

Genetic technology applied to medicine

Question Paper 1

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Genetic Technology
Sub Topic	Genetic technology applied to medicine
Booklet	Theory
Paper Type	Question Paper 1

Time Allowed : 46 minutes

Score : / 38

Percentage : /100

Grade Boundaries:

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

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- 2 A number of diseases, such as dengue fever, are spread by mosquitoes. The incidence of this disease has increased dramatically in recent years and this has been linked with the spread of the mosquito, *Aedes aegypti*.

In an attempt to reduce the numbers of *A. aegypti*, genetically modified (GM) male mosquitoes were produced. One of the genes added to these mosquitoes, **when switched on**, results in the production of a protein which is toxic to mosquitoes.

In 2010, in the Cayman Islands and in Malaysia, GM male mosquitoes were released into the wild to mate with females. All the resulting offspring died in the larval stage.

- (a) About 3 million GM male mosquitoes were released in the Cayman Islands.

Suggest why releasing such large numbers of male mosquitoes did not immediately increase the risk of transmission of dengue fever.

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

- (b) In Malaysia, both GM male and non-GM male mosquitoes were released in order to compare their dispersal and life span in the wild. The GM mosquitoes could be identified because they also carried a gene for green fluorescent protein (GFP).

Explain why, in many examples of gene technology, fluorescent markers are used in preference to antibiotic resistance genes.

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..... [2]

- (c) In addition to the gene for GFP, the DNA that has been added to the GM mosquitoes consists of
- a promoter
 - a gene coding for a toxic protein, tTA
 - a binding site for tTA.

When a GM mosquito larva hatches from an egg, the promoter induces the production of only a small amount of tTA, so that the larva does not die immediately. In a process of positive feedback, the tTA produced binds to the DNA as shown in Fig. 2.1. This increases the expression of the gene until the increased concentration of tTA kills the larva.

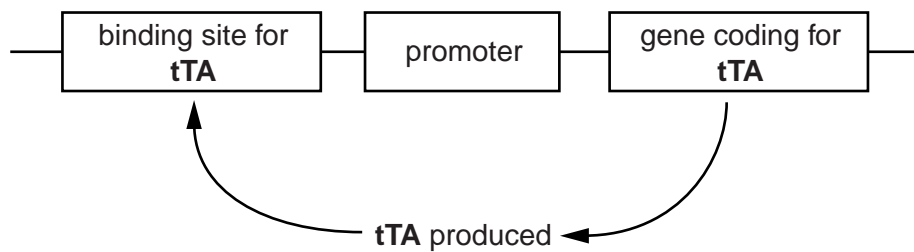


Fig. 2.1

- (i) Suggest why this process is called *positive feedback*.

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..... [1]

- (ii) Explain why, in gene technology, a promoter needs to be transferred along with the desired gene.

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..... [3]

- (iii) Switching on the gene coding for tTA in the mosquito larvae, rather than in the eggs, increases the effectiveness of this method of controlling mosquito numbers.

Suggest why this is so.

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..... [2]

- (d) GM mosquitoes carrying the tTA gene can live and reproduce normally when fed on a diet containing an added chemical, **A**.

With reference to Fig. 2.1:

- (i) suggest how **A** could prevent death of the GM mosquitoes

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..... [2]

- (ii) suggest how large numbers of adult GM male mosquitoes can be produced for release into the wild, from an original stock of GM males

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..... [2]

- (iii) suggest why there is little danger of the gene carried by these GM mosquitoes being passed to other organisms from GM mosquitoes which escape or are released into the wild.

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..... [2]

[Total: 15]

3 (a) Cystic fibrosis (CF) is an inherited disease.

(i) Explain briefly how two parents who do not have CF may have a child with CF.

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..... [2]

(ii) Describe **two** ways in which CF affects the lungs.

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..... [2]

(b) One potential way of treating CF is by using gene therapy.

(i) Outline, with reference to CF, what is meant by *gene therapy*.

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..... [2]

(ii) Describe one possible advantage and one possible disadvantage of using gene therapy to treat CF.

advantage

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disadvantage

..... [2]

[Total: 8]