

Antibodies and vaccination

Question Paper 8

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Immunity
Sub Topic	Antibodies and vaccination
Booklet	Theory
Paper Type	Question Paper 8

Time Allowed : 30 minutes

Score : / 25

Percentage : /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 Pompe disease is a rare neuromuscular disease caused by an autosomal recessive allele. This allele prevents the production of an enzyme called acid alpha-glucosidase (AG), which breaks down glycogen in muscle cells. Glycogen can build up in muscle cells causing damage to the cells. This damage leads to muscle weakness which gets worse with time.

(a) Explain how two parents, both of whom produce normal amounts of AG, can produce a child with Pompe disease.

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(b) One form of treatment is enzyme replacement therapy where AG is given through regular injections.

(i) Suggest how AG may be manufactured.

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.....[1]

(ii) Name the hormone that stimulates the breakdown of glycogen in **liver** cells.

.....[1]

(iii) State under what conditions glycogen would need to be broken down in liver or muscle cells.

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.....[1]

(c) The MN blood group system is based on the presence of glycoproteins M and N, on the surface membrane of red blood cells, which act as *antigens*.

State what is meant by the term *antigen*.

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.....[1]

- (d) The type of MN antigen on the surface membrane of red blood cells is controlled by a single gene with two alleles, L^M and L^N . The phenotypes of the MN blood group system are MM, MN and NN.

Complete the genetic diagram to show how the MN blood group is inherited.

parental phenotypes MN x MN

parental genotypes

gametes

offspring genotypes

offspring phenotypes [3]

- (e) Allele frequencies for L^M and L^N vary in different human populations throughout the world.

Table 7.1 shows the L^M and L^N allele frequencies from five populations.

Table 7.1

population	allele frequency / %	
	L^M	L^N
Canadian Inuit	91	9
Egyptian	52	48
German	55	45
Chinese	57	43
Nigerian	55	45

Discuss the data shown in Table 7.1.

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- 2 Receptor proteins are part of the fluid mosaic structure of cell surface (plasma) membranes of T-lymphocytes. Each type of receptor protein is specific to a particular antigen.

Fig. 1.1 shows a receptor protein and the surrounding phospholipids of a cell surface membrane of a T-lymphocyte.

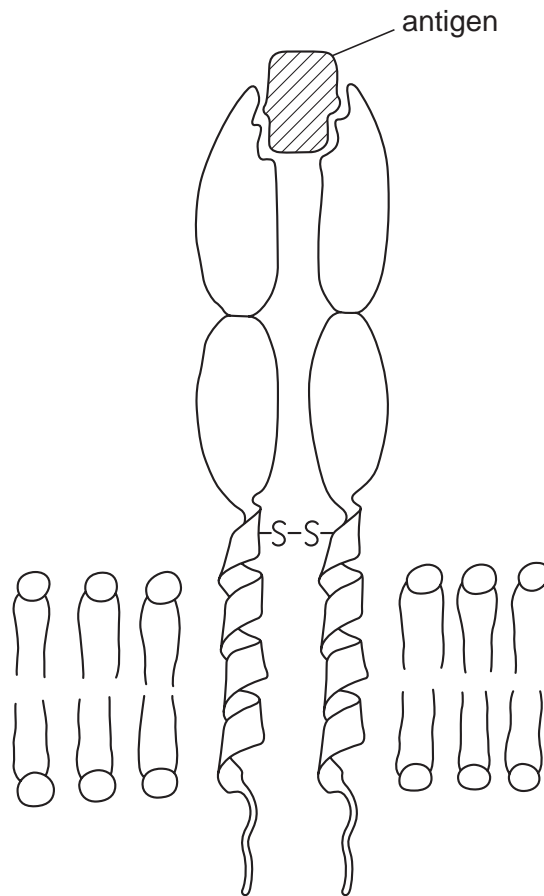


Fig. 1.1

- (a) (i) Draw a bracket () on Fig. 1.1 to indicate the width of the phospholipid bilayer. [1]
- (ii) Explain the term *fluid mosaic*.

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(iii) Describe how the **structure** of the receptor shown in Fig. 1.1 is similar to the structure of an antibody molecule.

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(b) Describe the roles of T-lymphocytes in a primary immune response.

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(c) Describe three functions of cell surface membranes, **other than** the recognition of antigens.

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[Total: 12]