

Exercise walk-through

21.1

Biotechnology and genetic modification

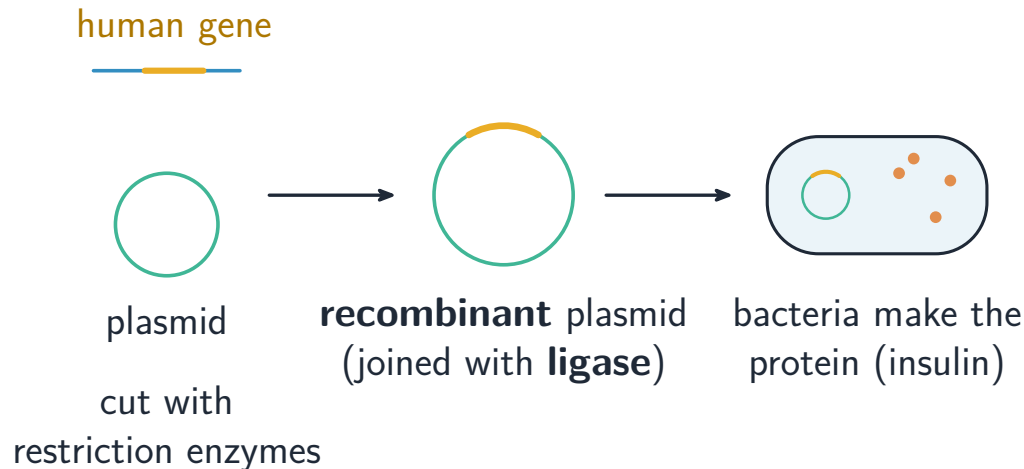
IGCSE Biology

Genetic modification

Genetic modification

moves genes between organisms:

- 1 **restriction enzymes** cut (sticky ends)
- 2 **ligase** joins the gene into a plasmid
- 3 bacteria **express** it → the protein



GM examples

human **insulin** from bacteria

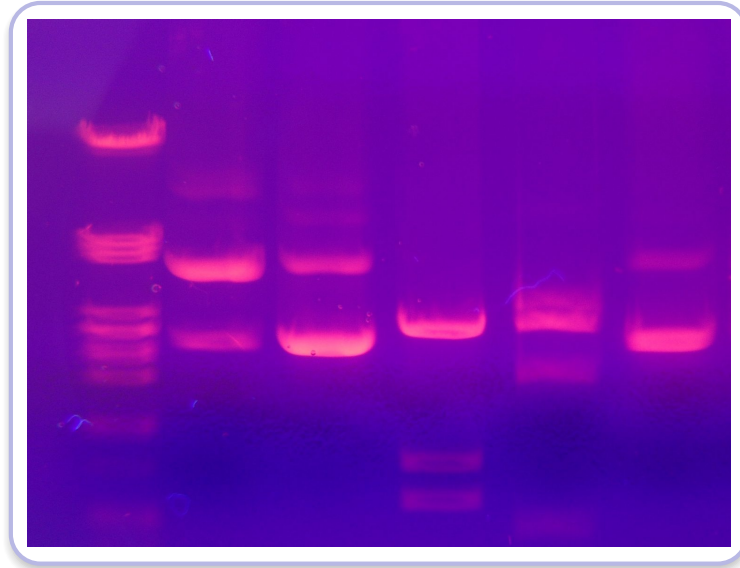
herbicide -resistant crops

insect-pest-resistant crops

crops with better nutrition

GM crops can give higher **yields** , but raise worries about health, wild species & cost.

Genetic modification, continued



DNA fragments separated by gel electrophoresis appear as glowing bands

Genetic modification, and what it is used for

genetic modification	changing an organism's genetic material by removing, changing or inserting individual genes
the steps	cut the gene out with an enzyme, insert it into a plasmid, put the plasmid into a bacterium, and let the bacterium multiply
insulin	human insulin made by bacteria – pure, plentiful, and free of animal-source objections
crop plants	genes inserted for herbicide tolerance, insect resistance , or improved food value
the concerns	effects on wild species, the cost of seed to small farmers, and long-term safety

The exam wants the **mechanism** – gene, enzyme, plasmid, bacterium – and then one benefit and one concern. All three parts are marked.

Exam tips

- Bacteria are used because they reproduce fast, make complex molecules, and contain plasmids.
- Yeast (anaerobic respiration) → ethanol (biofuel) and carbon dioxide (bread).
Enzymes: pectinase (fruit juice), proteases and lipases (washing powders), lactase (lactose-free milk).
- Fermenters make insulin, penicillin and mycoprotein; control temperature, pH, oxygen, nutrients and waste.
- Genetic modification: cut a gene with restriction enzymes (sticky ends) → join it into a plasmid with ligase (a recombinant plasmid) → put into bacteria → express the gene to make the protein.
- GM crops can resist herbicides or insect pests, or have better nutrition.

Exercises 2.1·2.2

2.1 Define biotechnology.

[1]

2.2 Define genetic modification.

[1]

Exercises 2.1·2.2

2.1 Define biotechnology.

[1]

2.1

- biotechnology is **using living things (or their enzymes) to make useful products**
-

2.2 Define genetic modification.

[1]

2.2

- genetic modification is **changing an organism's genetic material** by removing, changing or inserting genes

Exercise 3.1

3.1 Bacteria are useful in biotechnology because they:

[1]

☐

A reproduce slowly

B reproduce very fast and contain plasmids

C cannot make molecules

D have no DNA

Exercise 3.1

3.1 Bacteria are useful in biotechnology because they:

[1]

☐

A reproduce slowly

B reproduce very fast and contain plasmids

C cannot make molecules

D have no DNA

3.1 B

- bacteria **reproduce very fast and contain plasmids**
- A, C and D are false

Exercise 3.2 (a)

3.2 Bacteria are widely used in biotechnology.

(a) State two reasons why bacteria are suitable.

[2]

Exercise 3.2 (a)

3.2 Bacteria are widely used in biotechnology.

(a) State two reasons why bacteria are suitable.

[2]

(a)

- any **two** of: reproduce fast / make complex molecules / contain plasmids / few ethical concerns

Exercise 3.2 (b)

3.2 Bacteria are widely used in biotechnology.

(b) State one product made using bacteria.

[1]

Exercise 3.2 (b)

3.2 Bacteria are widely used in biotechnology.

(b) State one product made using bacteria.

[1]

(b)

- any **one** of: **insulin** / **penicillin** / **mycoprotein**