

Exercise walk-through

5.9

Plant responses and phytochrome (statements 8.11–8.12, core practical 18)

Pearson Edexcel · International A-Level · Biology

Four stages, one purpose

Stage	Where	Yield
Glycolysis	cytoplasm	2 ATP + 2 reduced NAD
Link reaction	matrix	CO ₂ + reduced NAD
Krebs cycle	matrix	ATP + reduced NAD + reduced FAD
Oxidative phosphorylation	cristae	most ATP; O ₂ to water

Recombinant DNA: cut, paste, select

Cut : the same restriction enzyme opens plasmid and gene



Paste : complementary sticky ends sealed by DNA ligase



Transform : heat shock carries plasmids into bacteria



Select : antibiotic marker - only transformants survive

Check yourself

Your turn

Why is the human insulin gene made from mRNA before inserting into bacteria?

- ☐ A. bacteria cannot splice introns, and mature mRNA has none
- ☐ B. mRNA is more stable than DNA
- ☐ C. mRNA is double-stranded and easier to cut
- ☐ D. restriction enzymes only cut RNA

Exercises 2.1·2.3

2.1 Name the form of phytochrome that absorbs red light and the form active in daylight. [2]

2.2 State the enzyme induced by gibberellin in germinating barley, and its substrate. [2]

2.3 Explain how auxin causes a shoot to bend toward light. [3]

Exercises 2.1·2.3

2.1 Name the form of phytochrome that absorbs red light and the form active in daylight. [2]

2.1 Pr absorbs red; Pfr accumulates in daylight.

2.2 State the enzyme induced by gibberellin in germinating barley, and its substrate. [2]

2.2 Amylase; starch (in the endosperm).

2.3 Explain how auxin causes a shoot to bend toward light. [3]

2.3 Auxin accumulates on the shaded side; it elongates those cells more; the shoot bends toward the light because the shaded side grows faster.

Exercises 3.1·3.2

3.1 Describe an experiment to show that gibberellin increases the rate of germination, including controls, the measurements taken and the expected results. [5]

3.2 A long-day plant flowers only when nights are shorter than a critical length. Explain how phytochrome controls this response, referring to the two forms and the effect of daylight. [5]

Exercises 3.1·3.2

3.1 Describe an experiment to show that gibberellin increases the rate of germination, including controls, the measurements taken and the expected results. [5]

3.1 Equal batches of same-age seeds (e.g. 50 cress), one soaked in gibberellin solution, a control in distilled water; identical temperature, moisture and light; count germinated seeds daily and record the time to 50 % germination; gibberellin batch germinates faster and to a higher percentage.

3.2 A long-day plant flowers only when nights are shorter than a critical length. Explain how phytochrome controls this response, referring to the two forms and the effect of daylight. [5]

3.2 Daylight converts Pr to Pfr, so Pfr accumulates during the day; in long days (short nights) Pfr remains high through the dark interval, too briefly for reversion; high Pfr triggers flowering in long-day plants; in short days the long night allows Pfr to revert to Pr, and flowering is not triggered.

Exercise 3.3

3.3 Coleus cuttings are treated with auxin on one side of an agar block. Predict the growth of roots and shoots on the treated and untreated sides, and explain the basis of the difference.

[4]

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3.3 Auxin at moderate concentration promotes root growth on the treated side; shoots respond similarly at low concentration; roots are far more auxin-sensitive, so concentrations that promote shoots may inhibit roots - high auxin on the root side suppresses growth there; differential growth produces bending - roots down, shoots up, in both cases toward greater growth.