

OXFORD CAMBRIDGE AND RSA EXAMINATIONS**Advanced GCE****BIOLOGY****2805/05****Mammalian Physiology and Behaviour**

Friday

25 JUNE 2004

Afternoon

1 hour 30 minutes

Candidates answer on the question paper.

Additional materials:

Electronic calculator

Ruler (cm/mm)

Candidate Name	Centre Number	Candidate Number										
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TIME 1 hour 30 minutes**INSTRUCTIONS TO CANDIDATES**

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers, in blue or black ink, in the spaces provided on the question paper.
- Read each question carefully before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	17	
2	16	
3	19	
4	15	
5	12	
6	11	
TOTAL	90	

This question paper consists of 19 printed pages and 1 blank page.

Answer all the questions.

1 Fig. 1.1 is a drawing of the human brain that shows the origin of the cranial nerves.

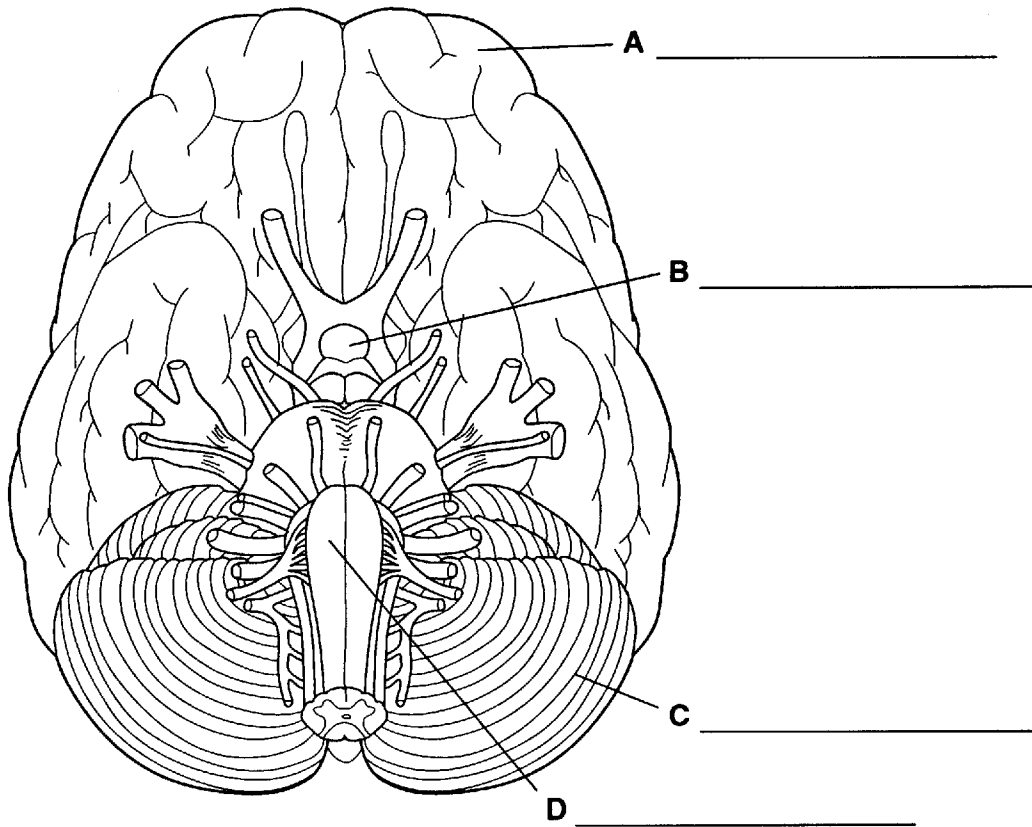


Fig. 1.1

(a) State the direction from which the brain has been drawn.

.....[1]

(b) Label the structures shown on Fig. 1.1.

[4]

(c) Name the types of neurone found in the cranial nerves.

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

Alzheimer's disease is a disease of the brain.

(d) Give two symptoms of Alzheimer's disease.

1
.....
2
.....[2]

- (e) The brains of sufferers from Alzheimer's disease contain deposits called plaques between the neurones of the cerebral cortex. A peptide molecule, β amyloid 40 ($A\beta$ 40) is produced by normal cerebral cortex neurones throughout life and appears to play an important role in a healthy brain. A second peptide molecule, β amyloid 42 ($A\beta$ 42), is an abnormal form of $A\beta$ 40 and is associated with the formation of plaques.

Fig. 1.2 shows the results of an investigation into the effects of different drugs on the amounts of $A\beta$ 40 and $A\beta$ 42 secreted by cerebral cortex neurones.

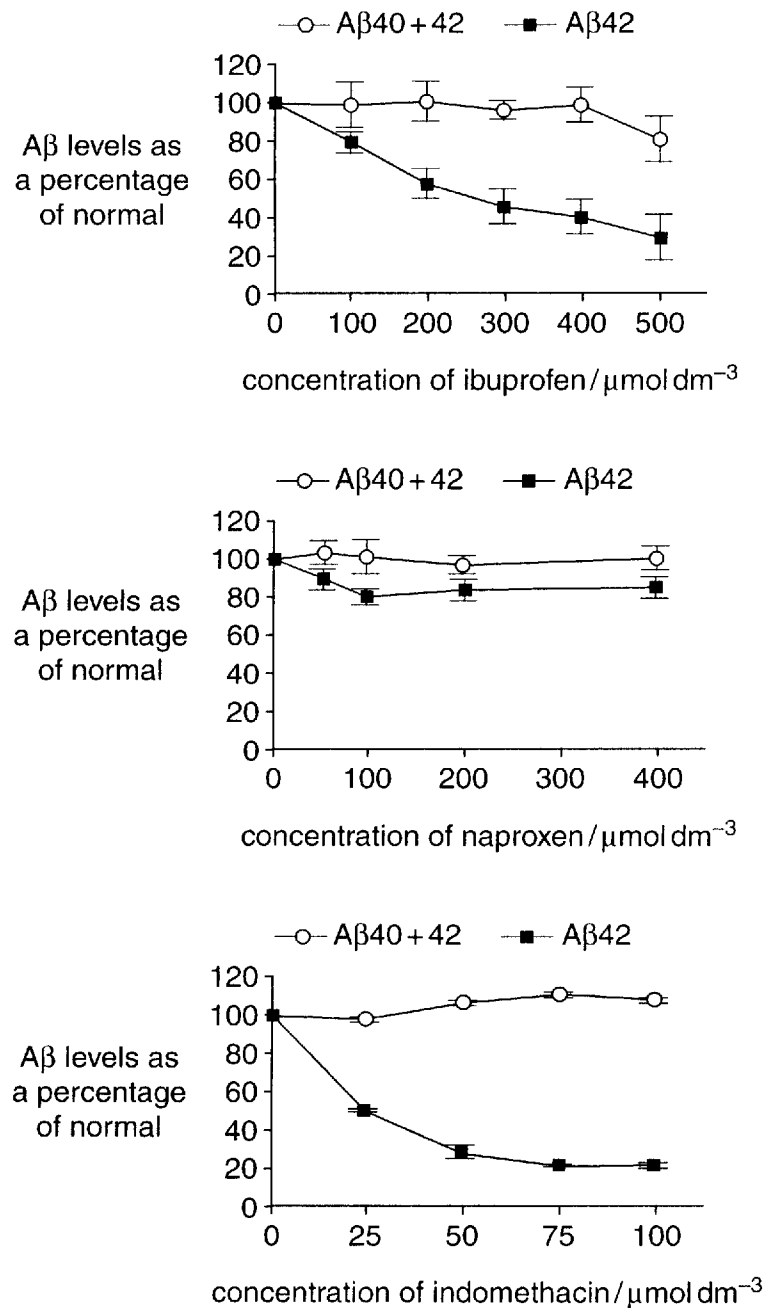


Fig. 1.2

- 2 (a) The table below contains information about some secretions of the digestive system in a mammal. Complete the table.

secretion	name of region of alimentary canal	function of secretion	secretion stimulated by
salivary amylase	mouth	digestion of starch
pancreatic alkaline fluid	pancreas
cholecystokinin (CCK)	presence of products of protein / lipid digestion
.....	stomach	increase release of pepsinogen and hydrochloric acid	presence of food in stomach

[6]

- (b) Ruminant mammals contain mutualistic microorganisms which produce enzymes that hydrolyse cellulose to the disaccharide cellobiose and then to glucose.

Explain why

- (i) the relationship between some mammals and the cellulose-digesting microorganisms in their gut is described as mutualistic;

.....

 [2]

- (ii) the digestion of cellulose to cellobiose, and cellobiose to glucose are described as hydrolysis reactions.

.....

 [2]

- (c) The mutualistic microorganisms require anaerobic conditions. A ruminant swallows large amounts of air, yet maintains anaerobic conditions in the chambers of the stomach.

Suggest how anaerobic conditions are maintained in the chambers of the stomach.

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

- (d) Rabbits are herbivores and produce two sorts of faeces. One type of faeces, called caecotropes, are reingested by rabbits. Caecotropes are a soft mass of partly digested plant material and microorganisms from the caecum, surrounded by a thick layer of mucus. After this material has passed through the alimentary canal for a second time, it is egested as dry, brown faecal pellets, which rabbits do not reingest.

Suggest the advantage to rabbits of

- (i) the caecotropes being covered in a layer of thick mucus;

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

- (ii) reingesting the caecotropes.

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

[Total: 16]

- 3 (a) Name the process or reaction performed by the liver that is described in each of the following statements:
- (i) The conversion of one type of amino acid molecule into a different type of amino acid molecule.
.....[1]
- (ii) The production of glucose from an amino acid molecule.
.....[1]
- (iii) The conversion of an amino acid molecule into a molecule of an organic acid and a molecule of ammonia.
.....[1]
- (iv) The production of a molecule of glycogen from molecules of glucose.
.....[1]
- (b) Table 3.1 shows the mass of glycogen stored in the liver and skeletal muscle before and after a period of not eating food (fasting). It also shows the ratio between the mass of glycogen stored in the liver and in skeletal muscle before and after fasting. The ratio has been obtained by dividing the mass of liver glycogen by the mass of skeletal muscle glycogen.

Table 3.1

	tissue	mass of glycogen stored / g	ratio between mass of glycogen stored in the liver and mass of glycogen stored in skeletal muscle
before fasting	liver	82.1	0.217
	skeletal muscle	378.5	
after fasting	liver	8.4	0.097
	skeletal muscle		

- (i) Calculate the mass of glycogen stored in the skeletal muscles **after fasting**.
Show your working.

Answer g [2]

- (ii) Explain why the total mass of glycogen stored decreases after a period of fasting.

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

Cholesterol plays an important role as a component of cell membranes.

- (c) Describe the role of cholesterol in cell membranes.

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

Cholesterol is transported in the bloodstream as lipoprotein.

- (d) State the property of cholesterol that makes it necessary for it to be transported as lipoprotein in the blood.

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

Low density lipoproteins (LDLs) are one type of lipoprotein found in the blood. LDLs are removed from the blood by the liver. There are receptors for LDLs on the cell surface membranes of liver cells.

Fig. 3.1 is a diagram showing the role of LDL receptors in liver cells.

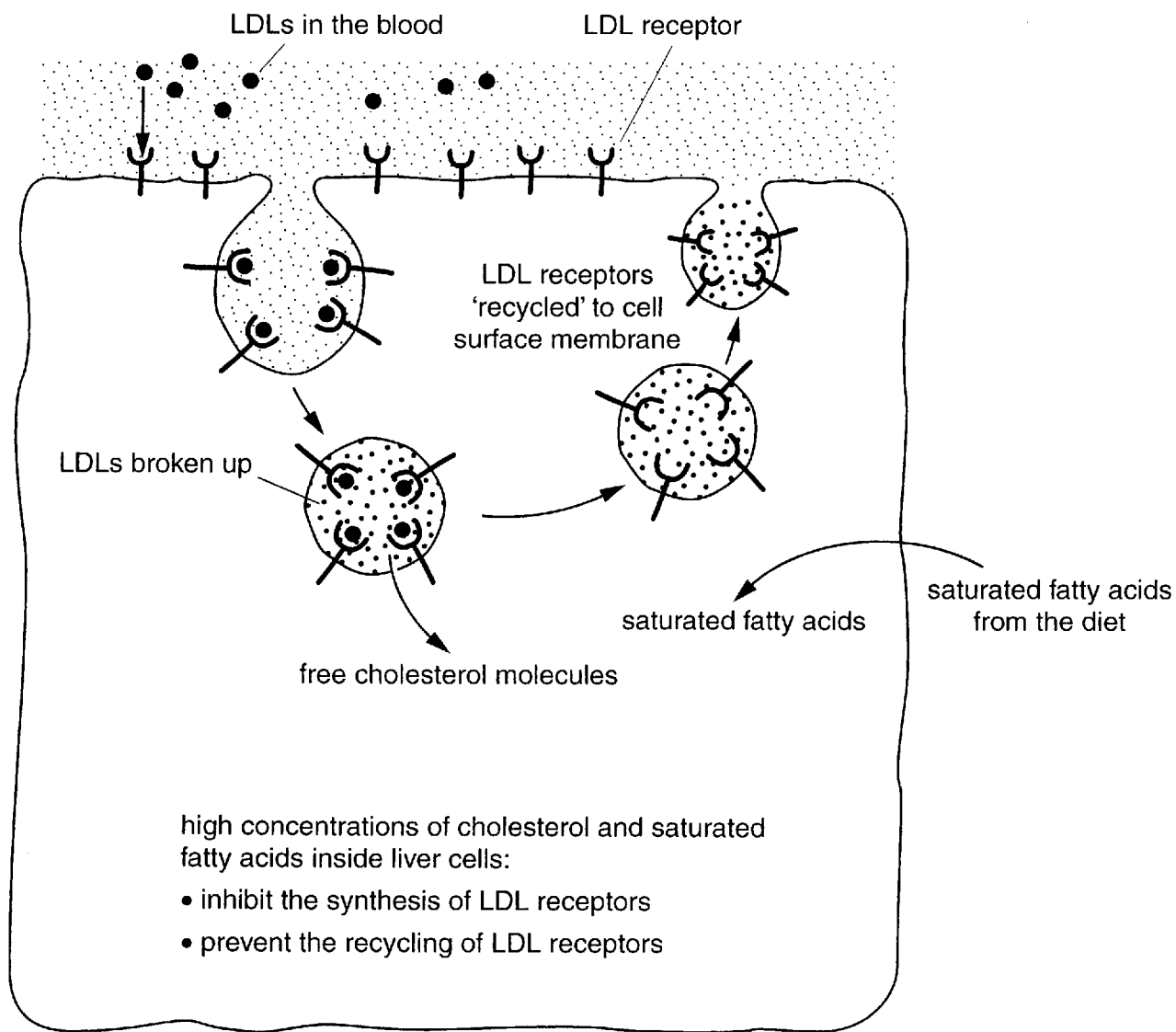


Fig. 3.1

(e) Using the information in Fig. 3.1, describe how LDLs are taken up into liver cells.

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.....

.....

.....[2]

4 (a) Fig. 4.1 shows some structures in the human eye.

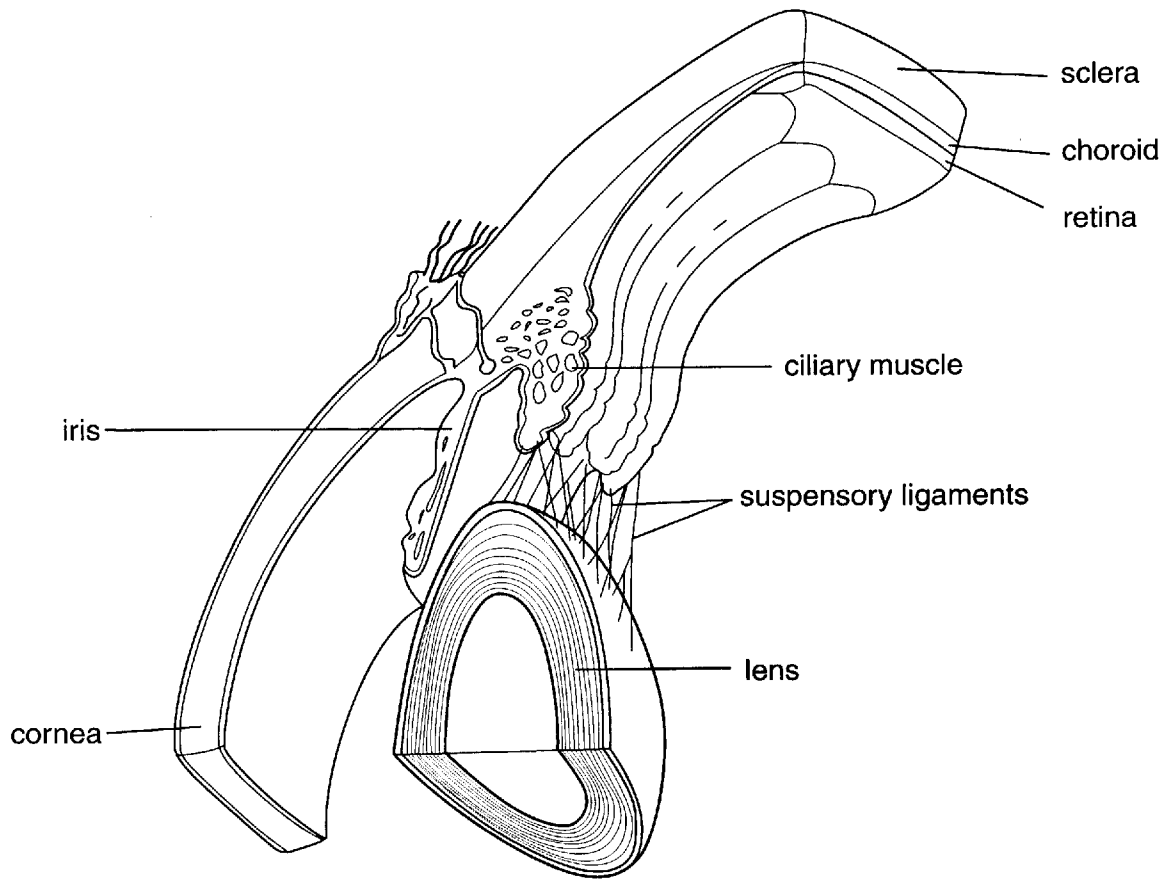


Fig. 4.1

Explain how the structures shown in Fig. 4.1 allow the focusing of clear images.
You may use the space opposite for any drawings you wish to include to illustrate your answer.

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Space for drawing(s)

[5]

(b) Table 4.1 shows the effect of age on the focusing ability of a human eye.

Table 4.1

age / years	10	20	30	40	50
closest distance to the eye that an object can be brought into focus / m	0.07	0.11	0.16	0.68	1.35

Explain the data in Table 4.1.

.....

.....

.....[2]

(c) The eyes of cats differ from those of humans in the following ways:

- There are two pairs of shutter-like muscles that allow a much wider variation in pupil size than in humans.
- There is an additional layer, the *tapetum lucidum*, in front of the choroid. This layer reflects light, explaining why the eyes of cats glow in the dark when exposed to a beam of light.
- The retina contains 375 million rod cells and 3 million cone cells. The human retina contains 125 million rod cells and 6 million cone cells.

Explain how these features help cats to hunt at night.

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.....[4]

- (d) The size of the pupil of the eye is controlled by radial and circular muscle fibres of the iris. The sympathetic nervous system stimulates the radial muscle fibres by releasing noradrenaline and the parasympathetic nervous system stimulates the circular muscle fibres by releasing acetylcholine.

The actions of four different drugs when applied to the eye are as follows:

- pilocarpine stimulates acetylcholine receptors
- prazosin blocks noradrenaline receptors
- neostigmine inhibits the enzyme cholinesterase
- hyoscine blocks acetylcholine receptors

Using the information,

- (i) state which drug will result in dilation (enlargement) of the pupil of the eye;

.....[1]

- (ii) explain your answer in terms of the action of the drug on the autonomic nervous system and the muscle fibres of the iris.

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.....[3]

[Total: 15]

- (c) All newly born chimpanzees display the 'grip reflex' by holding onto an object with their hands.

The grip reflex is always made in the same way in response to the presence of any object near to the young chimp.

- (i) Explain why the grip reflex is an example of an innate behaviour.

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.....[2]

- (ii) Suggest **two** advantages of the grip reflex to the young chimps.

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.....[2]

[Total: 12]

6 Fig. 6.1 shows a motor neurone terminating in skeletal muscle.

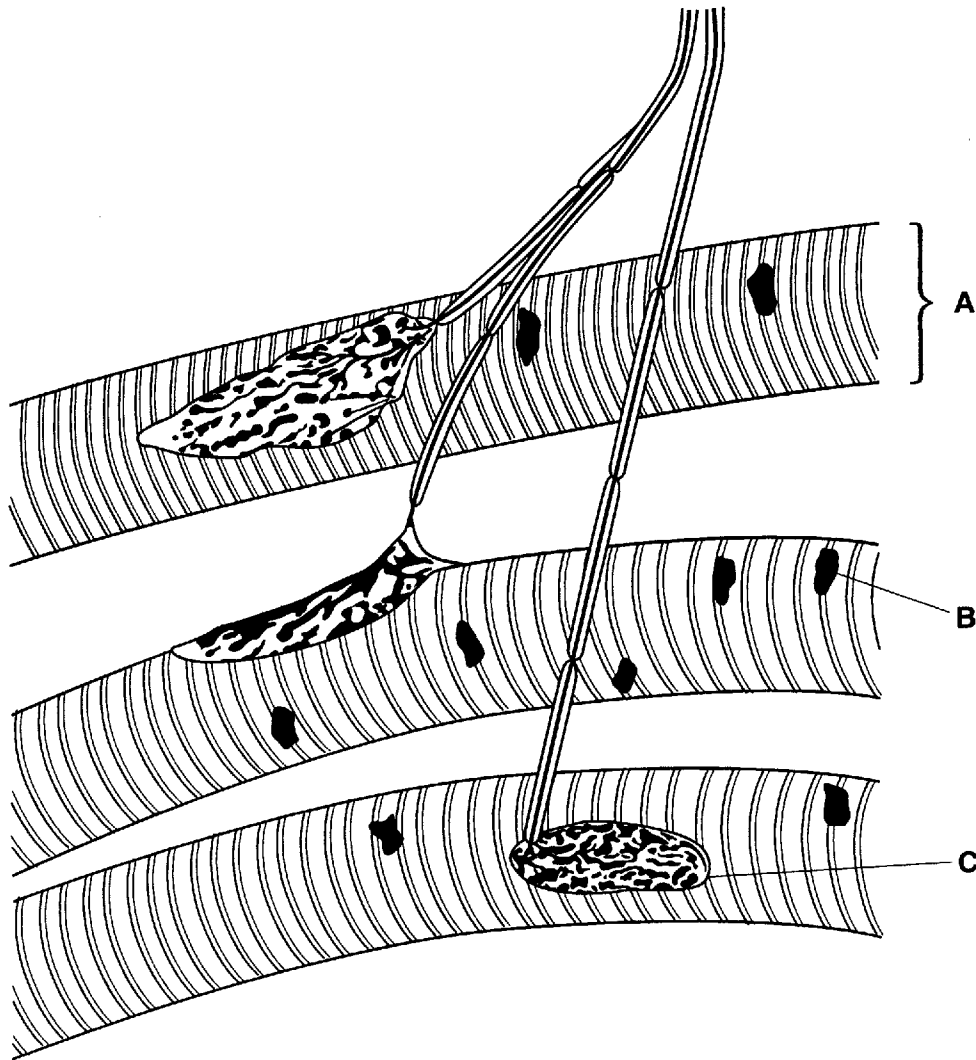


Fig. 6.1

(a) Name the structures A to C.

A

B

C [3]

Copyright Acknowledgements:

- Q.1 Fig. 1.1 From *Human Physiology, Foundations and Frontiers*, p.196 Fig. 9.4, by C. Schauff, D. Moffet & S. Moffett, published by Times Mirror/Mosby College Publishing, 1990 (ISBN 08016 435540).
- Q.1 Fig. 3.1 From *Nature*, p.213, vol. 414, 2001, by S. Weggen et al, published by Macmillan Magazines Ltd. (ISBN 0028 0836).
- Q.3 Fig. 3.1 From *Report of the cardiovascular review group of COMA: nutritional aspects of cardiovascular disease* © HMSO.
- Q.4 Fig. 4.1 From *Human Physiology, Foundations and Frontiers*, p.236 Fig. 10.16, by C. Schauff, D. Moffet & S. Moffett, published by Times Mirror/Mosby College Publishing, 1990 (ISBN 08016 435540).
- Q.6 Fig. 6.1 From *An atlas of histology*, p.39, by W. Freeman and B. Bracegirdle, published by Heinemann Educational Books Ltd. (ISBN 0 435 60311 6).

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