

Exercise walk-through

Genetically modified organisms in agriculture ■ 19.3

eXercise

You must be able to

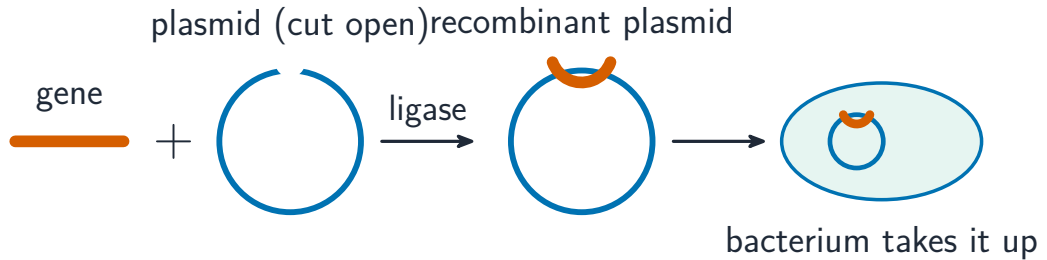
- explain how genetic engineering can improve the quality and productivity of crops and animals
- give the examples of GM salmon, herbicide-resistant soybean and insect-resistant cotton
- discuss the ethical and social implications of GMOs in food production

Method — Improving crops and animals

Genetic engineering can help feed a growing world by adding useful genes:

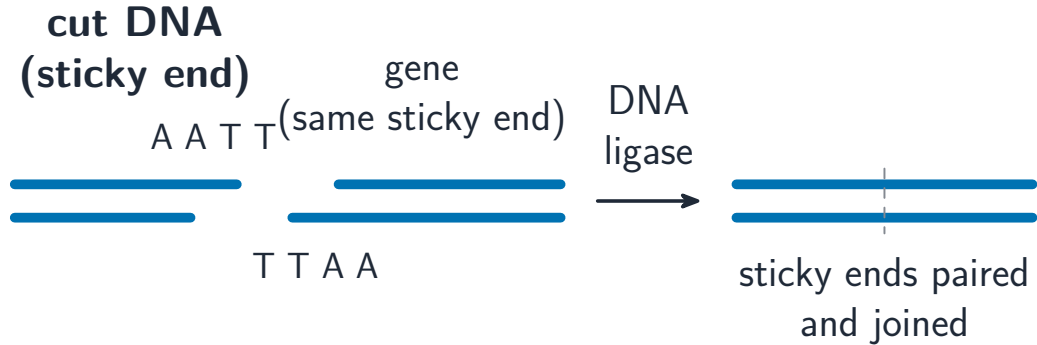
- **GM salmon 鲑鱼** — grow to size faster.
- herbicide-resistant **soybean 大豆** — weeds can be sprayed with a **herbicide 除草剂** without harming the crop.
- insect-resistant **cotton 棉花** — makes a protein that kills the insect **pests 害虫**.

Method — Improving crops and animals



A gene joined into a plasmid by ligase to make a recombinant plasmid, taken up by a cell

Method — Improving crops and animals



Restriction enzymes and ligase build the recombinant DNA

Method — Ethical and social implications

Concerns include: whether GMOs are safe to eat; their effect on the environment and wild species; whether the engineered genes might spread to wild plants; and whether a few large companies should control the food supply. These must be weighed against the benefits of higher yields.

Practice 2.1 ■ 2 marks

State the advantage to a farmer of growing herbicide-resistant soybean.

Solution 2.1

Method: Improving crops and animals

Worked steps

the field can be sprayed with herbicide to kill weeds **M1** without harming the crop, so the crop has less competition and a higher yield **A1**.

Practice 2.2 ■ 1 mark

State how insect-resistant cotton protects itself from pests.

Solution 2.2

Method: Improving crops and animals

Worked steps

it makes a protein that kills the insect pests that eat it **B1**.

Exam-style 3.1 ■ 1 mark

GM salmon have been engineered mainly to:

- A** resist herbicides
- B** grow to market size faster
- C** kill insect pests
- D** survive in fresh water

Solution 3.1

- A** resist herbicides
- B** grow to market size faster 
- C** kill insect pests
- D** survive in fresh water

Worked steps

- B.** GM salmon are engineered to grow to size faster.

Exam-style 3.2 ■ 1 mark

A concern about growing herbicide-resistant crops is that:

- A** the crop cannot photosynthesise
- B** the resistance gene might spread to wild plants (weeds)
- C** the crop needs no water
- D** the crop produces no seeds

Solution 3.2

Method: Improving crops and animals

- A the crop cannot photosynthesise
- B the resistance gene might spread to wild plants (weeds)** 
- C the crop needs no water
- D the crop produces no seeds

Worked steps

- B. The resistance gene could spread to wild plants.**

Exam-style 3.3 ■ 2 marks

- (a) Explain how insect-resistant cotton increases the yield of a crop.
- (b) Discuss **one** environmental and **one** social concern about growing GM crops.

Solution 3.3

Method: Improving crops and animals

Worked steps

- (a) the cotton makes a protein that kills insect pests **M1**; fewer pests eat the crop, so more survives — a higher yield **A1**.
- (b) environmental, e.g. harm to non-pest insects / gene spread to wild plants **B1**;
social, e.g. a few companies controlling the seed supply / cost to small farmers **B1**.

Exam-style 3.4 ■ 2 marks

Suggest why some people are cautious about eating food made from GMOs.

Solution 3.4

Method: Ethical and social implications

Worked steps

they may worry the food is not proven safe to eat **M1**, or have ethical objections to altering organisms' genes **A1**.