

# DNA Technology



## DNA Extraction

- **Chemical treatments** cause cells and nuclei to burst
- The DNA is inherently **sticky**, and can be pulled out of the mixture
- This is called **"spooling"** DNA



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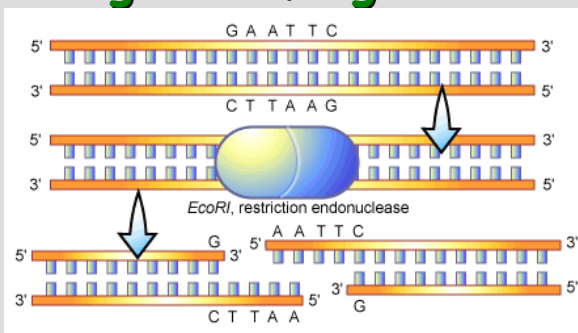
# "Spooled" DNA



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# Cutting DNA

- **Restriction enzymes** cut DNA at specific sequences
- Useful to divide DNA into **manageable fragments**

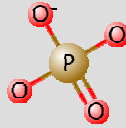


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# Electrophoresis

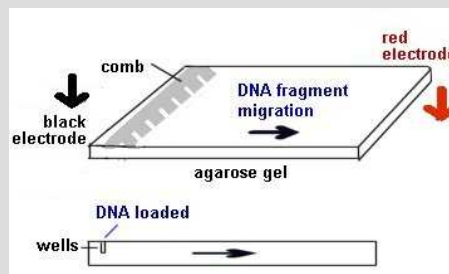
- DNA can be separated based on **size and charge**
- The **phosphate groups** are **negatively charged**
- DNA is placed in a **gel** and electricity is run through



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# Electrophoresis

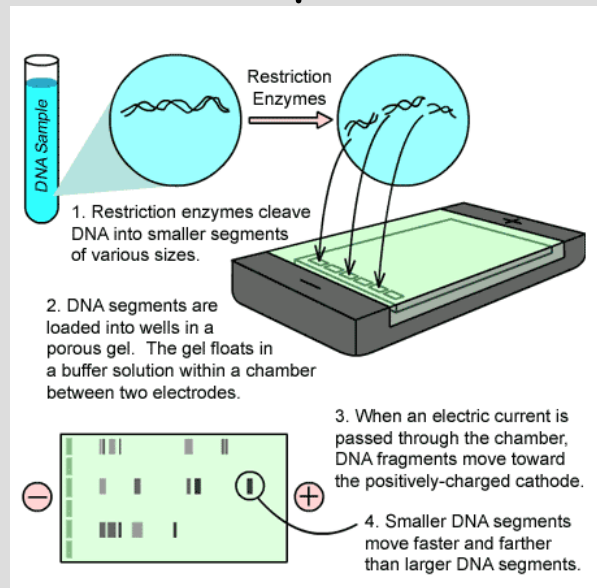
- **Negative DNA** moves toward the positive end
- **Smaller** fragments move farther and faster



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# Electrophoresis



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# Steps in DNA Sequencing

- Many **copies** of a single strand of DNA are placed in a test tube
- **DNA polymerase** is added
- A mixture of nucleotides is added some of which have **dye molecules attached**
- **Each base (A, T, C, G) has a different color dye**



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## Steps in DNA Sequencing

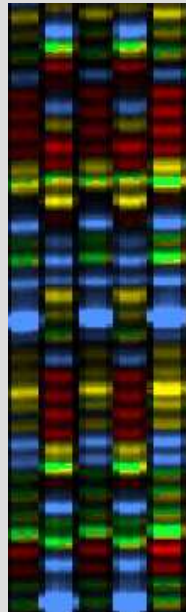
- By chance, **some dyed nucleotides & some regular ones** are added
- Dye molecules are large and **stop the chain** from growing



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## DNA Sequencing

- The **result** is DNA fragments of **multiple sizes with colors that can be identified**



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# DNA Sequencing

- After the gel separates the resulting fragments by size, we 'read' the sequence from bottom to top.

```

Frame 1
000001 AGCCCGCTGAGGGGTATTGAGATGTACCCACACGCTACTCTACTTCCACTAAATATAATGG
000065 TCTCTAGGTCCTGGAGAGGAAATGTTTTTACGAGAAAGCCTAGTATCCGGTTACGAGGGA
000129 CCTCATCCGGAACGGTCTATCCTACGACTGACACTGGATACAGCTCTCCATTCCGTCACGAGACC
000193 AAGTTGAG

Frame 2
000001 AGCCCGCTGAGGGGTATTGAGATGTACCCACACGCTACTCTACTTCCACTAAATATAATGG
000065 TCTCTAGGTCCTGGAGAGGAAATGTTTTTACGAGAAAGCCTAGTATCCGGTTACGAGGGA
000129 CCTCATCCGGAACGGTCTATCCTACGACTGACACTGGATACAGCTCTCCATTCCGTCACGAGACC
000193 AAGTTGAG

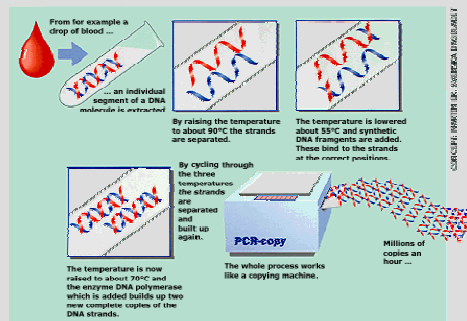
Frame 3
000001 AGCCCGCTGAGGGGTATTGAGATGTACCCACACGCTACTCTACTTCCACTAAATATAATGG
000065 TCTCTAGGTCCTGGAGAGGAAATGTTTTTACGAGAAAGCCTAGTATCCGGTTACGAGGGA
000129 CCTCATCCGGAACGGTCTATCCTACGACTGACACTGGATACAGCTCTCCATTCCGTCACGAGACC
000193 AAGTTGAG
    
```



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# Copying DNA

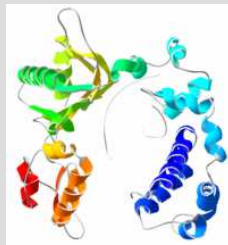
- **Polymerase Chain Reaction**
- Also called PCR
- A method of making many copies of a piece of DNA



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## Steps in Copying DNA

- A DNA molecule is placed in a small test tube
- **DNA polymerase** that can work at high temps is added



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## Steps in Copying DNA

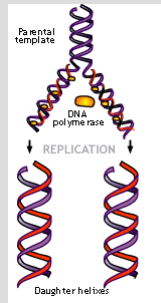
- The **DNA is heated** to separate the two strands
- **Primers**, short pieces of DNA complementary to the ends of the molecule to be copied, are added



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# Copying DNA

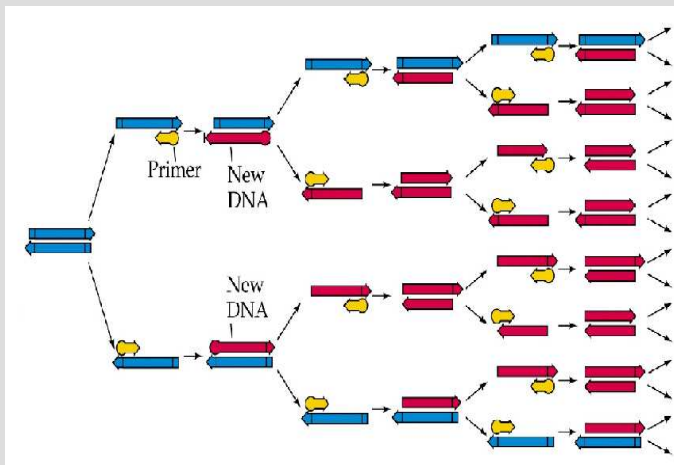
- The tube is cooled, and **DNA polymerase adds new bases to the separated strands**



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# PCR



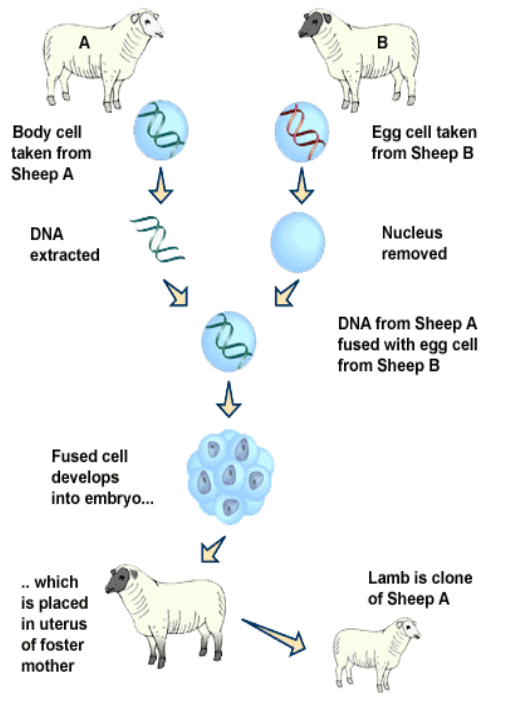
**Large amounts of DNA can be made from a small starting sample**

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# Cloning

- **Clone**- a member of a group of genetically identical cells
- May be produced by **asexual reproduction** (mitosis)



# Cloning organisms

- A **body cell** from one organism and an **egg cell** from another are fused
- The resulting cell **divides like a normal embryo**



# Cloning "Dolly"



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