

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

Fig. 2.1 shows the composition of a collagen fibre.

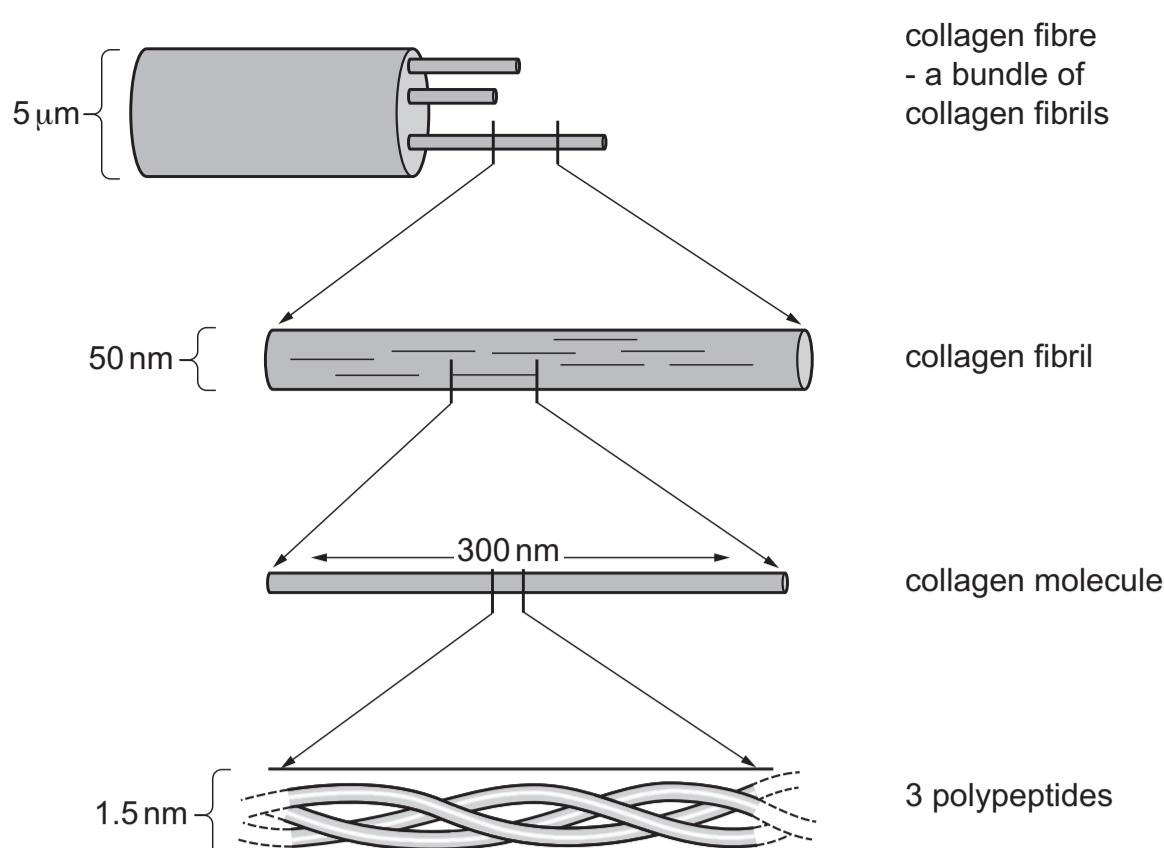


Fig. 2.1

(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.

.....  
 .....  
 .....  
 .....  
 ..... [1]

[31]

(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

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

(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]