

Protein synthesis

Question Paper 5

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Nucleic acids and protein synthesis
Sub Topic	Protein synthesis
Booklet	Theory
Paper Type	Question Paper 5

Time Allowed : 68 minutes

Score : / 56

Percentage : /100

Grade Boundaries:

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

1 Cultivated rice, *Oryza sativa*, is often grown in fields flooded with water.

(a) Explain how rice plants are adapted for growth with the roots submerged in water.

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(b) Some varieties of cultivated rice are able to grow long internodes when they are submerged in water, keeping the leaves and flowers above water level (an internode is a length of stem between leaves). These varieties are known as deepwater rice.

The snorkel genes *SK1* and *SK2*, thought to be responsible for this response, were identified in a variety of deepwater rice, C9285. A non-deepwater variety, T65, did not have these genes.

When submerged, rice plants produce the gaseous plant hormone ethene. This has a very low solubility in water, so it accumulates in the aerenchyma tissue in the rice stems.

Fig. 4.1 shows the concentration of ethene in the aerenchyma of T65 and C9285 when the plants are submerged in water for 18 hours.

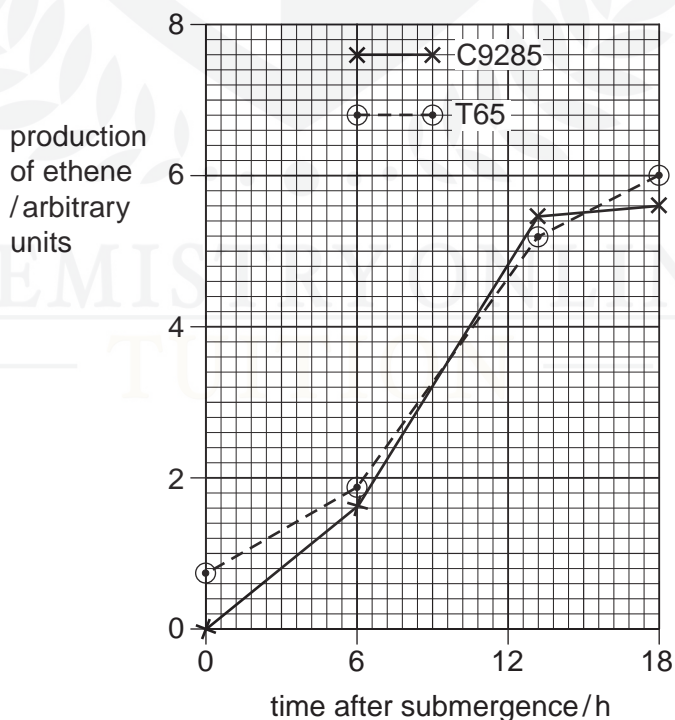


Fig. 4.1

Fig. 4.2 shows the results of exposing T65 and C9285 to different concentrations of ethene in dry conditions.

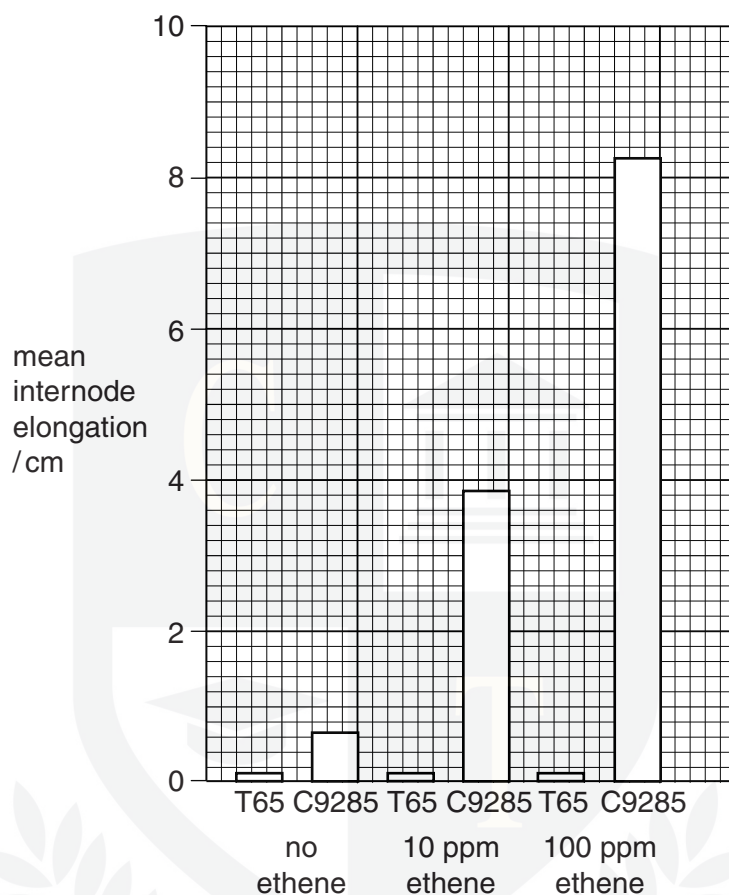


Fig. 4.2

- (i) With reference to Fig. 4.1, describe the effect of submergence in water on the production of ethene in rice.

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 [2]

- (ii) With reference to Fig. 4.2, compare the effect of ethene on internode elongation in C9285 and T65.

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 [2]

- (c) The snorkel genes were found to be expressed when the plant was exposed to ethene. The expression of these genes results in increased production of gibberellin, GA.

Fig. 4.3 shows the effect of submergence on GA production in C9285 and in T65.

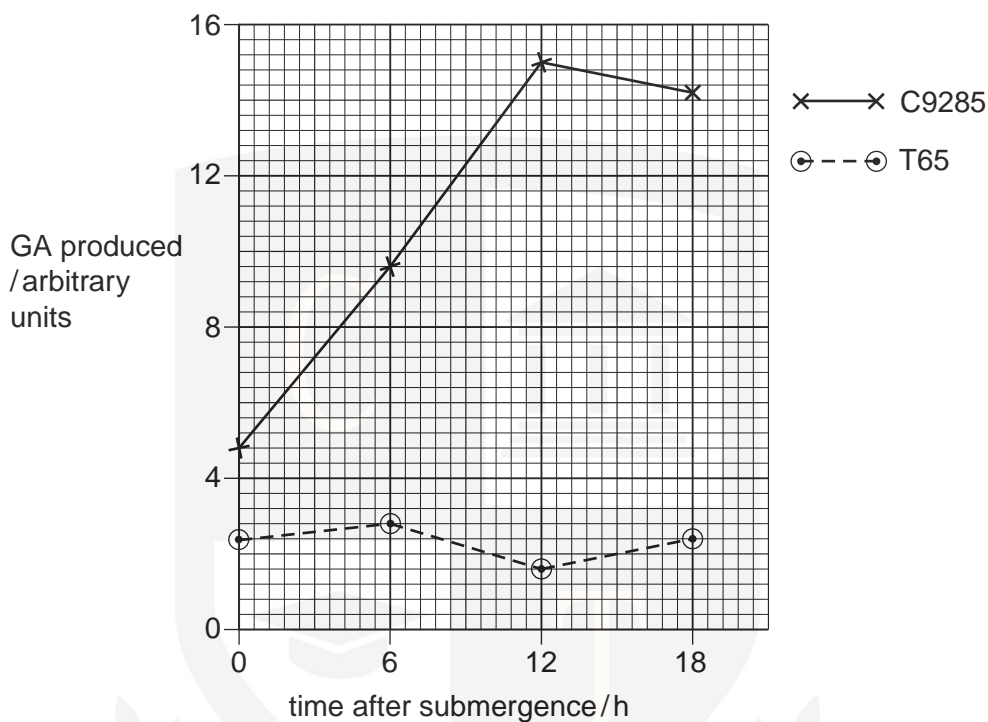


Fig. 4.3

With reference to Fig. 4.3, and your knowledge of the functions of GA, suggest an explanation for the differences in the effects of ethene in C9285 and T65 shown in Fig. 4.2.

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(d) Cultivated rice has been developed from the wild rice species *Oryza rufipogon* and *Oryza nivara*. *O. rufipogon* has a strong deepwater elongation response, but *O. nivara* has only a slight elongation response. Another species, *Oryza glumaepatula*, shows a strong elongation response.

- *O. rufipogon* has both the snorkel genes, *SK1* and *SK2*.
- *O. nivara* has *SK1*, but an addition (insertion) mutation has produced a stop triplet within *SK2*.
- *O. glumaepatula* has *SK2*, but not *SK1*.

(i) Describe what this information indicates about the relative importance of the genes *SK1* and *SK2* in the deepwater elongation response.

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(ii) Explain how an addition mutation could produce a stop triplet.

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(iii) Deepwater rice is the main food crop in many parts of the world that undergo flooding in the rainy season. Many varieties of deepwater rice have lower yields than non-deepwater varieties.

Suggest how a deepwater rice variety with high yield could be produced, using artificial selection.

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[Total: 17]

- 2 (a)** Explain how changes in the nucleotide sequence of DNA may affect the amino acid sequence in a protein. [8]
- (b)** Explain how the allele for haemophilia may be passed from a man to his grandchildren. You may use genetic diagrams to support your answer. [7]

[Total: 15]



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3 Fig. 1.1 shows a diagram of part of a cell surface membrane.

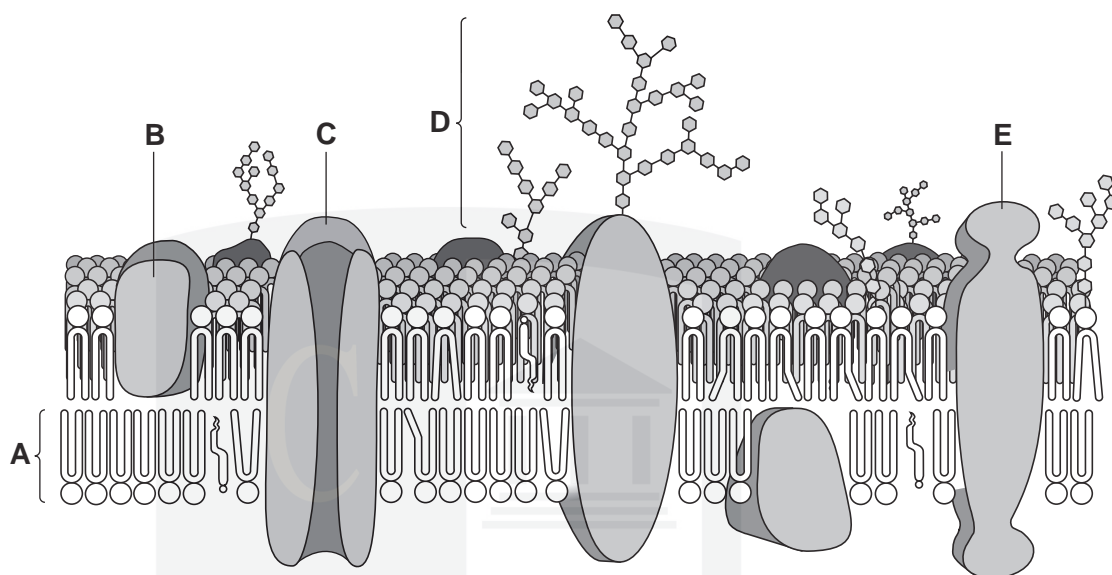


Fig. 1.1

(a) (i) Name molecules **A** and **B**.

A

B[2]

(ii) Explain how the features of molecules of **A** cause them to form a layer in the membrane as seen in Fig. 1.1.

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.....[3]

(b) State the functions of **C** and **D**.

C

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D

..... [2]

(c) Structure **E** is a protein composed of 588 amino acids.

Calculate the minimum number of nucleotide base pairs required in the gene coding for this protein. Show your working.

Answer = [2]

[Total: 9]

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- 4 (a)** Outline the behaviour of **chromosomes** during meiosis. [9]
- (b)** Describe the ways by which **gene** mutations can occur. [6]

[Total: 15]





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