

Exercise walk-through

21.3

Genetic modification

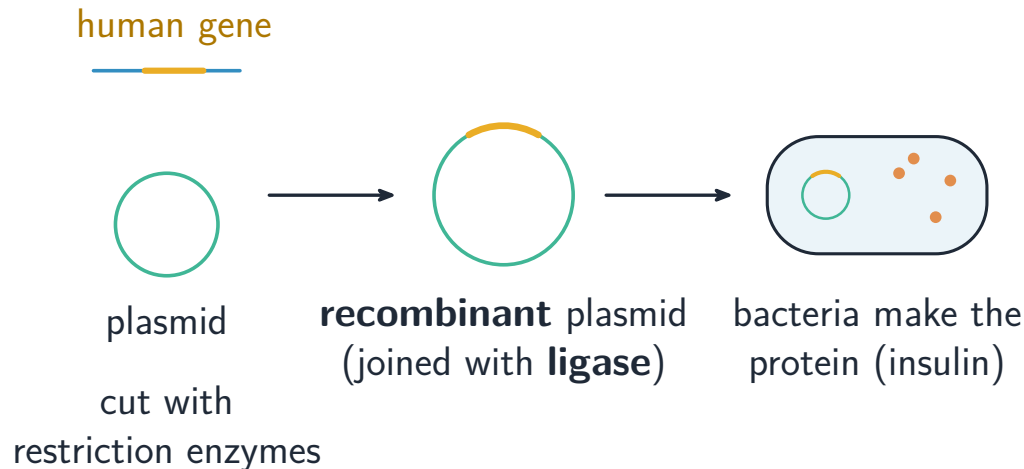
IGCSE Biology

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

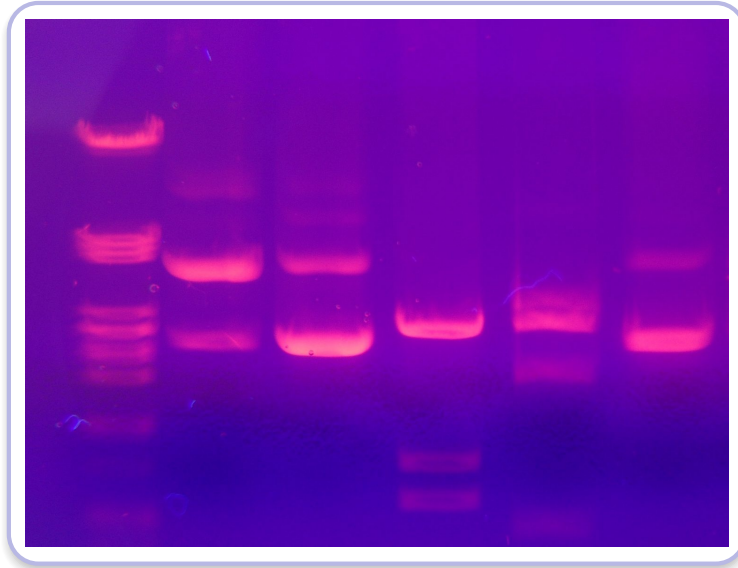
herbicide -resistant crops

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 Name the enzymes used to cut a gene out of DNA. [1]

2.2 Name the enzyme that joins the gene into a plasmid. [1]

Exercises 2.1-2.2

2.1 Name the enzymes used to cut a gene out of DNA. [1]

2.1

- genes are cut out with **restriction enzymes**
-

2.2 Name the enzyme that joins the gene into a plasmid. [1]

2.2

- the gene is joined into a plasmid by **(DNA) ligase**

Exercise 3.1

3.1 A plasmid carrying an inserted human gene is called a:

[1]

☐

A recombinant plasmid

B restriction enzyme

C ribosome

D chromosome

Exercise 3.1

3.1 A plasmid carrying an inserted human gene is called a:

[1]

☐

A recombinant plasmid

B restriction enzyme

C ribosome

D chromosome

3.1 A

- a plasmid carrying an inserted gene is a **recombinant plasmid**
- B is the cutting enzyme; C and D are not plasmids

Exercise 3.2 (a)

3.2 Human insulin can be made by genetically modified bacteria.

(a) Describe how the human gene is inserted into a bacterium.

[3]

Exercise 3.2 (a)

3.2 Human insulin can be made by genetically modified bacteria.

(a) Describe how the human gene is inserted into a bacterium.

[3]

(a)

- cut the human gene with **restriction enzymes**, leaving sticky ends
- cut a plasmid with the same enzyme and join with **ligase**
- put the recombinant plasmid into a bacterium, which **expresses the gene**

Exercise 3.2 (b)

3.2 Human insulin can be made by genetically modified bacteria.

(b) State one concern people have about GM crops.

[1]

Exercise 3.2 (b)

3.2 Human insulin can be made by genetically modified bacteria.

(b) State one concern people have about GM crops.

[1]

(b)

- any **one** of: concerns about **health** / effects on **wild species** / cost of GM seeds