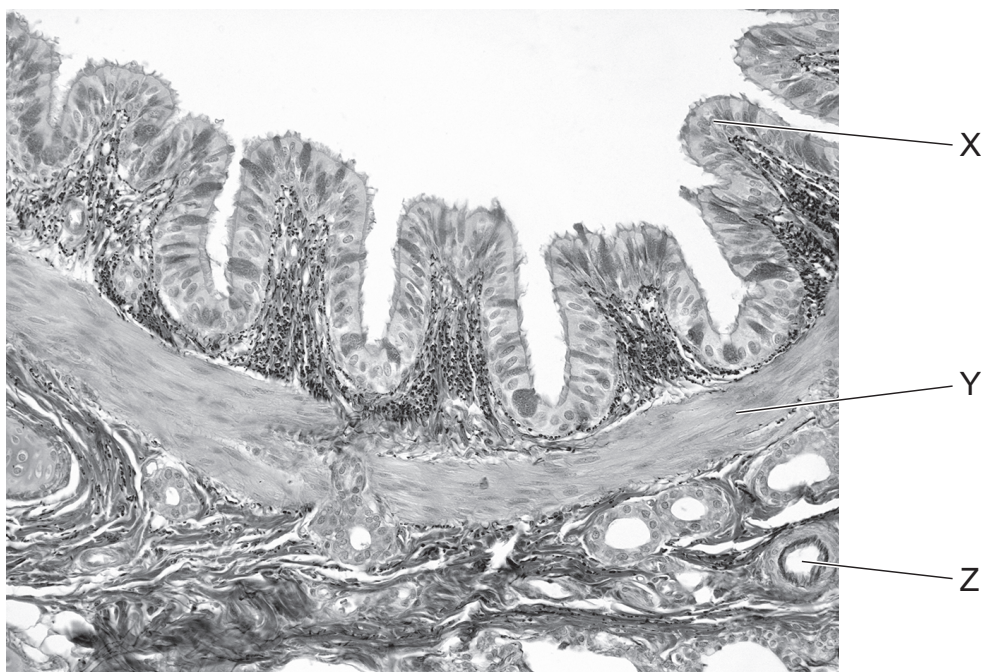
C



D



37 The photomicrograph shows the wall of a bronchus as seen with a light microscope.



Which row correctly identifies the structures labelled?

	X	Y	Z
A	epithelium	elastic fibres	bronchiole
B	endothelium	smooth muscle	bronchiole
C	epithelium	smooth muscle	blood vessel
D	endothelium	elastic fibres	blood vessel

35 What helps to maintain a concentration gradient between blood and the air in the alveolus?

- A** the flow of blood through the lungs
- B** the presence of haemoglobin in blood cells
- C** the single-celled alveolar walls
- D** the squamous epithelium of capillaries

6 (a) Alveolar macrophages are phagocytes found in the human gas exchange system. They produce hydrolytic enzymes, such as lysozyme, to digest pathogens entering the alveolus.

(i) State the term used to describe the sequence of nucleotides in the DNA of the alveolar macrophage that codes for a protein, such as lysozyme.

..... [1]

(ii) Synthesis of lysozyme occurs in two stages. The first stage occurs in the nucleus using one strand of DNA to synthesise mRNA.

State the name of the strand of DNA that is used to synthesise mRNA.

..... [1]

(iii) Name the organelle where the translation of mRNA takes place to produce lysozyme.

..... [1]

(iv) Lysozyme destroys bacterial cells by hydrolysing bonds in peptidoglycan.

Explain how the hydrolysis of bonds in peptidoglycan leads to the destruction of bacterial cells.

.....

.....

.....

..... [2]

(b) (i) Alveolar macrophages are found in contact with squamous epithelial cells in the walls of alveoli.

Explain how the cells lining the alveoli are adapted for gas exchange.

[2]

(ii) Describe the role of elastic fibres in the wall of an alveolus.

[2]

[Total: 9]

2 Collagen is a fibrous protein found in many tissues in animals.

Fig. 2.1 shows the composition of a collagen fibre.

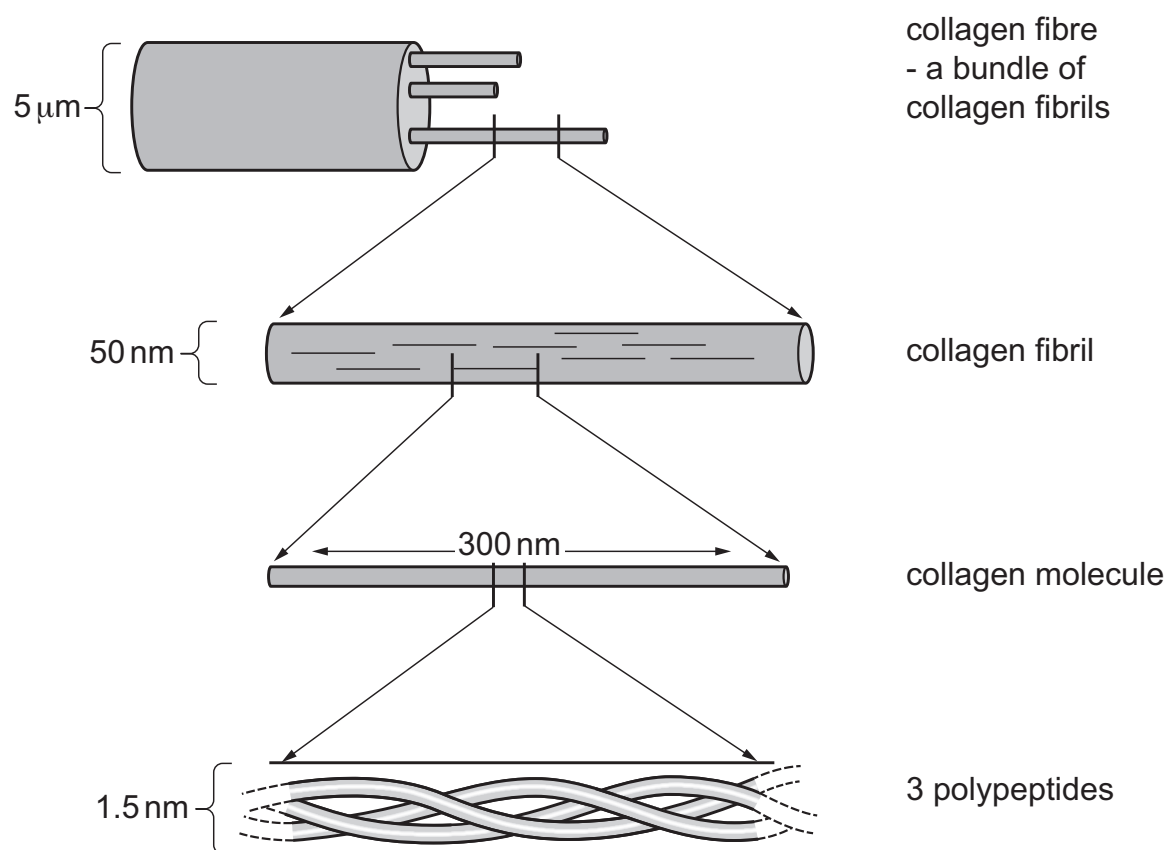


Fig. 2.1

(a) (i) Describe the arrangement of the 3 polypeptides in each molecule of collagen.

.....

.....

.....

.....

.....

..... [2]

(ii) With reference to Fig. 2.1, explain how the molecules of collagen are arranged **and** held together in a collagen fibril.

.....

.....

.....

.....

.....

.....

- (b) Collagen fibres and elastic fibres are found in the structures of the gas exchange system of mammals.
- (i) Suggest **two** properties of collagen that contribute to the function of cartilage in the trachea in the gas exchange system.

.....

.....

.....

.....

..... [2]

- (ii) State the function of elastic fibres in the alveoli in the lungs.

..... [1]

- (c) Table 2.1 shows the DNA triplets in the two strands of DNA in part of a gene that codes for one of the polypeptides in collagen.

Table 2.1

non-transcribed strand	GGT	CCA	ATG	GGT	CCC	CGA	GGT	CCC	CCA	GGT
template strand	CCA	GGT	TAC	CCA	GGG	GCT	CCA	GGG	GGT	CCA
amino acid	gly									

Table 2.2 shows the triplets of bases in **DNA** and the amino acids for which they code.

The table can be used to determine the sequence of the amino acids in a polypeptide.

Table 2.2

		second base											
first base		T		C		A		G					
		T	TTT	phe	TCT	ser	TAT	tyr	TGT	cys			T
	TTC		TCC		TAC		TGC		C				
	TTA		leu	TCA	TAA		stop	TGA	stop	A			
	TTG			TCG	TAG			TGG	trp	G			
	C	CTT	leu	CCT	pro	CAT	his	CGT	arg	T			
		CTC		CCC		CAC		CGC		C			
		CTA		CCA		CAA	gln	CGA		A			
		CTG		CCG		CAG		CGG		G			
	A	ATT	ile	ACT	thr	AAT	asn	AGT	ser	T			
		ATC		ACC		AAC		AGC		C			
		ATA	ACA	AAA		lys	AGA	arg	A				
		ATG	met	ACG			AAG		AGG	G			
	G	GTT	val	GCT	ala	GAT	asp	GGT	gly	T			
		GTC		GCC		GAC		GGC		C			
		GTA		GCA		GAA	glu	GGA		A			
		GTG		GCG		GAG		GGG		G			
			third base										

- (i) Complete Table 2.1 to show the amino acids coded by the DNA nucleotide sequence in Table 2.1. [1]

(ii) The sequence of amino acids that you have worked out is representative of the whole of the collagen polypeptide.

Explain how the sequence of amino acids makes the polypeptide suitable as a component of a collagen molecule.

[3]

- (iii) Two mutations, **P** and **Q**, can have an effect on the primary structure of the polypeptide.
- Mutation **P** is a deletion of the first nucleotide pair in the DNA nucleotide sequence shown in Table 2.1.
 - Mutation **Q** is a substitution of G with T as the first base in the DNA nucleotide sequence shown in Table 2.1.

State the effects of the mutations, **P** and **Q**, on the primary structure of the polypeptide.

mutation **P**

mutation **Q**

[2]

[Total: 14]

- 4 In mammals, the gas exchange system includes a set of branching airways that carry air to and from the gas exchange surface.

Air from the external atmosphere passes through different types of airway to reach the gas exchange surface.

- (a) Name the type of airway of the gas exchange system that branches into airways known as bronchioles.

..... [1]

- (b) Fig. 4.1 is a photomicrograph of a section through a bronchiole.

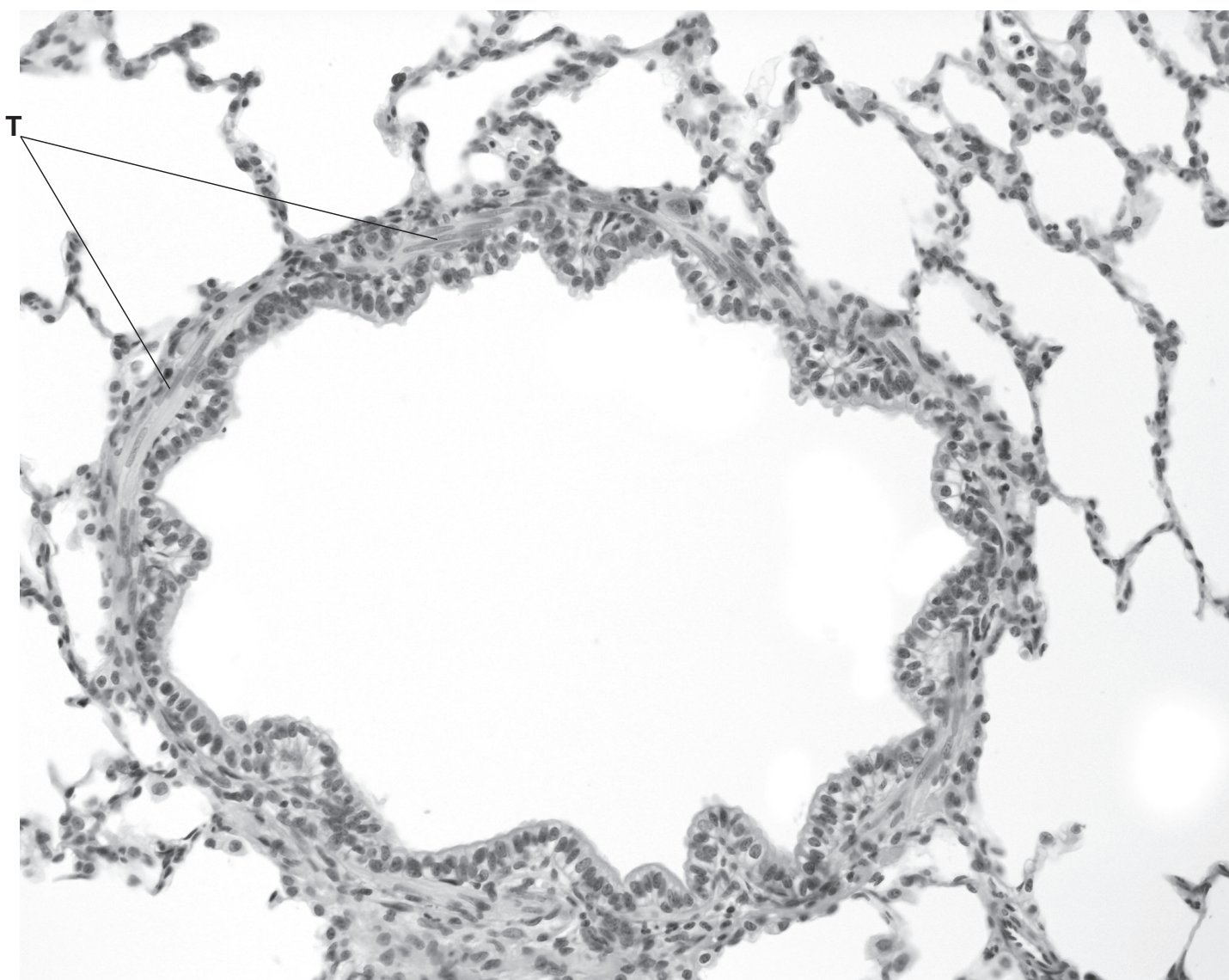


Fig. 4.1

(i) The bronchiole shown in Fig. 4.1 is **not** part of the gas exchange surface.

Name **one** structure in the gas exchange system, **visible in Fig. 4.1**, where gas exchange is carried out.

..... [1]

(ii) Name the type of cell found in the tissue labelled **T** in Fig. 4.1.

..... [1]

(iii) State the features that help to identify the type of airway shown in Fig. 4.1 as a bronchiole and **not** the other types of airway present in the gas exchange system.

.....
.....
.....
.....
.....
.....
..... [3]

(c) Blood is pumped to the lungs in the pulmonary circulation.

The lungs also receive a supply of blood from the systemic circulation.

Explain why the pulmonary circulation **and** the systemic circulation need to supply blood to the lungs.

.....
.....
.....
.....
..... [2]

[Total: 8]