

19.3 Genetically modified organisms in agriculture

Name: _____ Class: _____ Date: _____

Total: 11 marks

KEY WORDS herbicide 除草剂 • gm salmon 鲑鱼 • gmos 转基因生物 • genetic engineering 基因工程
• soybean 大豆

Objective

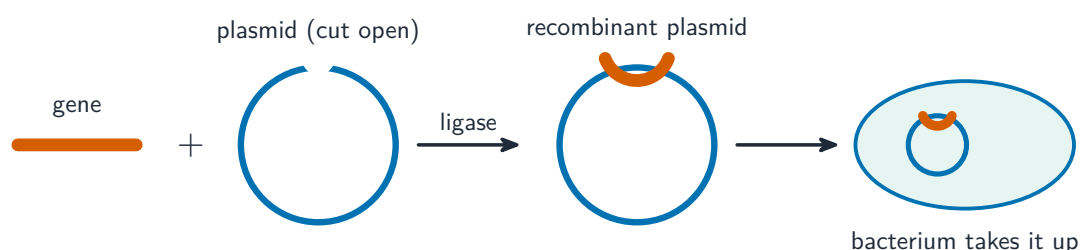
Build the skills to answer exam questions on **genetically modified organisms in agriculture** — how **GMOs** 转基因生物 improve crops and farm animals, and their ethical and social implications.

You must be able to:

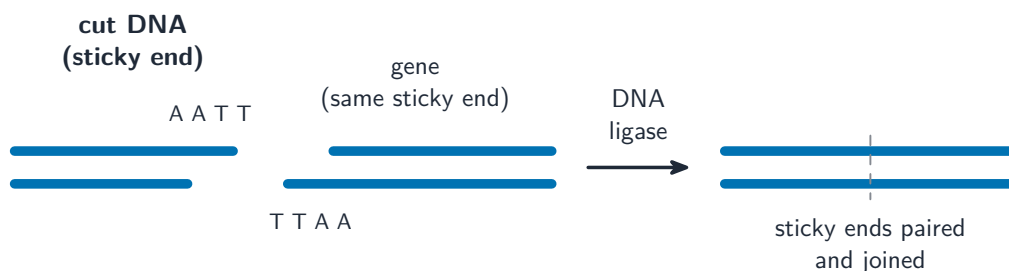
- explain how genetic engineering can improve the quality and productivity of crops and animals
- give the examples of GM salmon, herbicide-resistant soybean and insect-resistant cotton
- discuss the ethical and social implications of GMOs in food production

1 Worked examples

■ Improving crops and animals



The same gene-transfer tools are used to make a genetically modified organism



Restriction enzymes and ligase build the recombinant DNA

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.

■ 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.

2 Practice

2.1 State the advantage to a farmer of growing herbicide-resistant soybean. [2]

2.2 State how insect-resistant cotton protects itself from pests. [1]

3 Exam-style questions

3.1 GM salmon have been engineered mainly to: [1]

- **A** resist herbicides
 - **B** grow to market size faster
 - **C** kill insect pests
 - **D** survive in fresh water
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3.2 A concern about growing herbicide-resistant crops is that: [1]

- **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
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3.3 (a) Explain how insect-resistant cotton increases the yield of a crop. [2]

(b) Discuss **one** environmental and **one** social concern about growing GM crops. [2]

3.4 Suggest why some people are cautious about eating food made from GMOs. [2]

Solutions

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

2.2 it makes a protein that kills the insect pests that eat it.

3.1 B. GM salmon are engineered to grow to size faster.

3.2 B. The resistance gene could spread to wild plants.

3.3 (a) the cotton makes a protein that kills insect pests; fewer pests eat the crop, so more survives — a higher yield.

(b) environmental, e.g. harm to non-pest insects / gene spread to wild plants; social, e.g. a few companies controlling the seed supply / cost to small farmers.

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