

19.2 Genetic technology applied to medicine

Name: _____ Class: _____ Date: _____ **Total: 25 marks**

KEY WORDS breast cancer 乳腺癌 • gene therapy 基因治疗 • genetic screening 基因筛查
• insulin 胰岛素 • recombinant human proteins 重组人蛋白

Objective

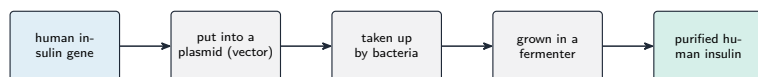
Build the skills to answer exam questions on **genetic technology applied to medicine** — **recombinant human proteins** 重组人蛋白, **genetic screening** 基因筛查, **gene therapy** 基因治疗, and their ethical issues.

You must be able to:

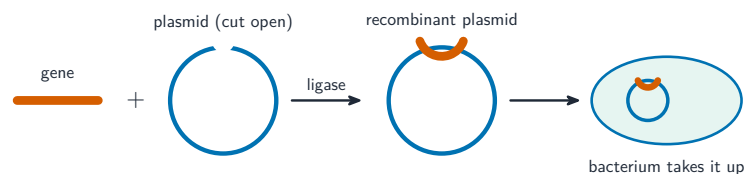
- explain the advantages of recombinant human proteins (insulin, factor VIII, ADA)
- outline genetic screening (BRCA, Huntington's, cystic fibrosis) and gene therapy (SCID)
- discuss social and ethical considerations

1 Worked examples

■ Recombinant human proteins



The insulin gene goes into bacteria, which become living factories — an exact human copy, never in short supply



A plasmid vector carries the human gene into bacteria

A human gene is placed in bacteria so they make a **recombinant** human protein — an exact copy. Advantages: it is identical to the human protein, never in short

supply, and avoids using animal/donor proteins (so fewer allergic reactions or infections). Examples: **insulin** 胰岛素 (diabetes), **factor VIII** (haemophilia), **adenosine deaminase** (a faulty immune system).

■ Genetic screening and gene therapy

Genetic screening tests DNA for disease alleles before symptoms appear — e.g. **BRCA1/BRCA2** (breast cancer risk), **Huntington's disease**, **cystic fibrosis** 囊性纤维化. **Gene therapy** puts a working gene into a patient's cells — used for **SCID** (failed immune system) and some inherited eye diseases.

■ Ethics

Concerns: who may see your results; misuse by insurers/employers; safety and permanence of changes; who decides. These are weighed against the benefits.

2 Practice

2.1 State **two** advantages of using recombinant human insulin rather than insulin from animals. [2]

2.2 Name **one** disease that can be detected by genetic screening. [1]

3 Exam-style questions

3.1 Gene therapy treats a genetic disease by: [1]

A	B
C	D

- A giving the patient a recombinant protein
- B putting a working copy of a gene into the patient's cells
- C screening the patient's DNA
- D removing the faulty allele from all body cells permanently

3.2 Which is an advantage of making insulin from genetically engineered bacteria? [1]

A	B
C	D

- A it is slightly different from human insulin
- B it is identical to human insulin and never in short supply
- C it must be extracted from animal pancreases
- D it cannot be purified

3.3 (a) Explain **one** advantage of genetic screening for a person with a family history of Huntington's disease. [2]

(b) Discuss **one** ethical concern raised by genetic screening. [2]

3.4 Explain how gene therapy could help a child with SCID. [2]

3.5 Human insulin for treating diabetes is produced by genetically modified bacteria.

(a) Describe how the human insulin gene is obtained and inserted into a bacterium, naming the enzymes and the vector used. [5]

(b) Explain why a marker gene is included, and describe how it is used. [3]

(c) Explain **two** advantages of using recombinant human insulin rather than insulin extracted from animals. [2]

(d) Distinguish between genetic screening and gene therapy, and state one ethical concern raised by each. [4]
