# AQA Biology A-level

## 8.4 - Gene technologies

Flashcards

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What is meant by recombinant DNA technology?

What is meant by recombinant DNA technology?

The transfer of DNA fragments from one organism to another.

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Why does recombinant DNA technology work?

Why does recombinant DNA technology work?

Because the genetic code is universal, and therefore transcription and translation occur by the same mechanism and result in the same amino acid sequence across organisms.

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Summarise the process of using reverse transcriptase to produce DNA fragments.

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Summarise the process of using reverse transcriptase to produce DNA fragments.

mRNA complementary to the target gene is used as a template. It is mixed with free nucleotides which match up to their base pairs, and reverse transcriptase which forms the sugar-phosphate backbone, to create cDNA (complementary DNA).

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Summarise the process of using enzymes to produce DNA fragments.



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## Summarise the process of using enzymes to produce DNA fragments.

Restriction endonucleases (RE) cut DNA at specific sequences. Different REs cut at different points but one RE will always cut at the same sequence. Therefore using particular REs allows you to cut out a certain gene of interest.

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In which two ways can we amplify DNA fragments?

In which two ways can we amplify DNA fragments?

- *In vitro* / polymerase chain reaction (PCR)
- *In vivo* / using host cells

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Describe the reaction mixture in the first stage of PCR.

Describe the reaction mixture in the first stage of PCR.

Contains the DNA fragment to be amplified, primers that are complementary to the start of the fragment, free nucleotides to match up to exposed bases, and DNA polymerase to create the new DNA.

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Summarise the process of amplifying DNA fragments using PCR.

Summarise the process of amplifying DNA fragments using PCR.

1. Heated to break apart the DNA strands.
2. Cooled to allow primers to bind.
3. Heated again to activate DNA polymerase and allow free nucleotides to join.
4. New DNA acts as template for next cycle.

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Summarise the process of inserting a DNA fragment into a vector.

Summarise the process of inserting a DNA fragment into a vector.

A plasmid (circular DNA from bacteria) is used as the vector, and is cut using the same restriction enzymes as the DNA, so that the ends are complementary. DNA ligase joins the fragment and plasmid together.

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Summarise the process of inserting a vector into a host cell.

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Summarise the process of inserting a vector into a host cell.

Known as cell transformation. The host cells (bacteria) are mixed with the vectors in an ice-cold solution, then heat shocked to encourage the cells to take up the vectors. The cells can then be grown and the DNA fragment will be cloned.

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Summarise the process of identifying transformed cells.

Summarise the process of identifying transformed cells.

Marker genes e.g. coding for fluorescence can also be inserted into vectors along with the DNA. When cells begin to grow, UV light can be used to identify which cells have taken up the vector and which haven't.

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How can DNA probes be used to locate specific alleles?

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How can DNA probes be used to locate specific alleles?

The probe is designed so that its sequence is complementary to the allele you want to find. They are labelled, amplified using PCR, then added to a sample of single stranded DNA. The probe will bind if the allele is present.

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Give some applications of DNA probes.

Give some applications of DNA probes.

- To screen someone’s DNA for a particular heritable health condition.
- To identify a gene for use in genetic engineering.
- To predict how someone will respond to a drug.

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What is the purpose of DNA hybridisation?

What is the purpose of DNA hybridisation?

To measure the degree of difference between two strands of DNA. Can be used to compare someone's DNA to a certain gene to see if they have it.

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Summarise the process of DNA hybridisation.

Summarise the process of DNA hybridisation.

One DNA strand is labelled and mixed with an unlabelled comparison strand. The more similar the strands, the more strongly they will bind, and more energy will be required to break the strands apart.

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What are the benefits of genetic profiling?

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What are the benefits of genetic profiling?

Can identify heritable diseases very early, and therefore begin to treat them before symptoms develop, reducing impact on the individual. Treatment can also be personalised to make it more effective.

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What is genetic fingerprinting?



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## What is genetic fingerprinting?

A technique used to compare two DNA samples and determine whether they came from the same individual.

How does genetic fingerprinting work?

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How does genetic fingerprinting work?

Every organism's genome contains non-coding regions called variable number tandem repeats (VNTRs). The probability of two individuals having the same VNTRs is very low, so we can compare these areas to see if two DNA samples came from the same person.

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Summarise the process of genetic fingerprinting analysis.

Summarise the process of genetic fingerprinting analysis.

DNA sample obtained, VNTRs cut out using restriction enzymes, labelled, and cloned using PCR. Fragments separated using gel electrophoresis. Banding patterns of each sample can then be compared.

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How does gel electrophoresis work?

How does gel electrophoresis work?

DNA fragments are placed at one end of a slab of gel. An electric current is applied, causing the DNA fragments to move towards the other end of the gel. Shorter fragments travel further. The pattern of bands created is unique to every individual.

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Give applications of genetic fingerprinting.

Give applications of genetic fingerprinting.

- Forensics e.g. to identify victims or suspects.
- Medical diagnosis e.g. to identify type of haemoglobin produced by an individual to diagnose sickle cell anaemia.
- Animal and plant breeding e.g. breed out harmful alleles, ensure pedigree.

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