

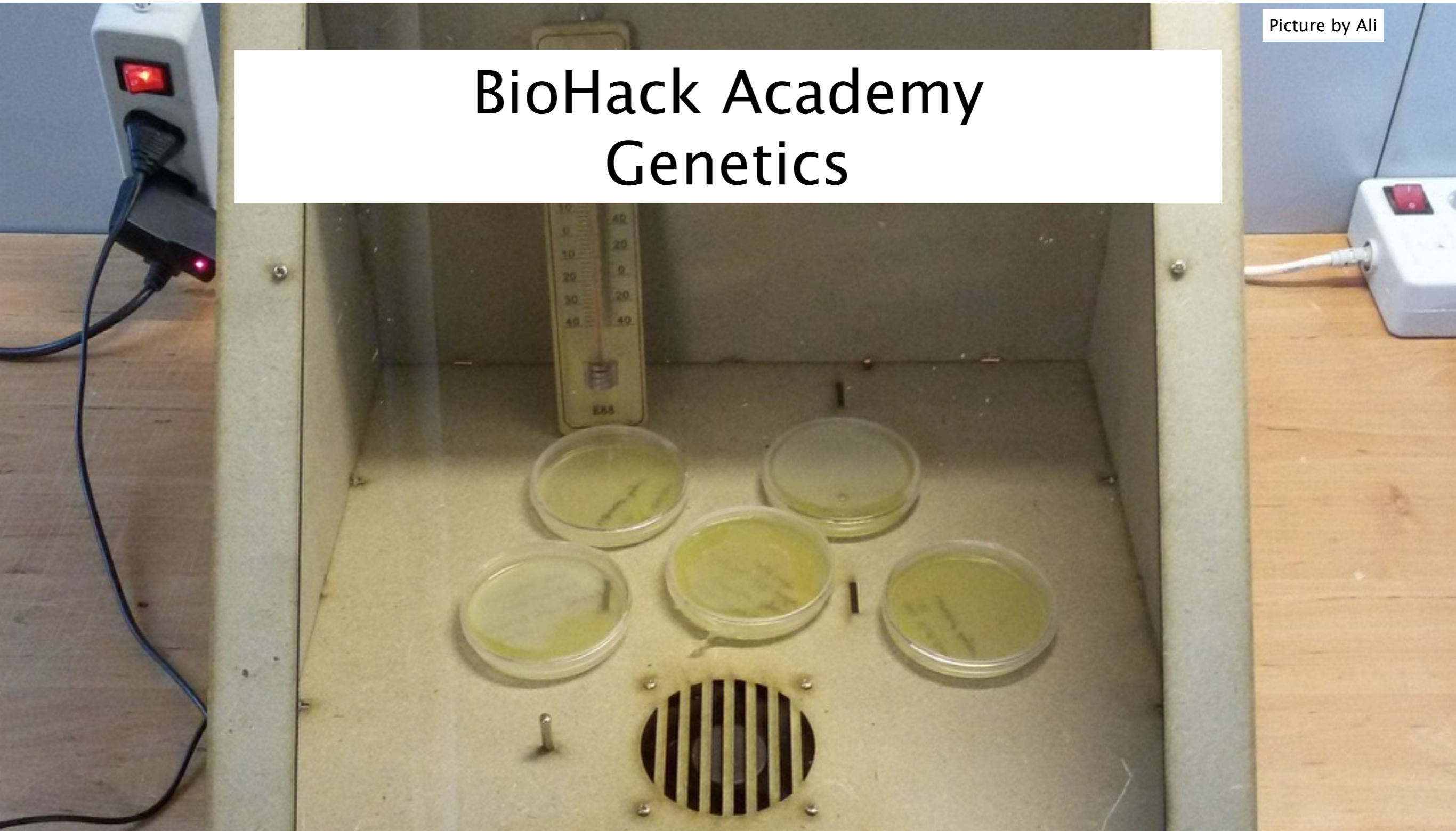


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Picture by Ali

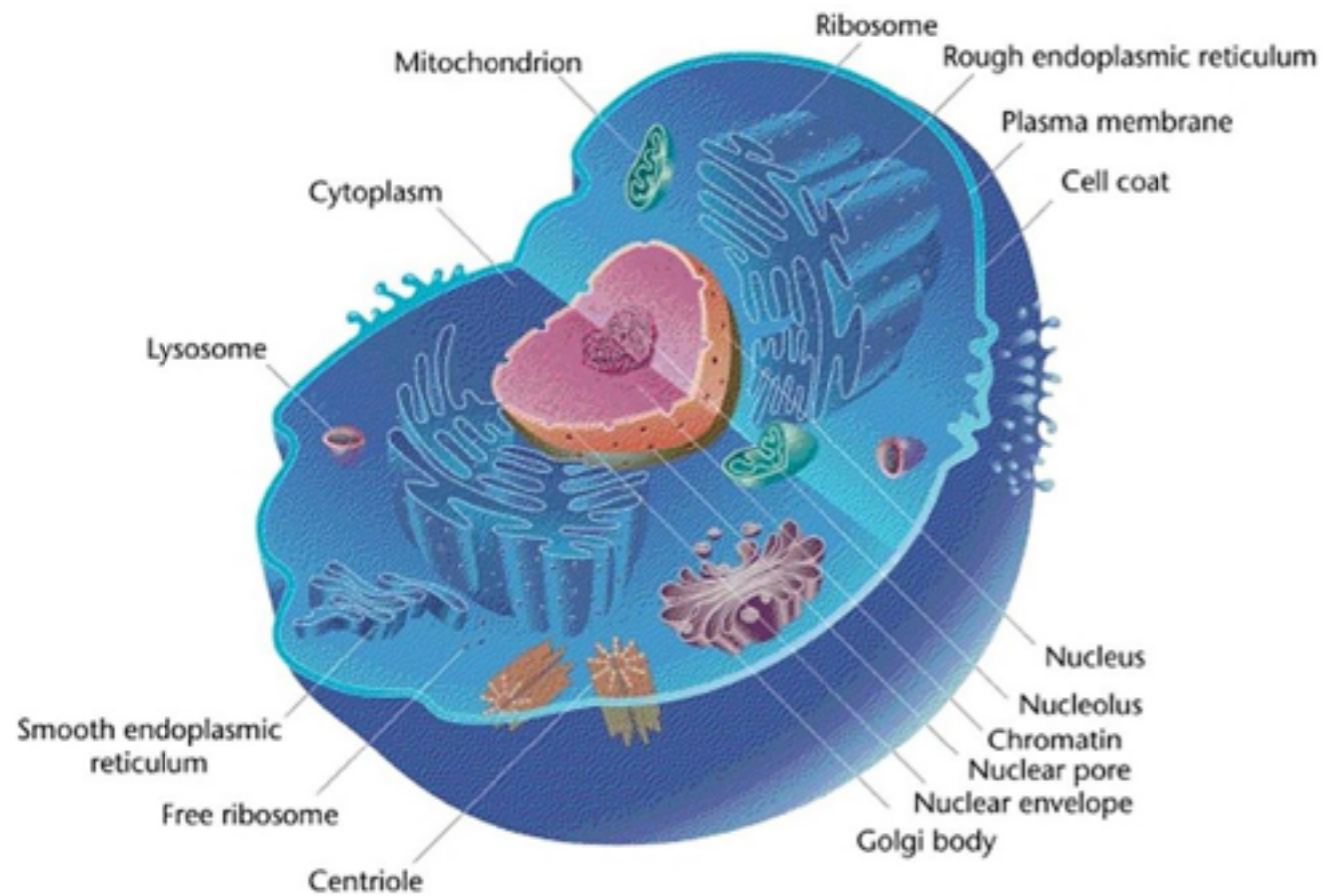
# BioHack Academy Genetics



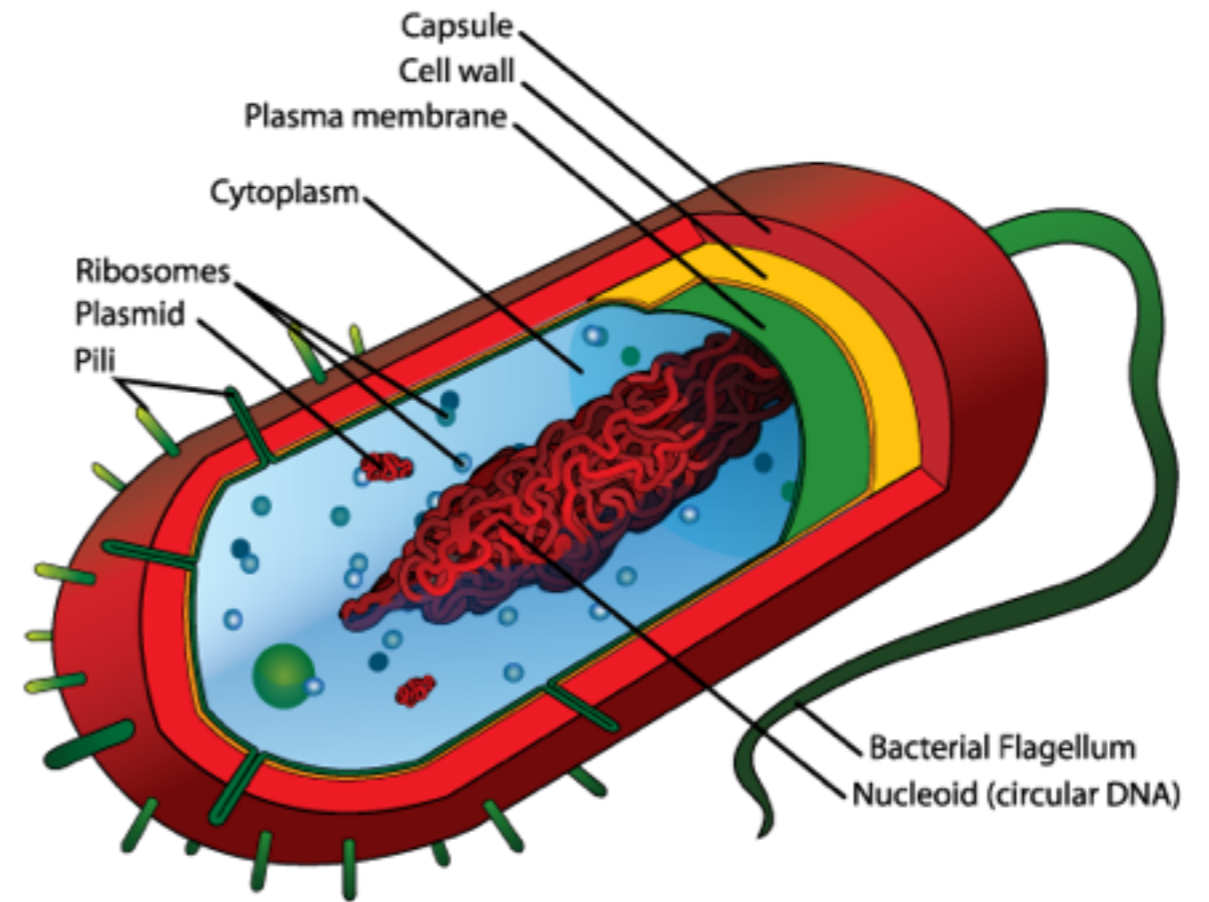


# Two main categories

## Eukaryotic cell

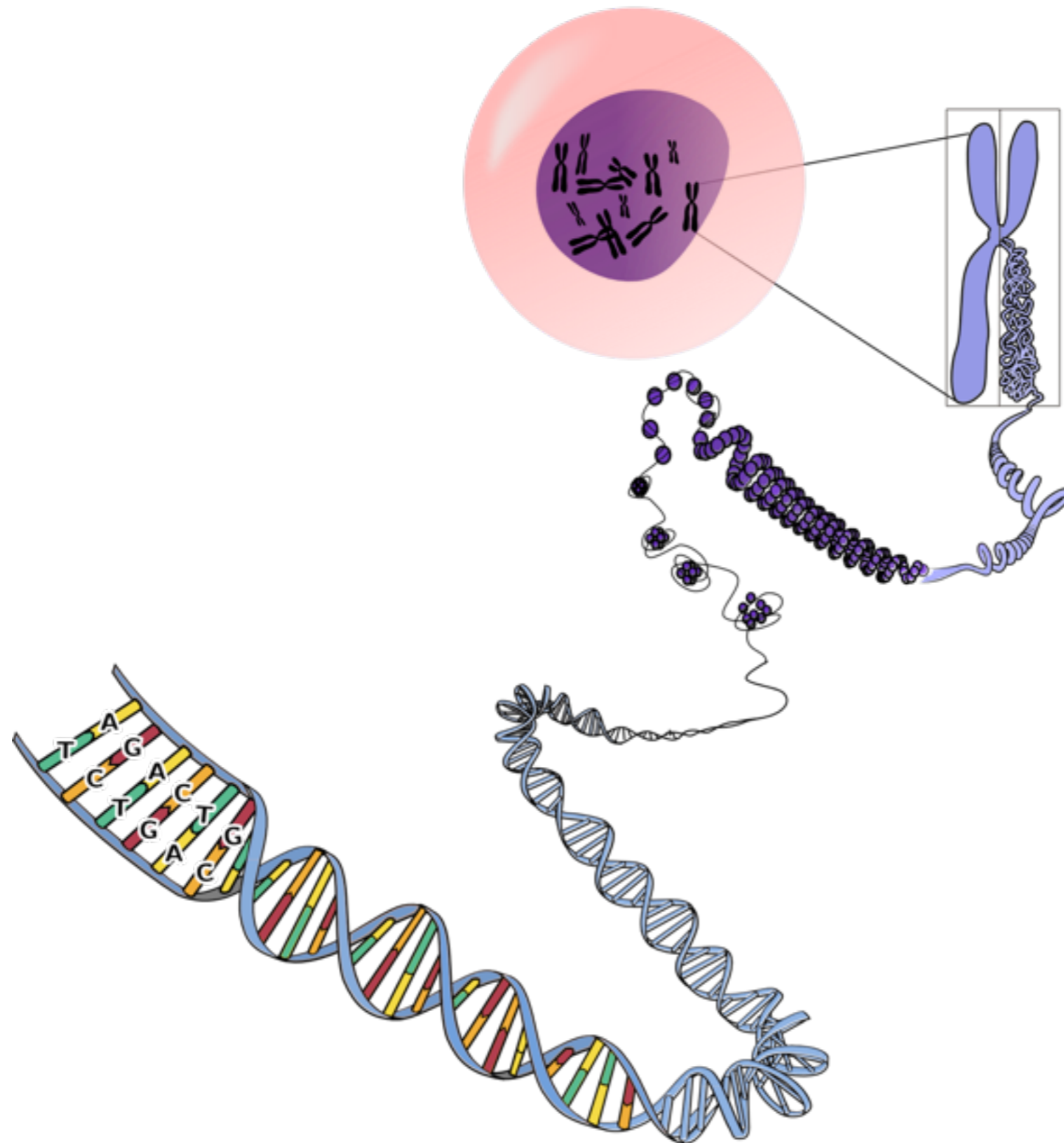


## Prokaryotic cell



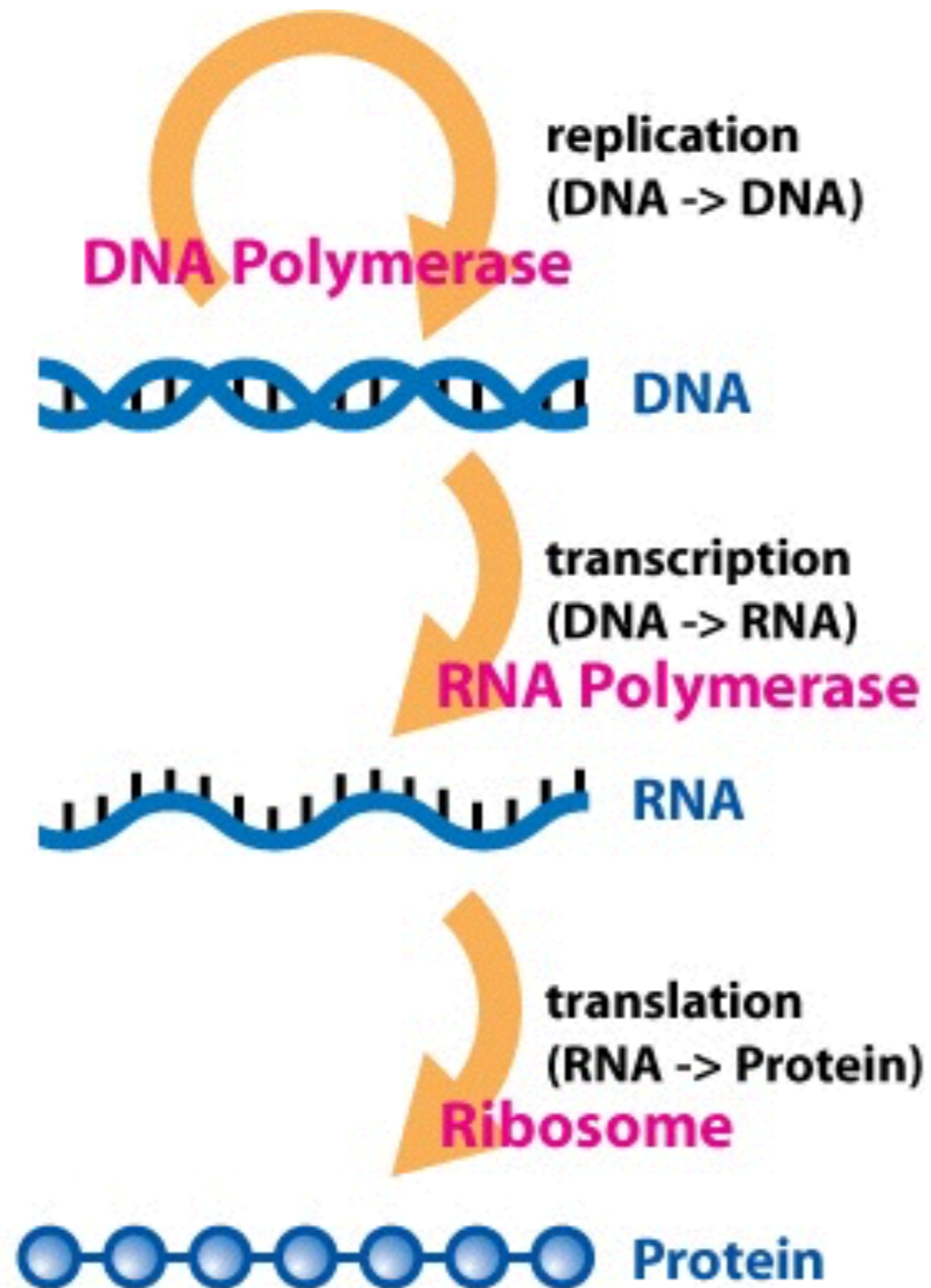


# DNA in the cell





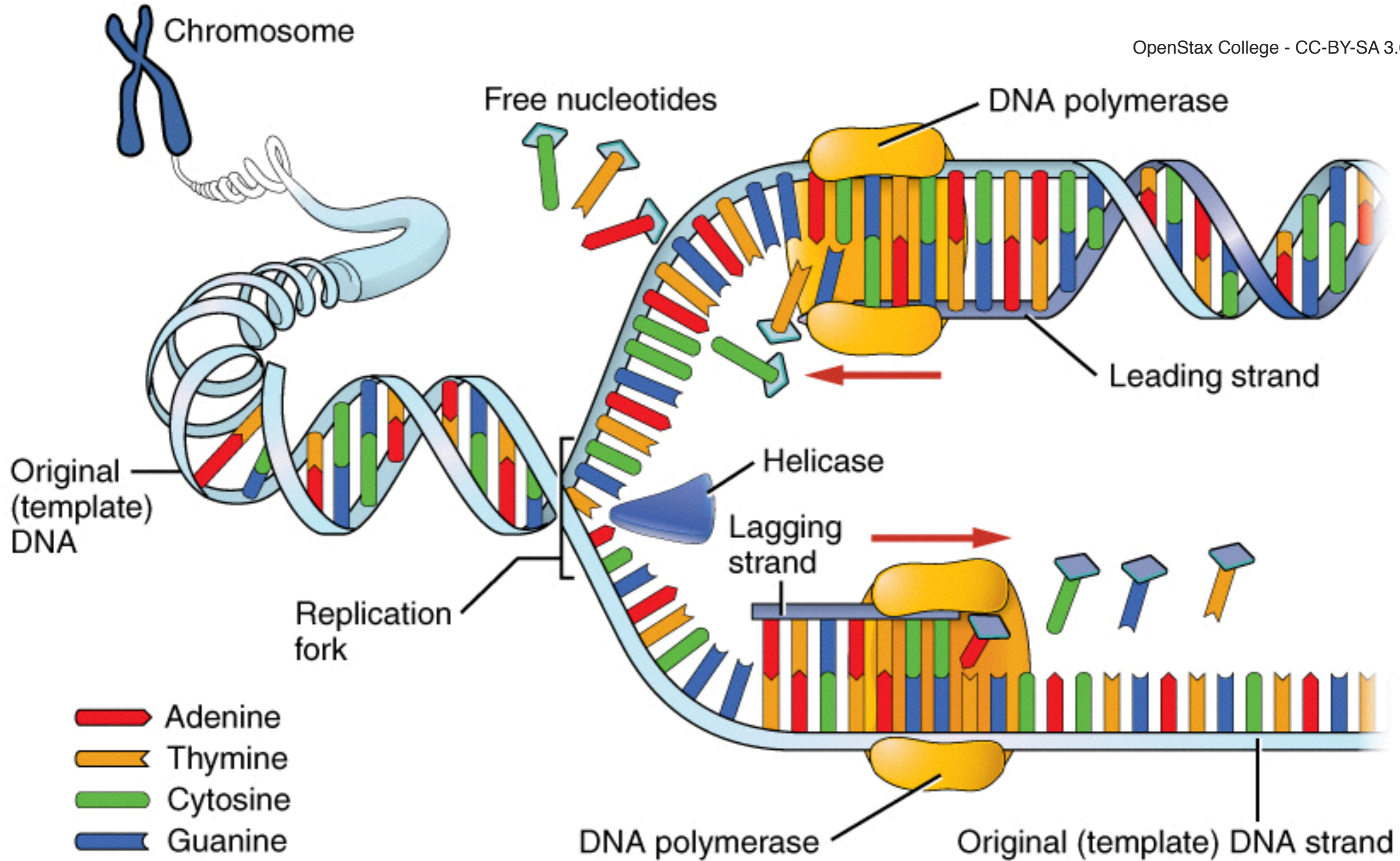
# Central Dogma





# DNA Replication

OpenStax College - CC-BY-SA 3.0





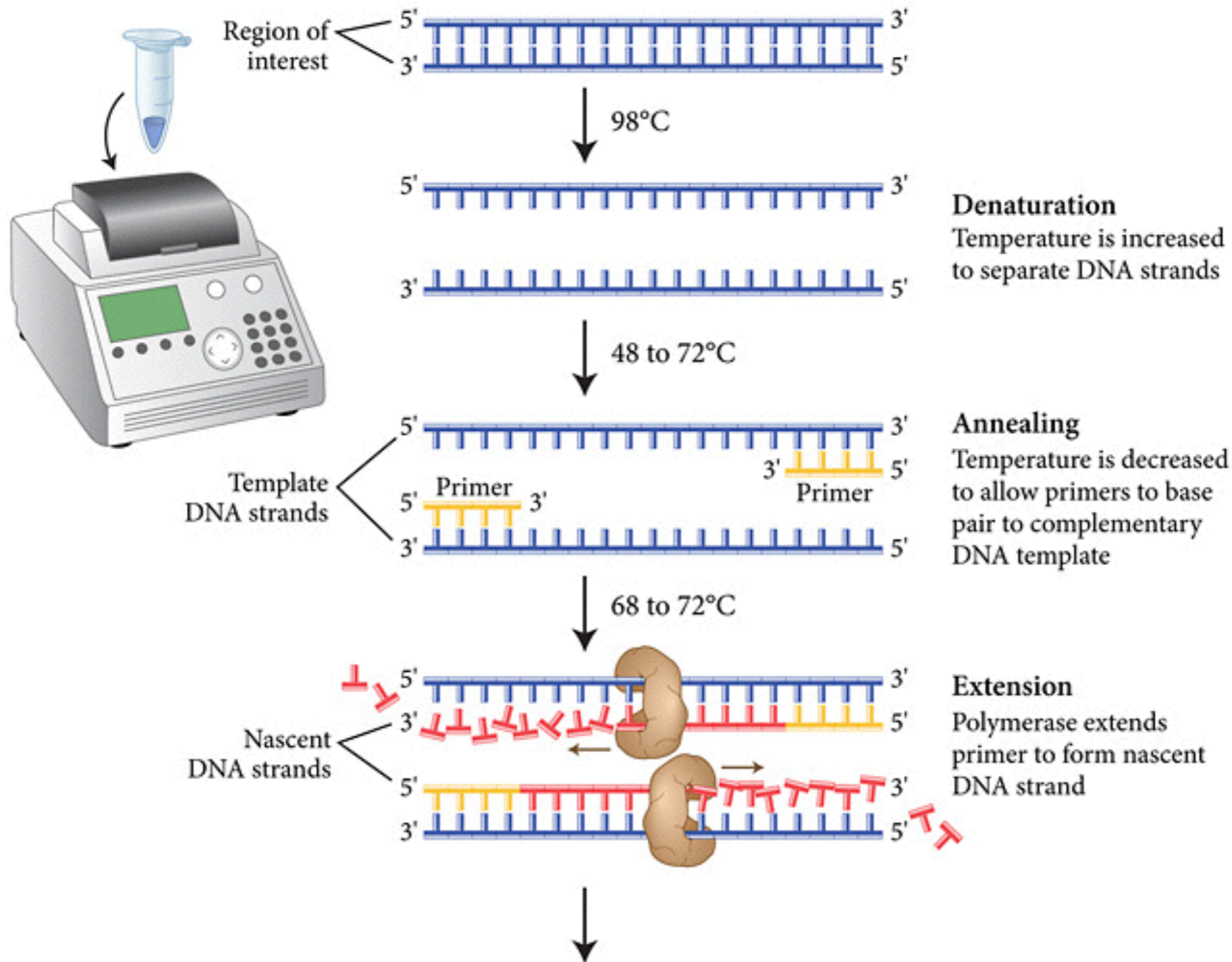
# Polymerase Chain Reaction, 1983



Kary Mullis

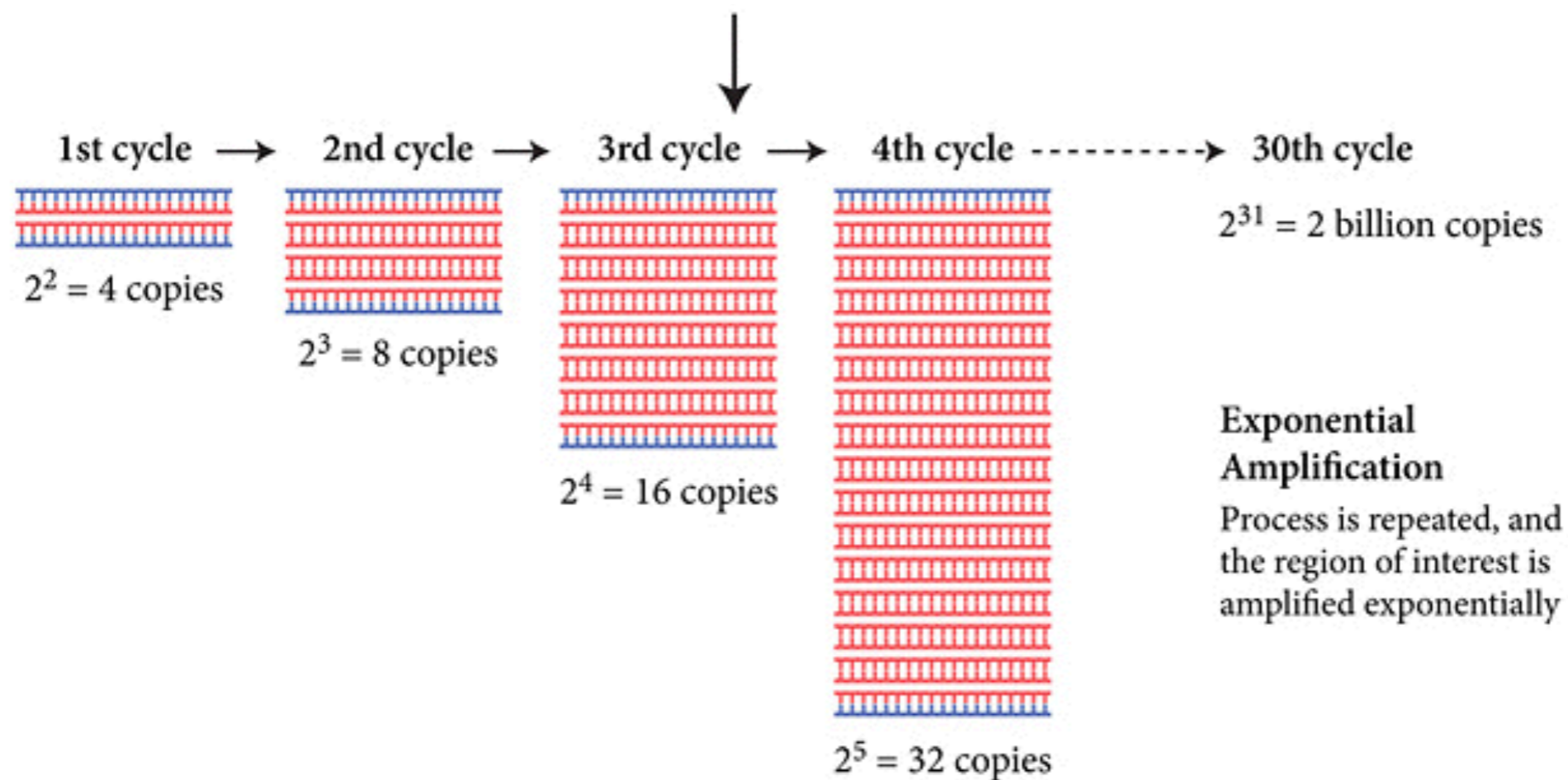


# Polymerase Chain Reaction





# Polymerase Chain Reaction







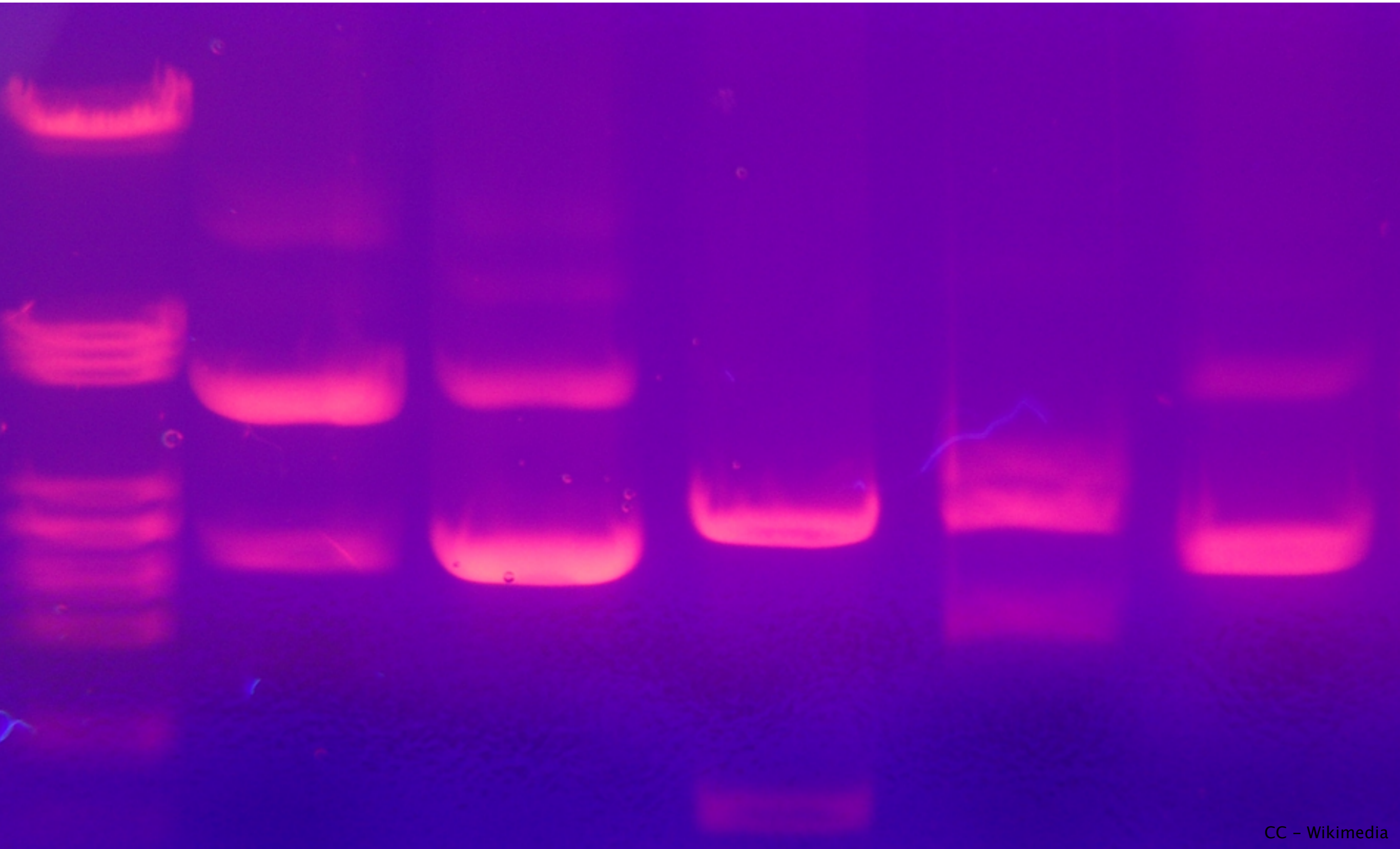
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# DNA fingerprinting



# DNA fingerprint





# Sushi test





# PooPrints

**PooPrints™**  
Match The Mess Through DNA



**DNA Collection Kit**

D305-520

**BioPet Vet Lab**  
A DIVISION OF GENES BIOTECH CORPORATION  
1-866-883-7389

**PET Identification Card**

DNA PET ID  
1-866-883-7389

**Customer Information Card**  
*\*Required Information*

**Account Information**

\*Country: \_\_\_\_\_  
\*Email: \_\_\_\_\_  
\*Your Name: \_\_\_\_\_  
\*Address: \_\_\_\_\_  
\*City, State, Zip \_\_\_\_\_  
Phone: \_\_\_\_\_

**Pet Information**

**Apply Barcode Sticker Here**

\*Pet's Name: \_\_\_\_\_  
\*Pet's Species: \_\_\_\_\_ Dog \_\_\_\_\_ Cat  
Where did you purchase your DNA Pet ID Kit?  
Company: \_\_\_\_\_

**BioPet Vet Lab**  
A DIVISION OF GENES BIOTECH CORPORATION


**DNA World Pet Registry**

**BioPet Vet Lab**  
A DIVISION OF GENES BIOTECH CORPORATION

Affix barcode sticker OR write dog's name here

**BioPet Vet Lab**  
A DIVISION OF GENES BIOTECH CORPORATION

**DNA World Pet Registry**



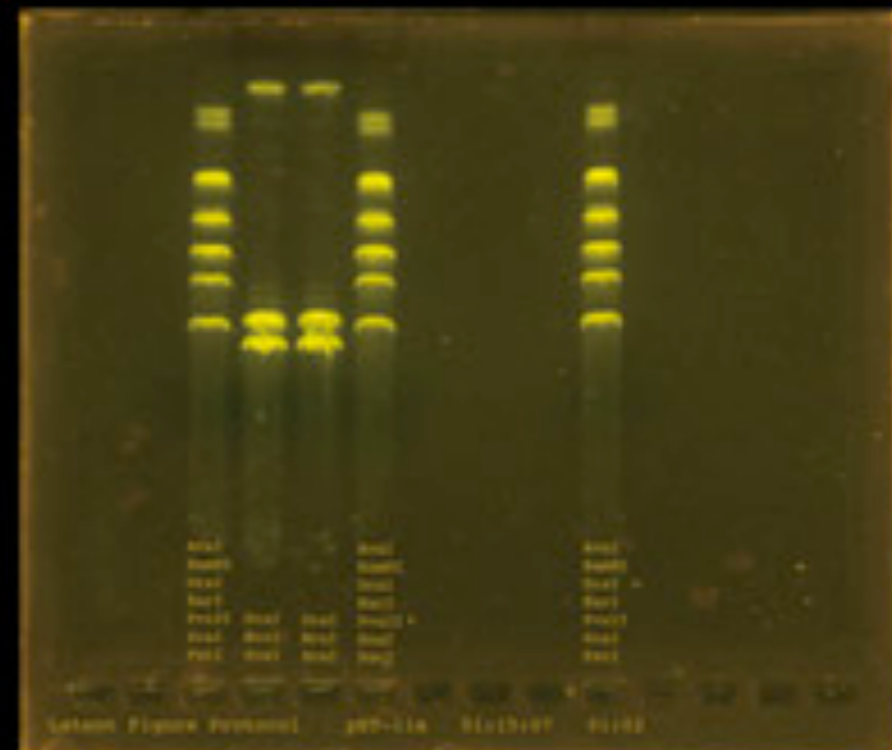
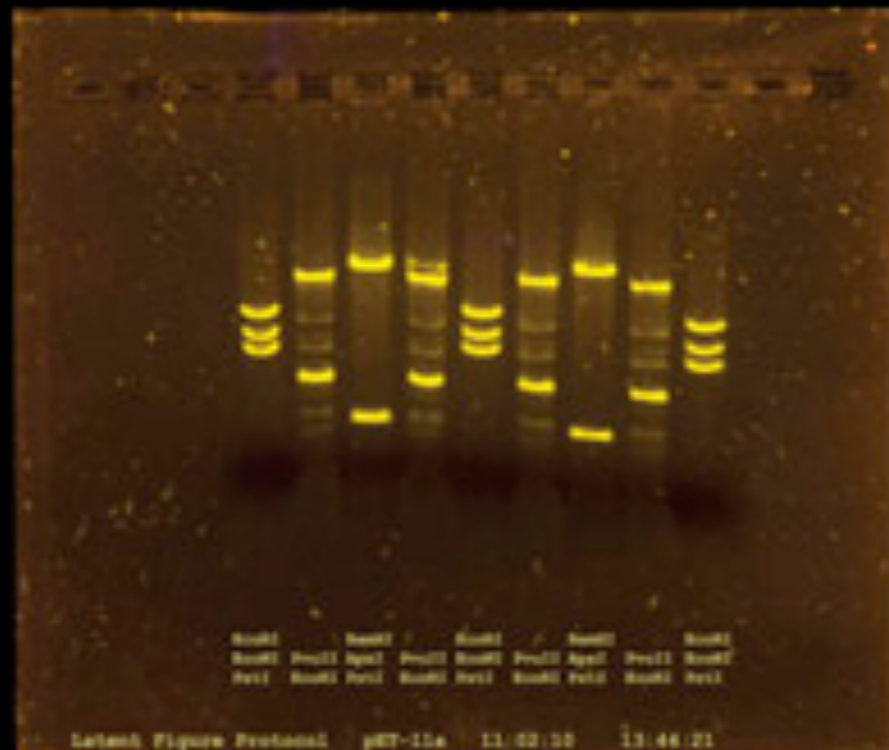
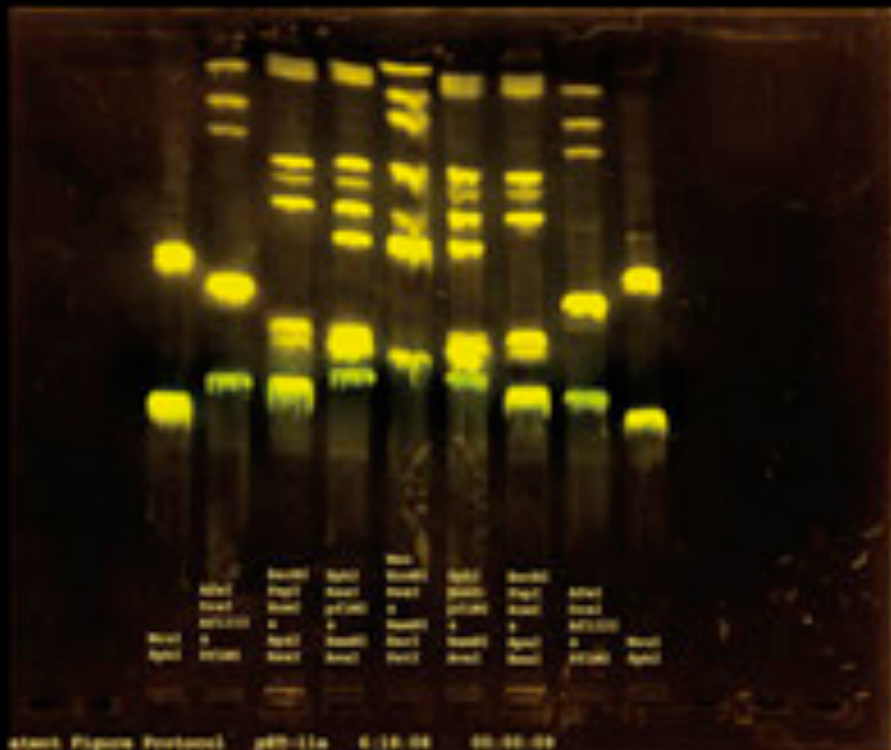
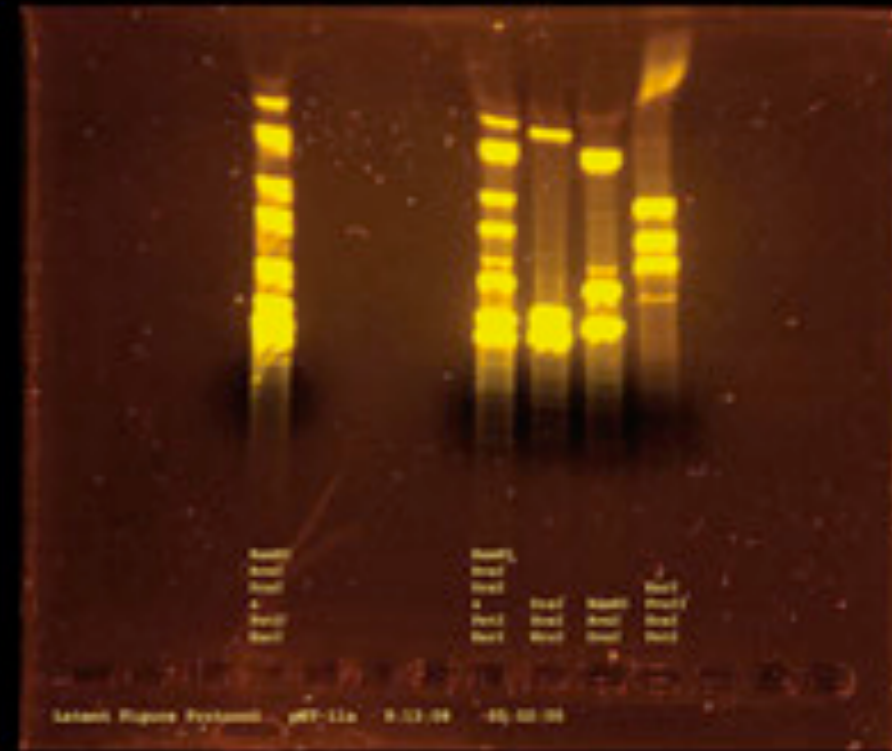
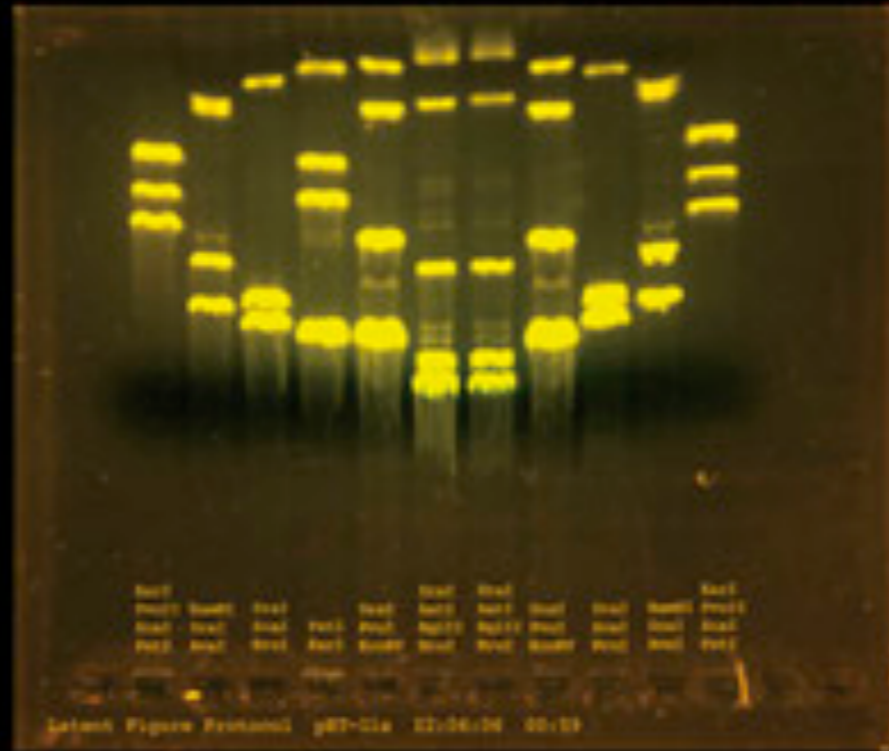
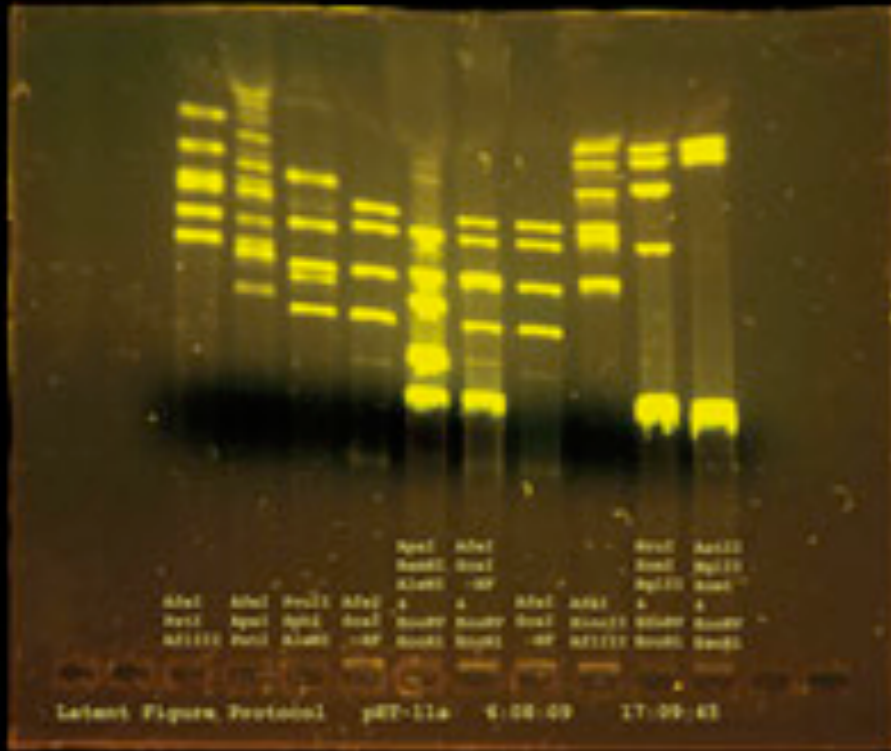


# Barcode





# Paul Vanouse





Paul Vanouse





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# DNA restriction

a.k.a cutting DNA





# Sequence specific cuts

Restrictie site

Palindrome



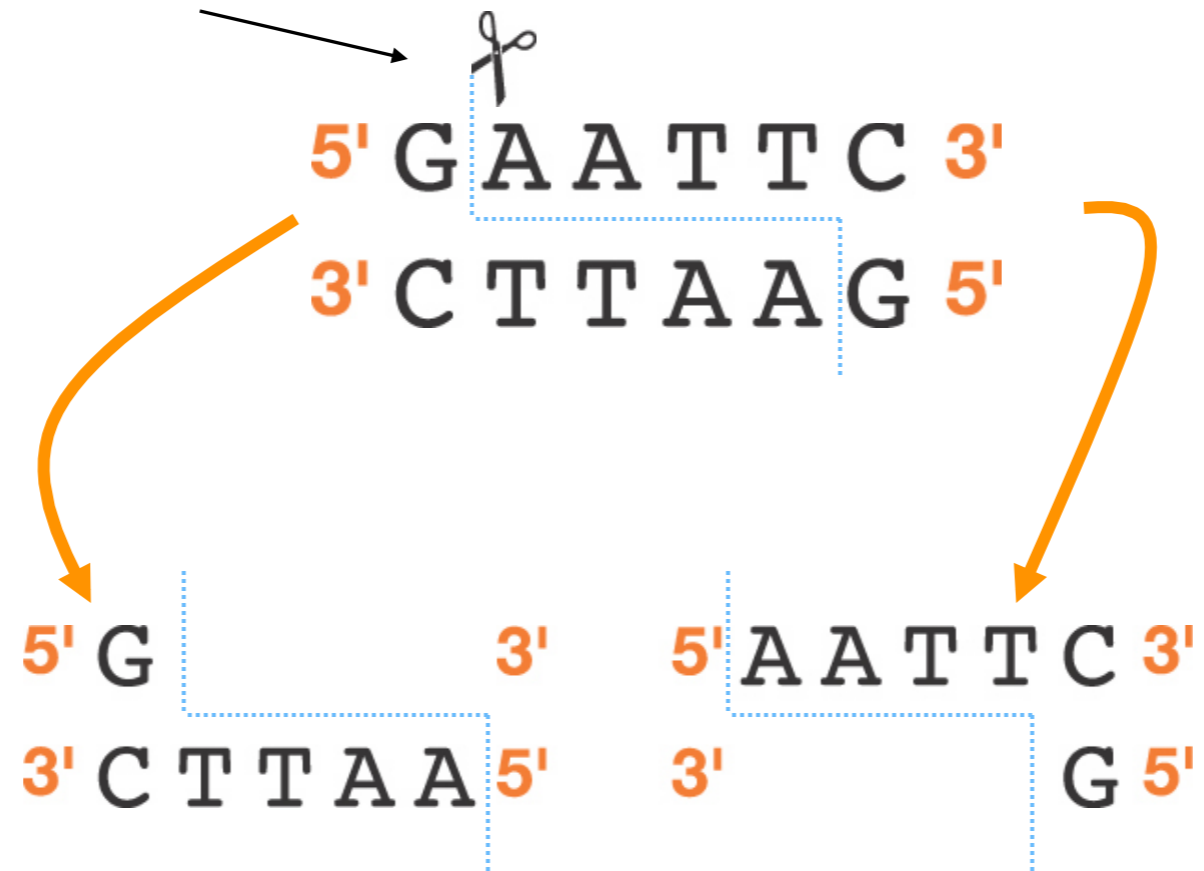
Fragment 1

Fragment 2



# 5 vs 3 accent overlap

cut site





# EcoRI en PstI



## EcoRI

- Escherichia coli
- 5 prime overlap



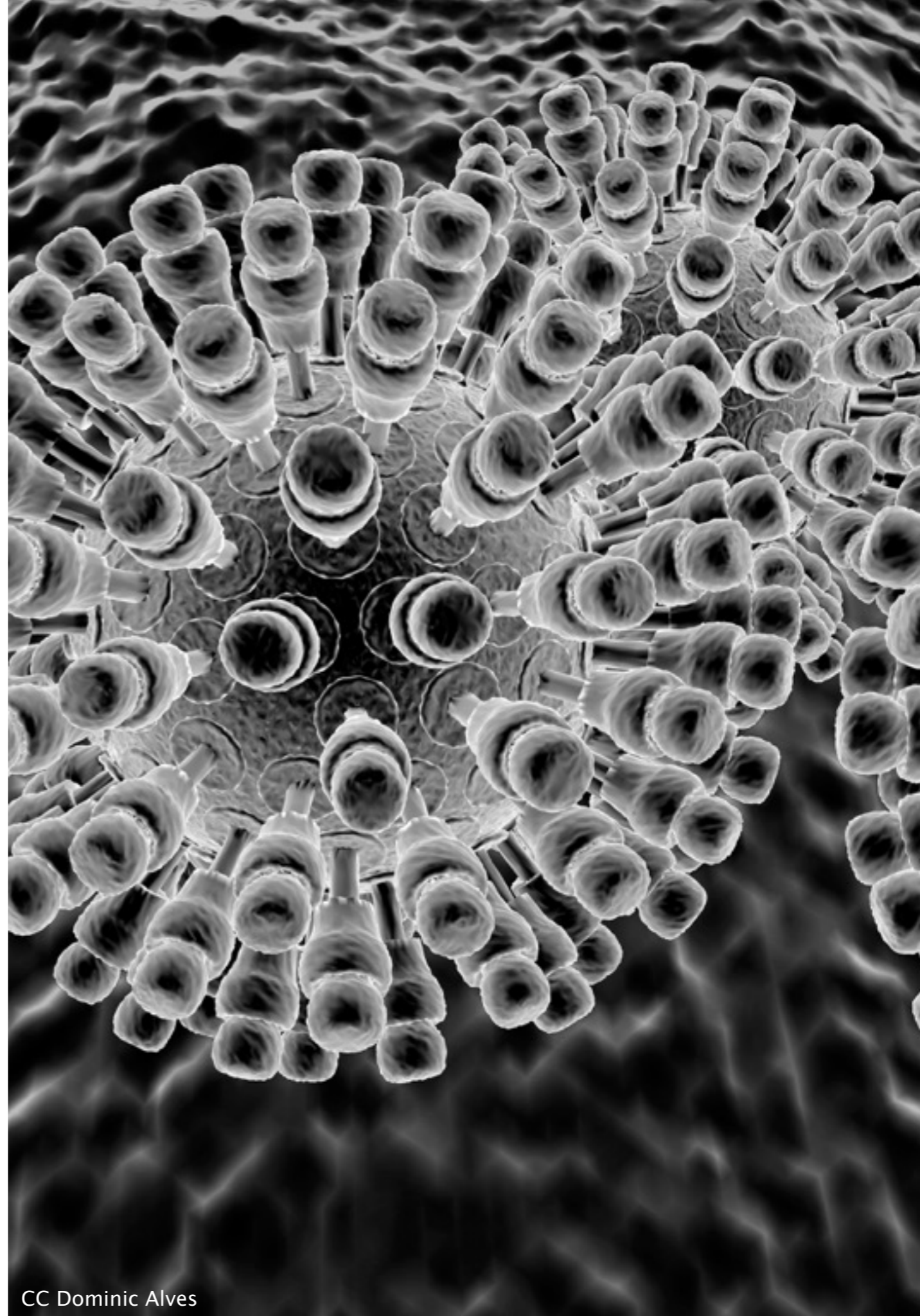
## PstI

- Providencia stuartii
- 3 prime overlap



## DNA restriction enzymes

- Protect against viral infections
- Over 3000 types known





# Step 1: samples and enzymes

Get DNA and enzymes

Crime Scene      Suspects      DNA reference

1      2      3      4      5



Take the 5 samples



Cut it using a EcoRI/  
PstI restriction-  
enzymmix

Incubate 45 minutes at 37 degrees

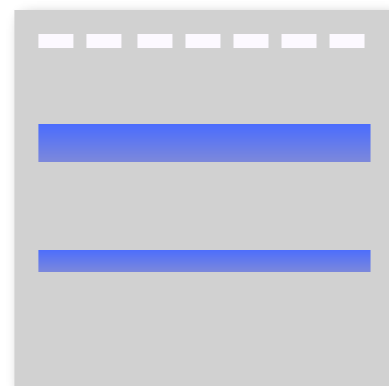


# Step 2: Gel electrophoreses

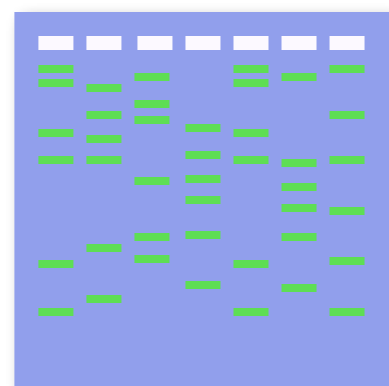
Mix the samples with loading dye



Load the samples in a gel



Apply current

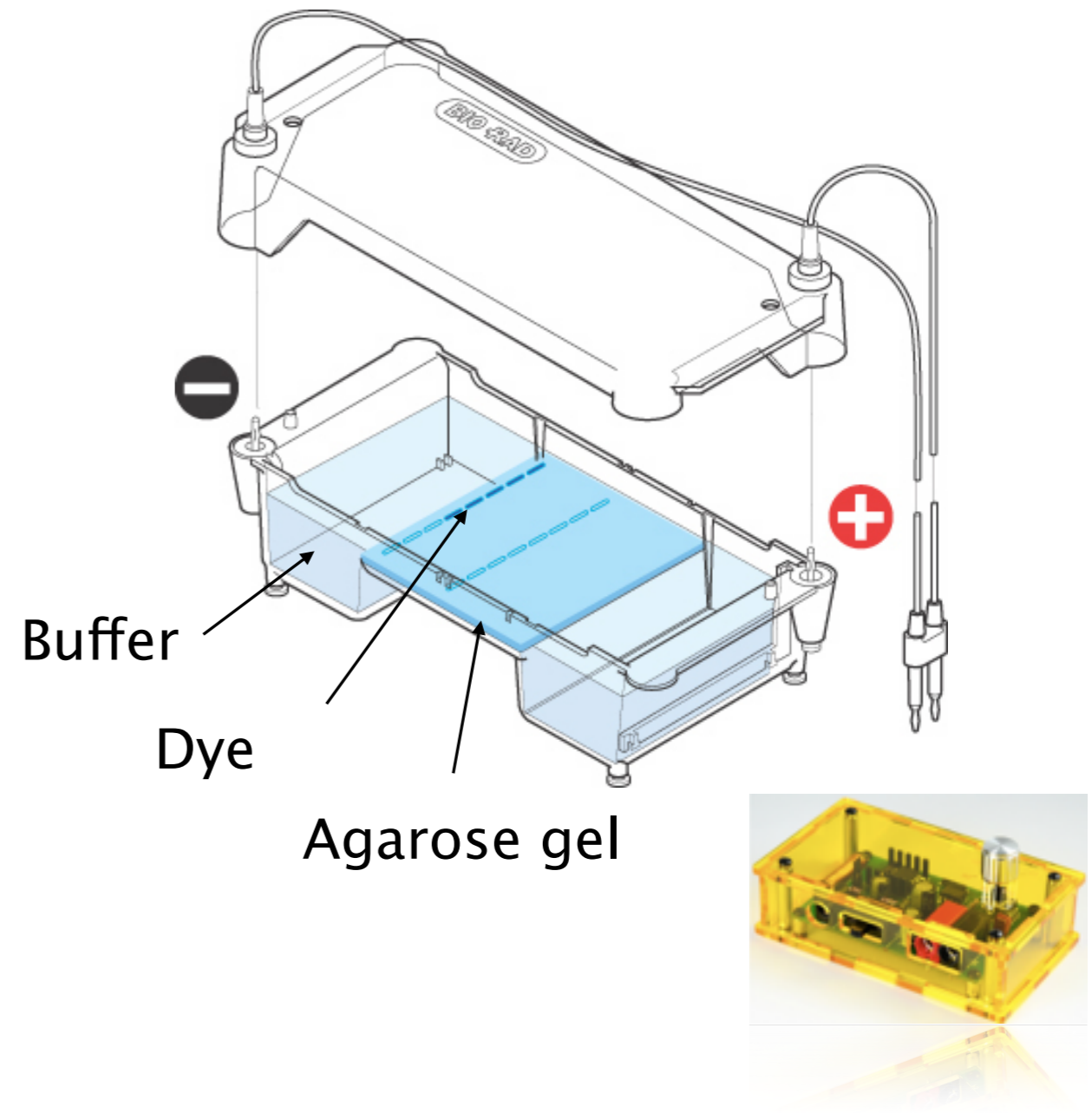


Read the pattern

Identify the killer

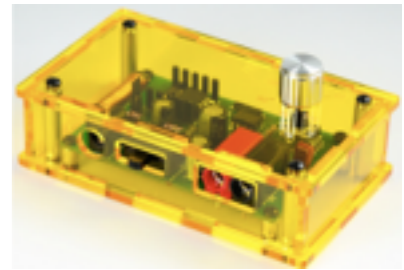
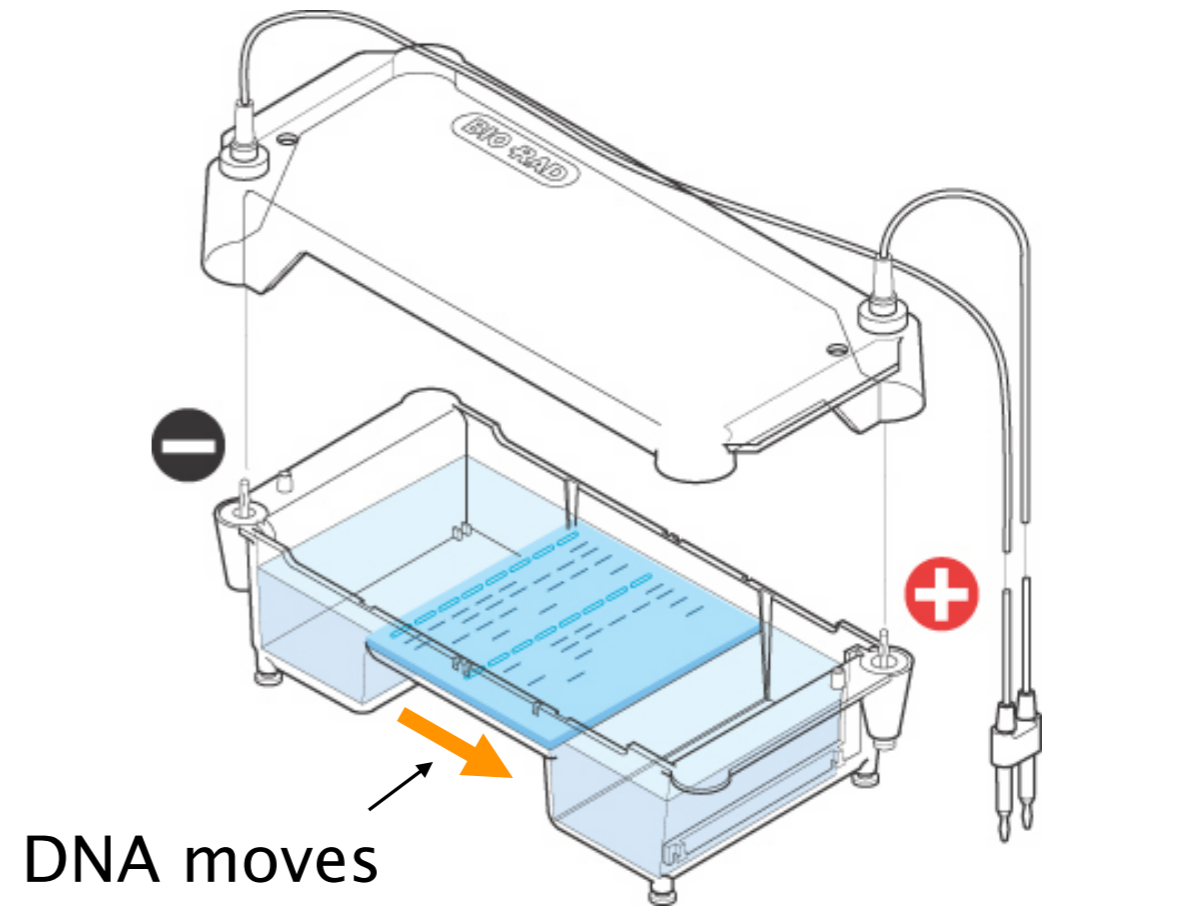
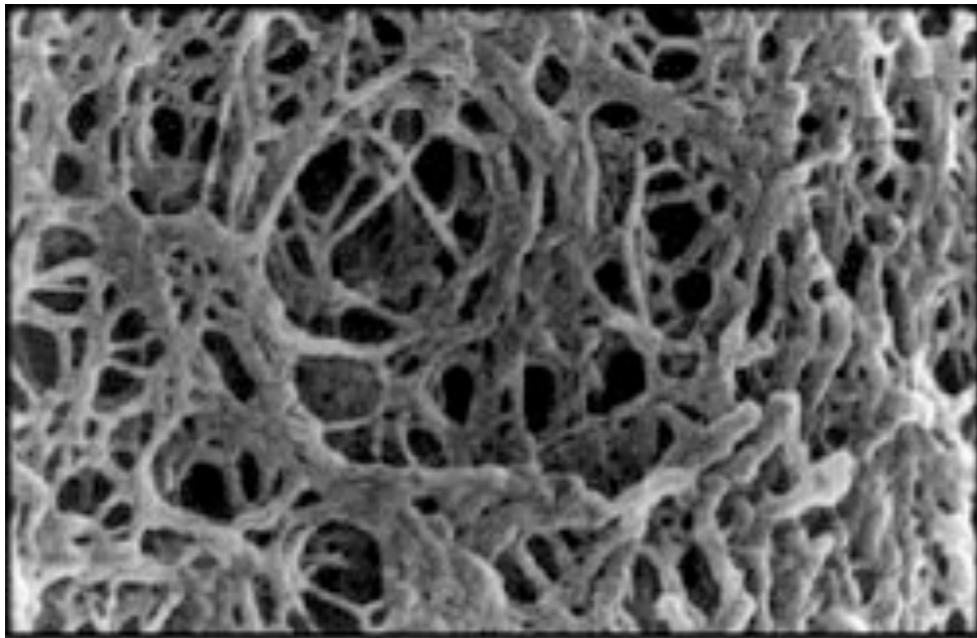


DNA is attracted by the anode





Short pieces move faster than long pieces

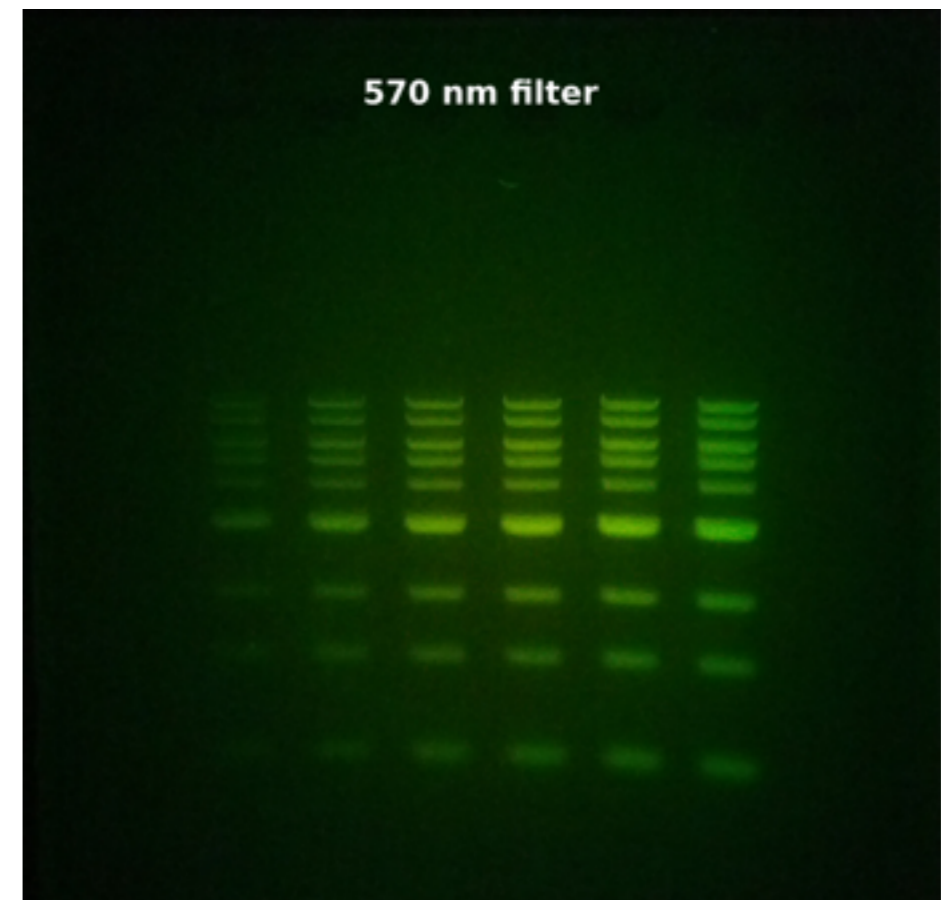
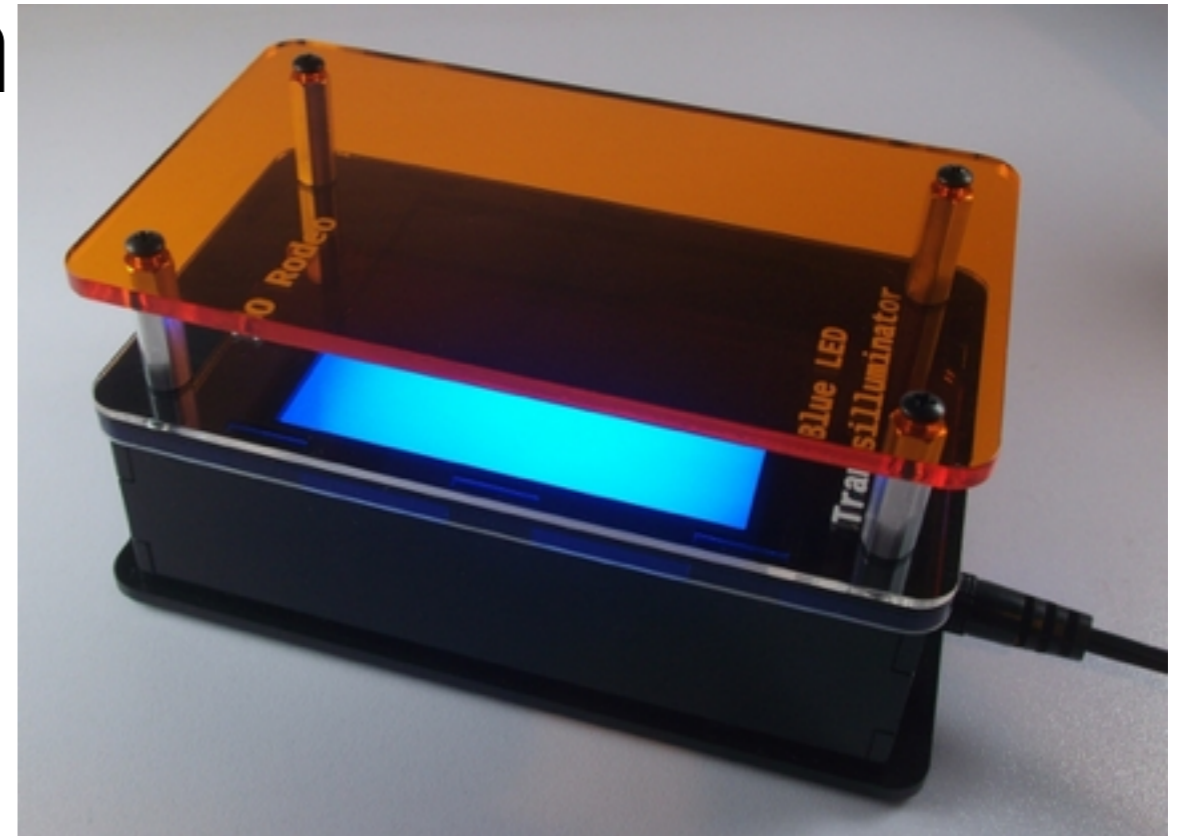






# Transillumination

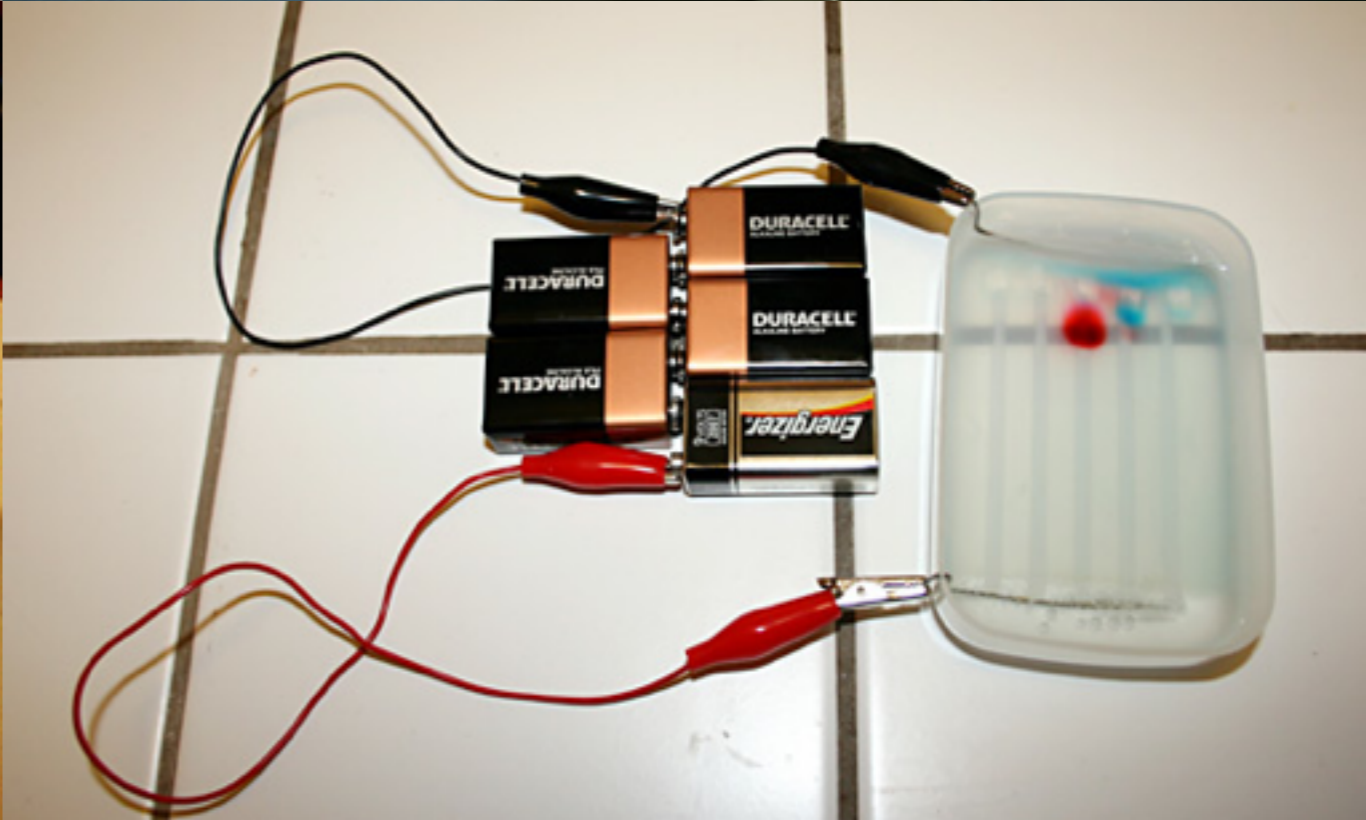
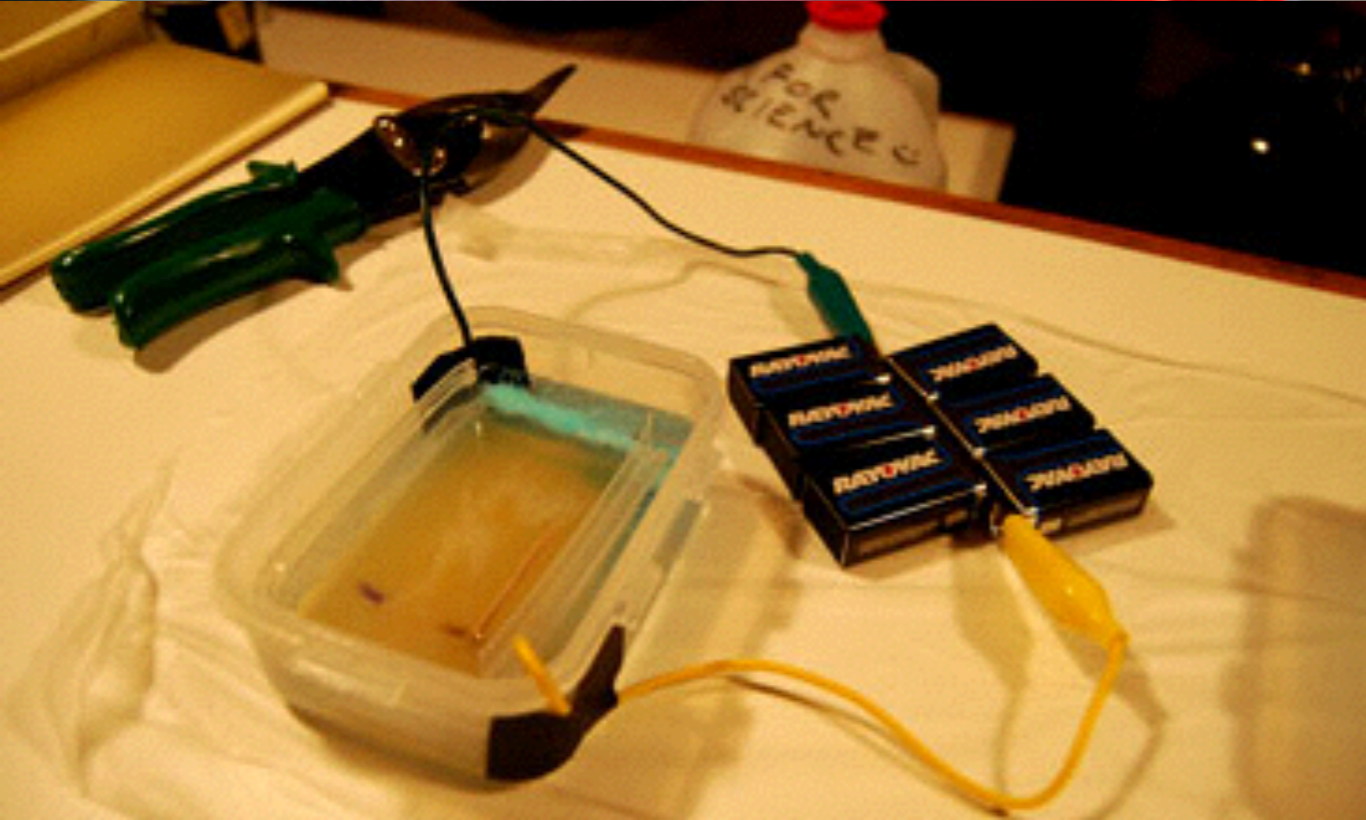
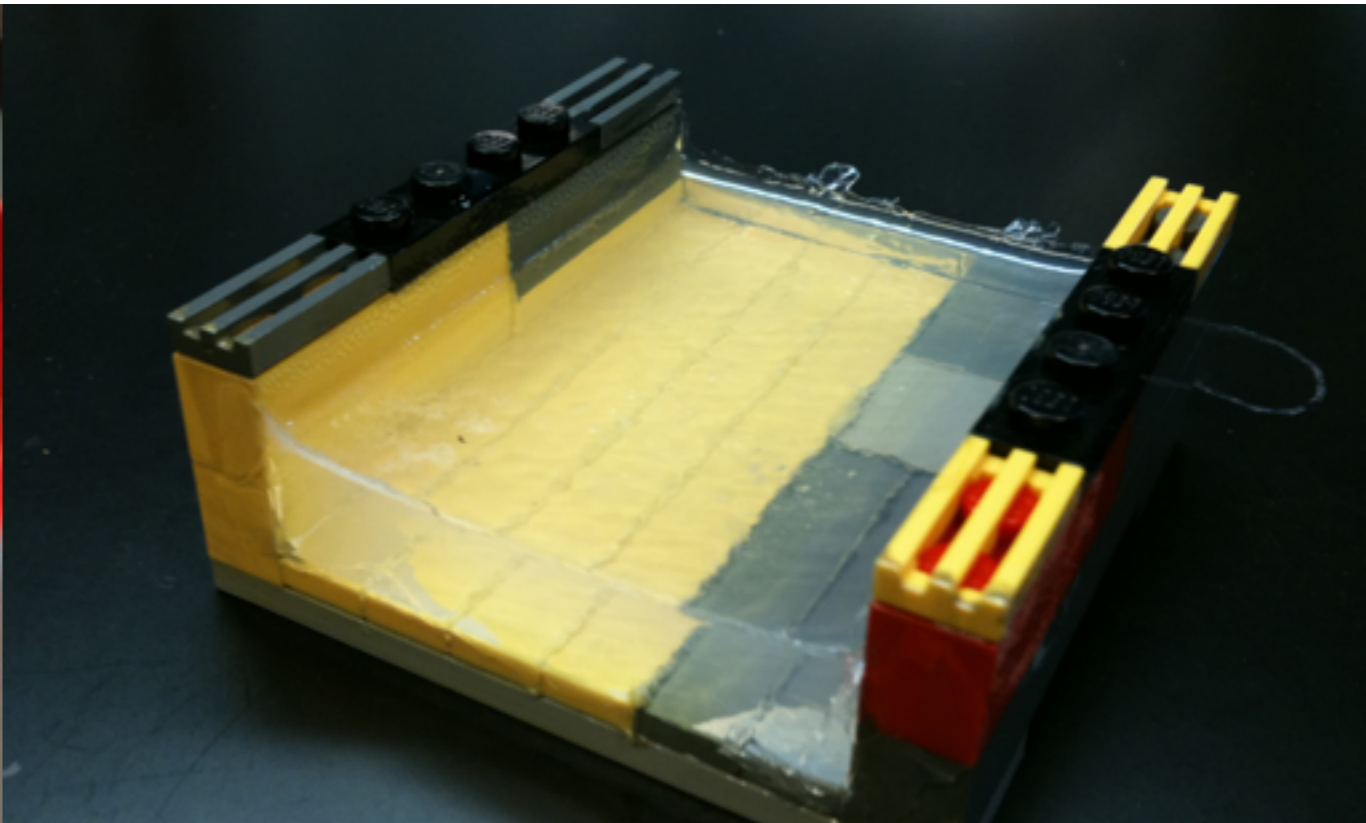
- Fluorescent DNA dye
- Sensitive to blue light
- Emits green light
- Orange filter blocks blue light





# DIY Electrophoresis

<http://fablab.waag.org/project/ow-dna-gel-electrophoresis-box>





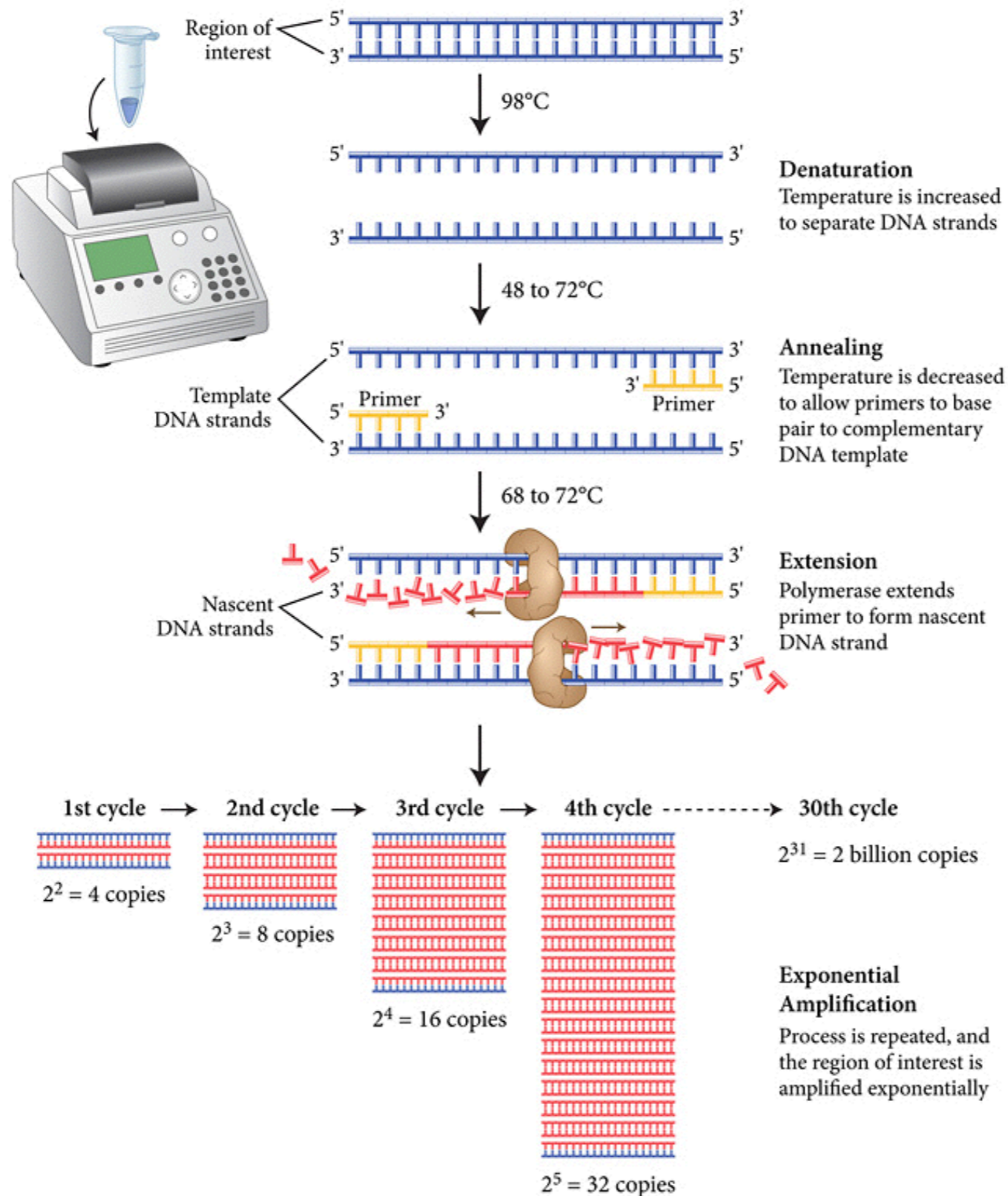
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# DNA analytics

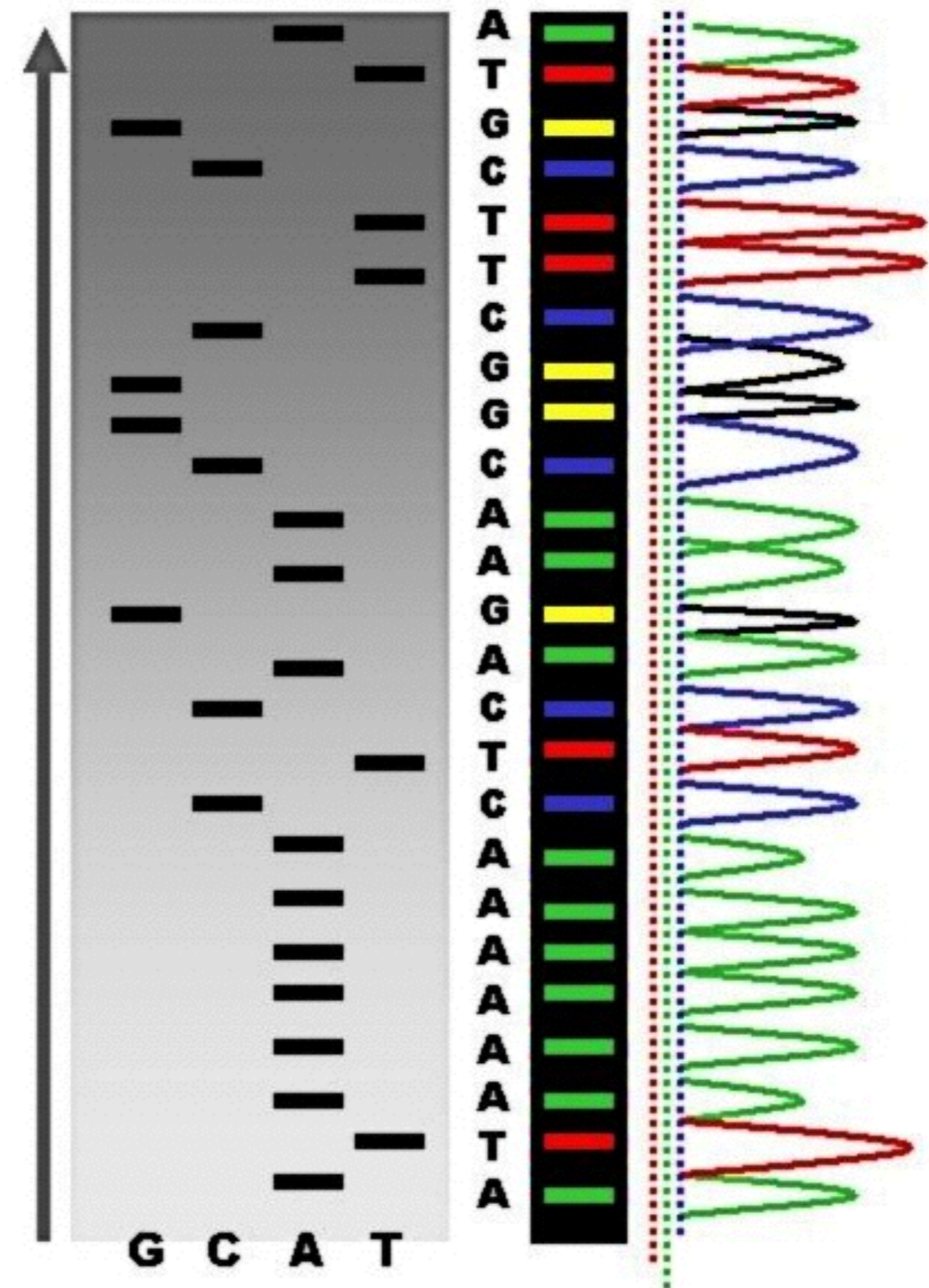
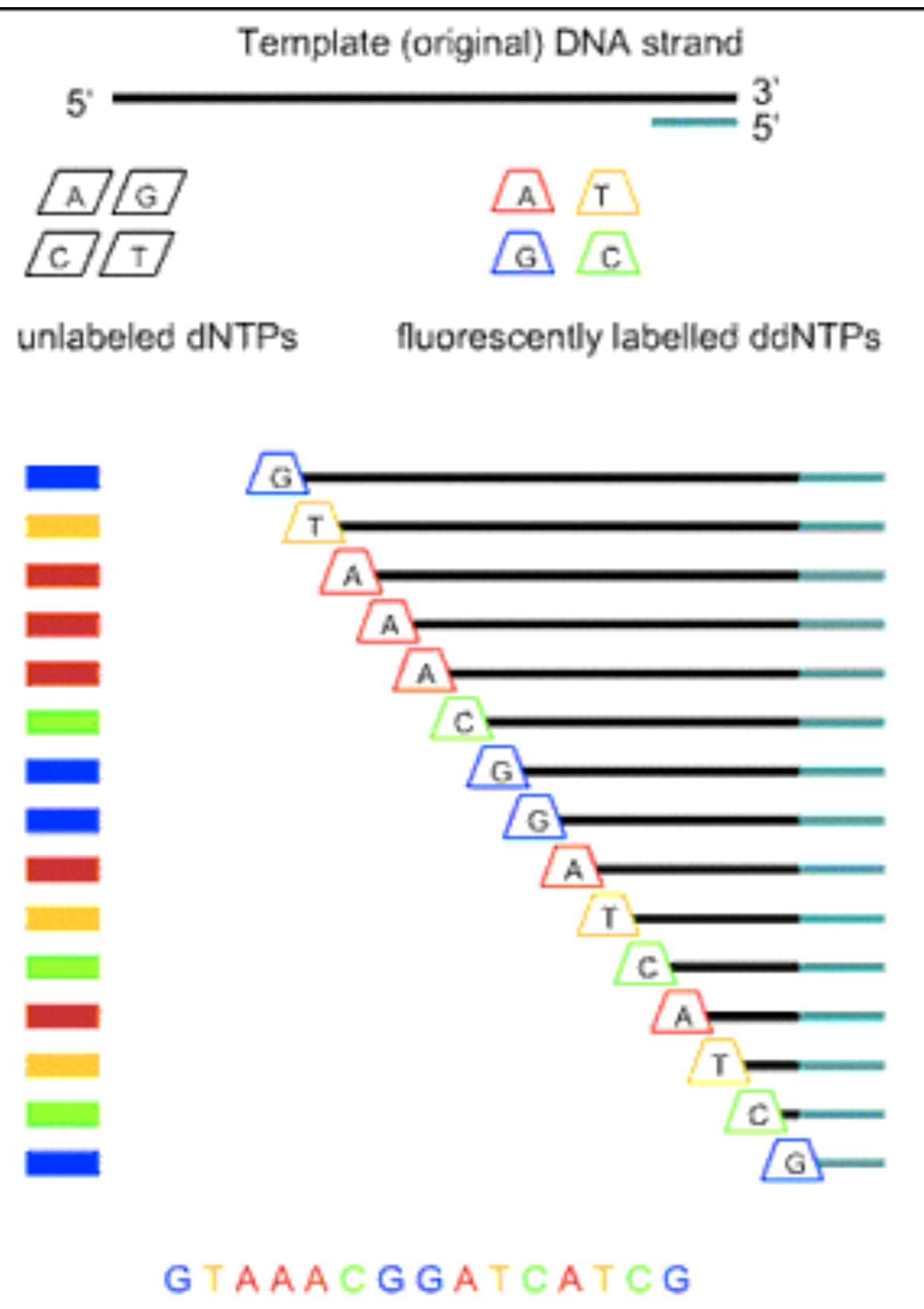


# Polymerase Chain Reaction





# Sanger Sequencing – chain termination





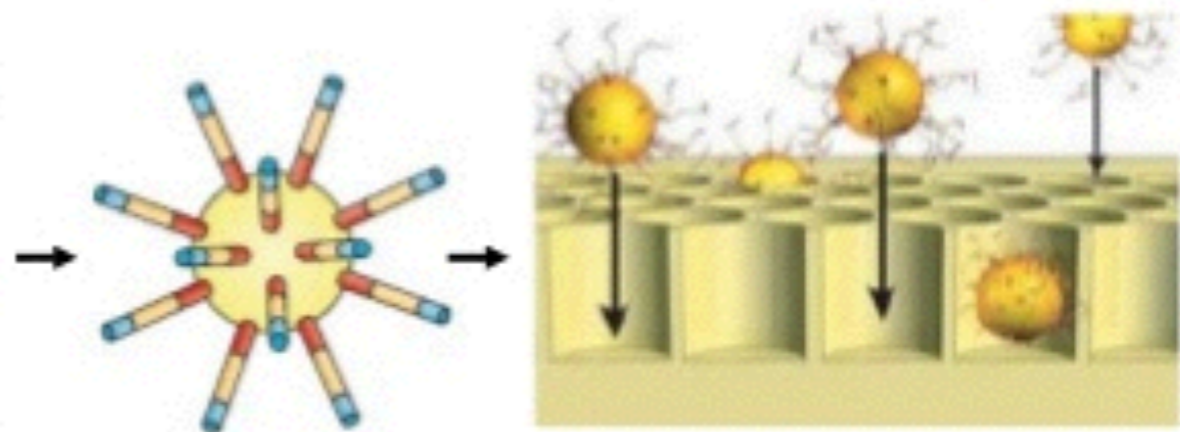
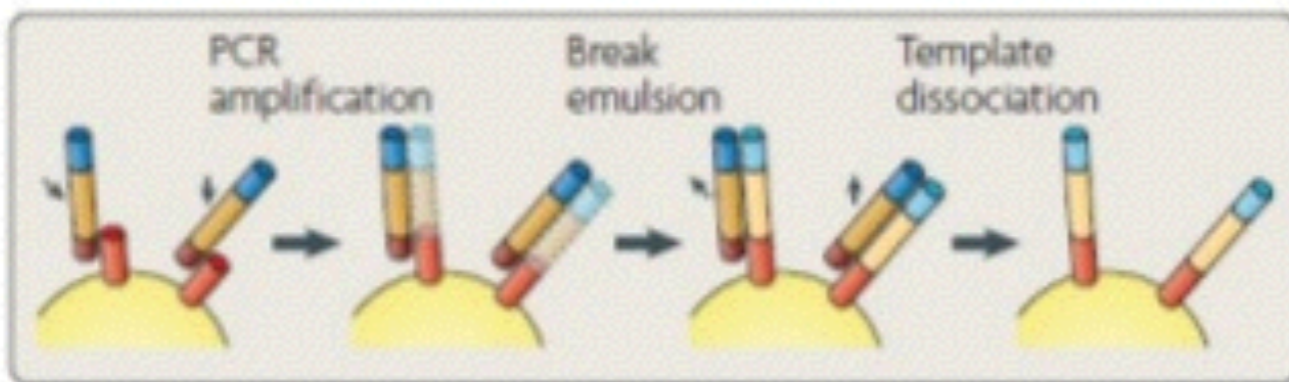
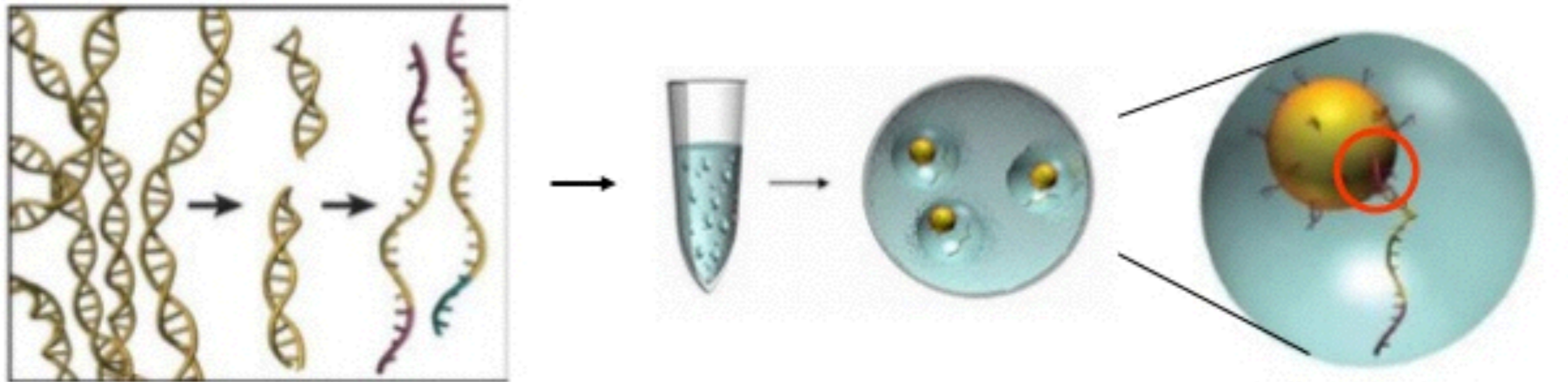
# 454 sequencer





# 454 Pyrosequencing

## 1. Emulsion-based sample preparation (emPCR)

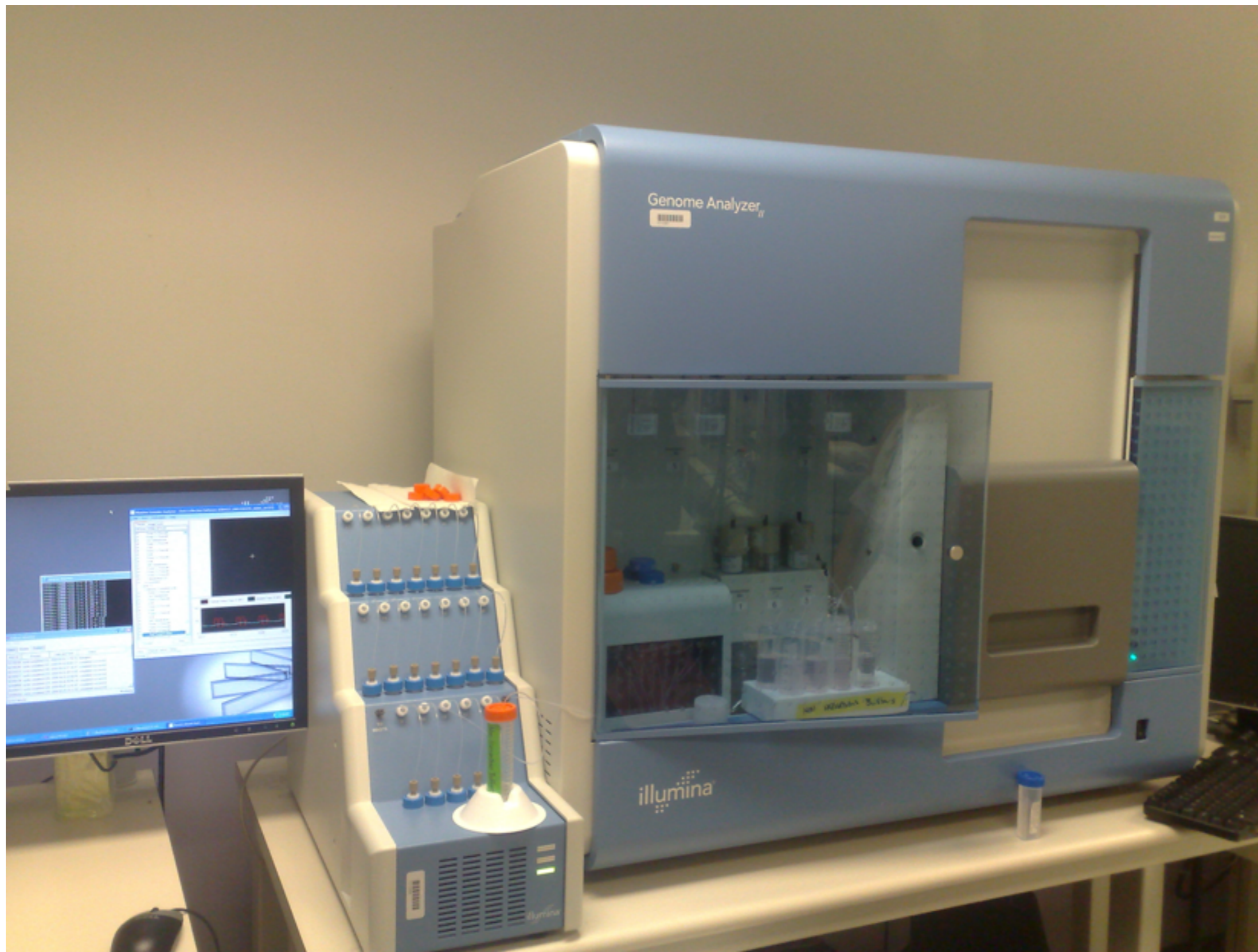


Several thousand copies of the same template sequence on each bead

on average 1.6 million wells



# Illumina – Solexa

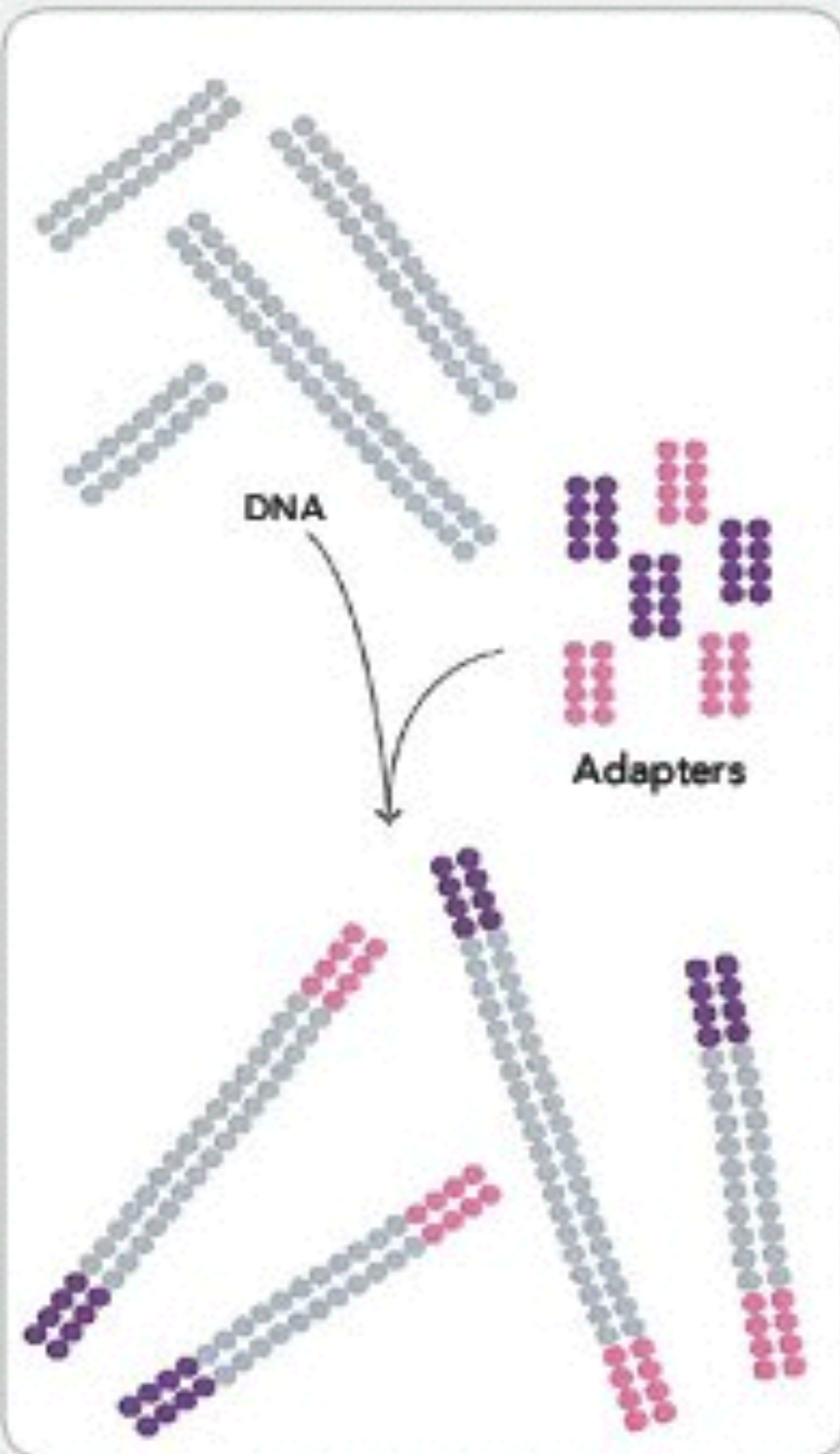




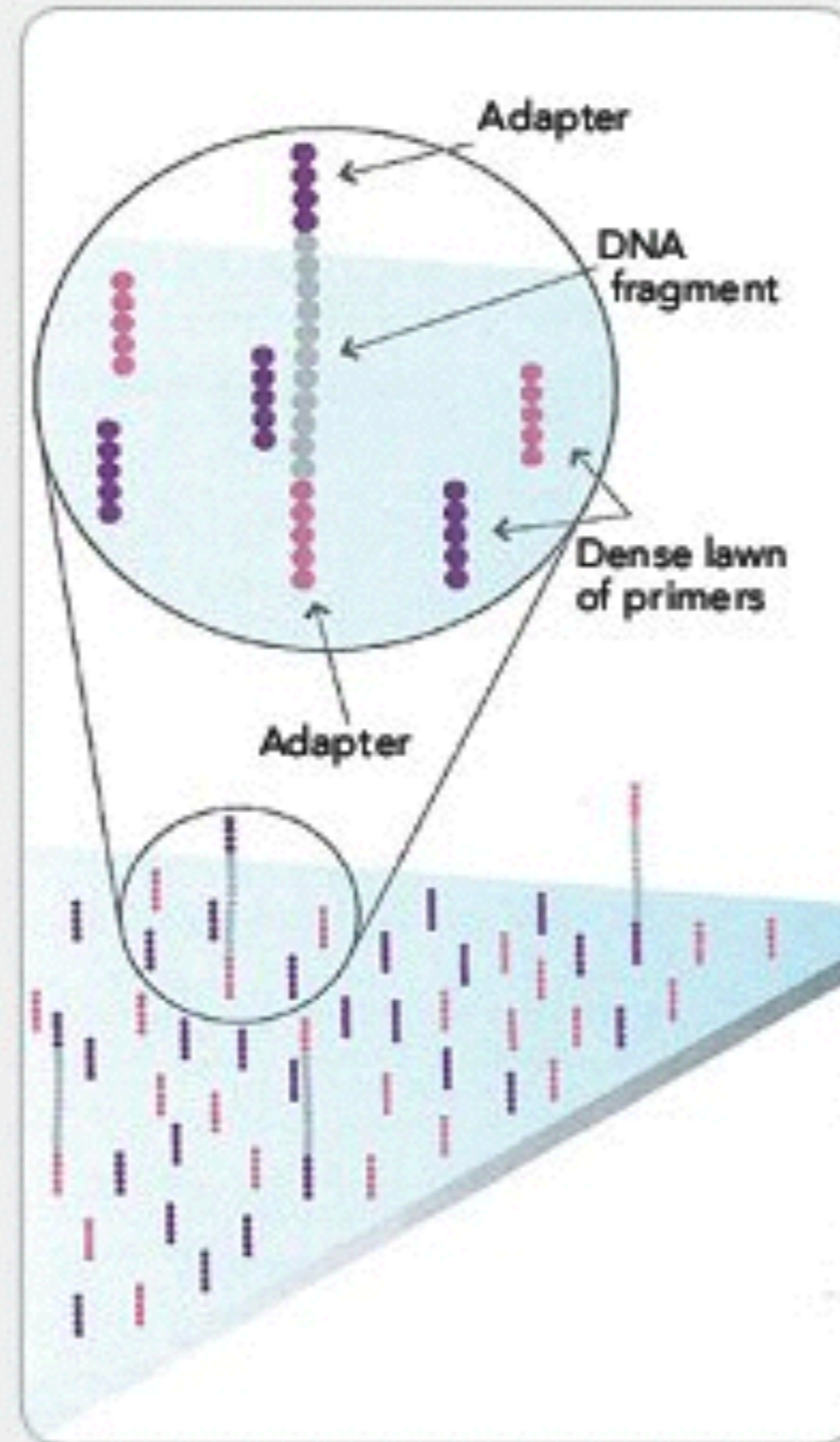


# Solexa – Illumina sequencing

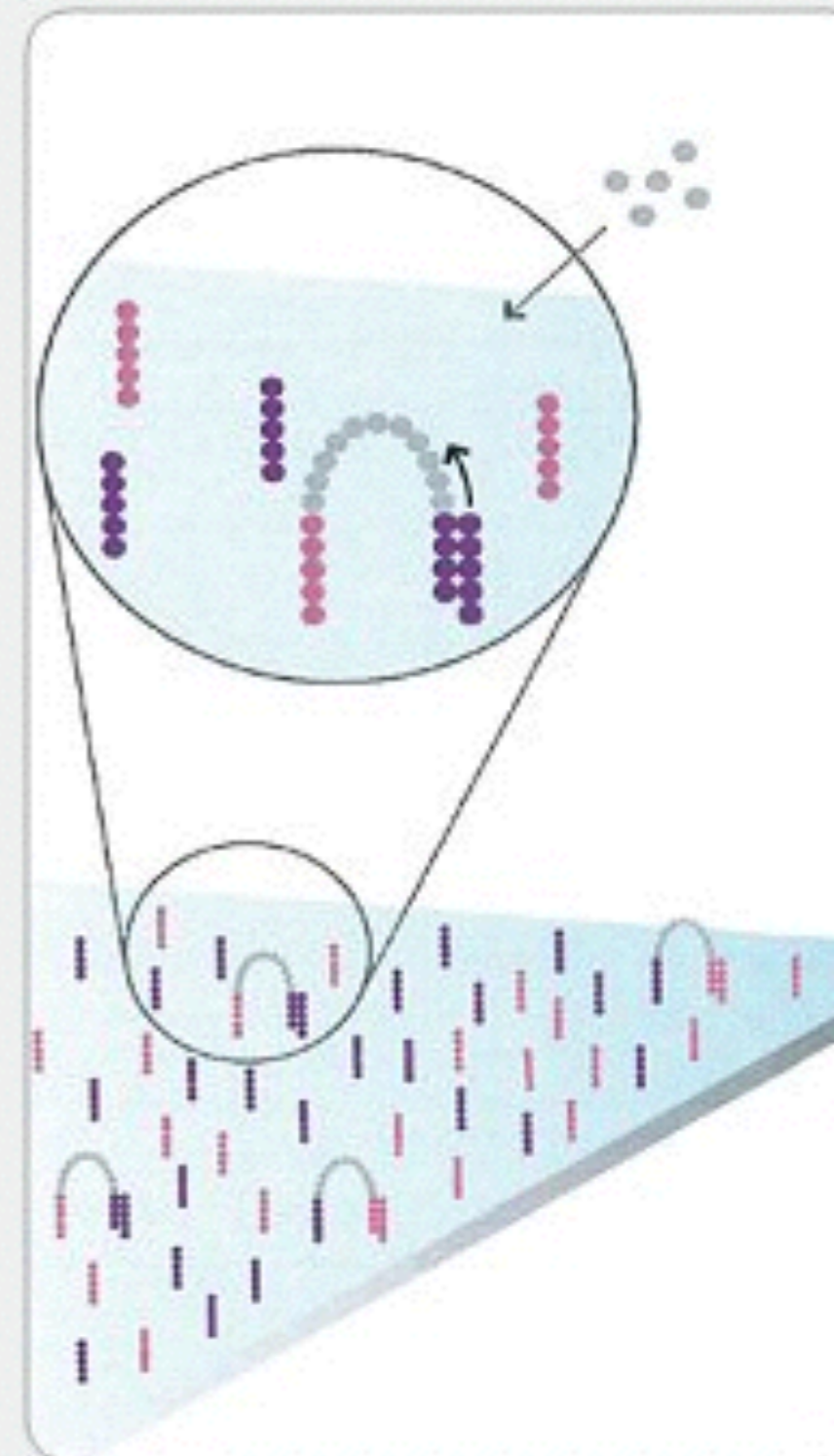
1. PREPARE GENOMIC DNA SAMPLE



2. ATTACH DNA TO SURFACE

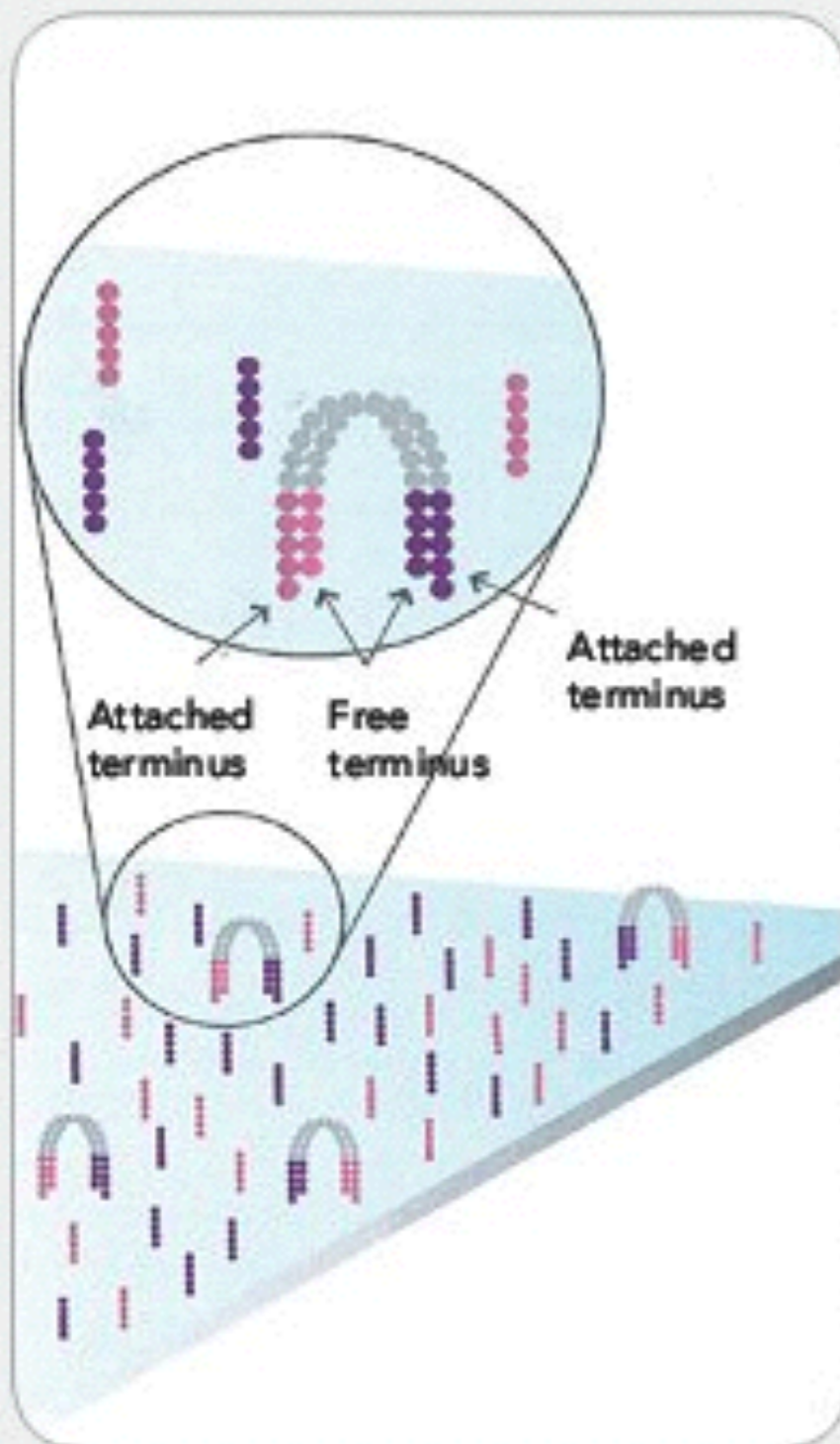


3. BRIDGE AMPLIFICATION

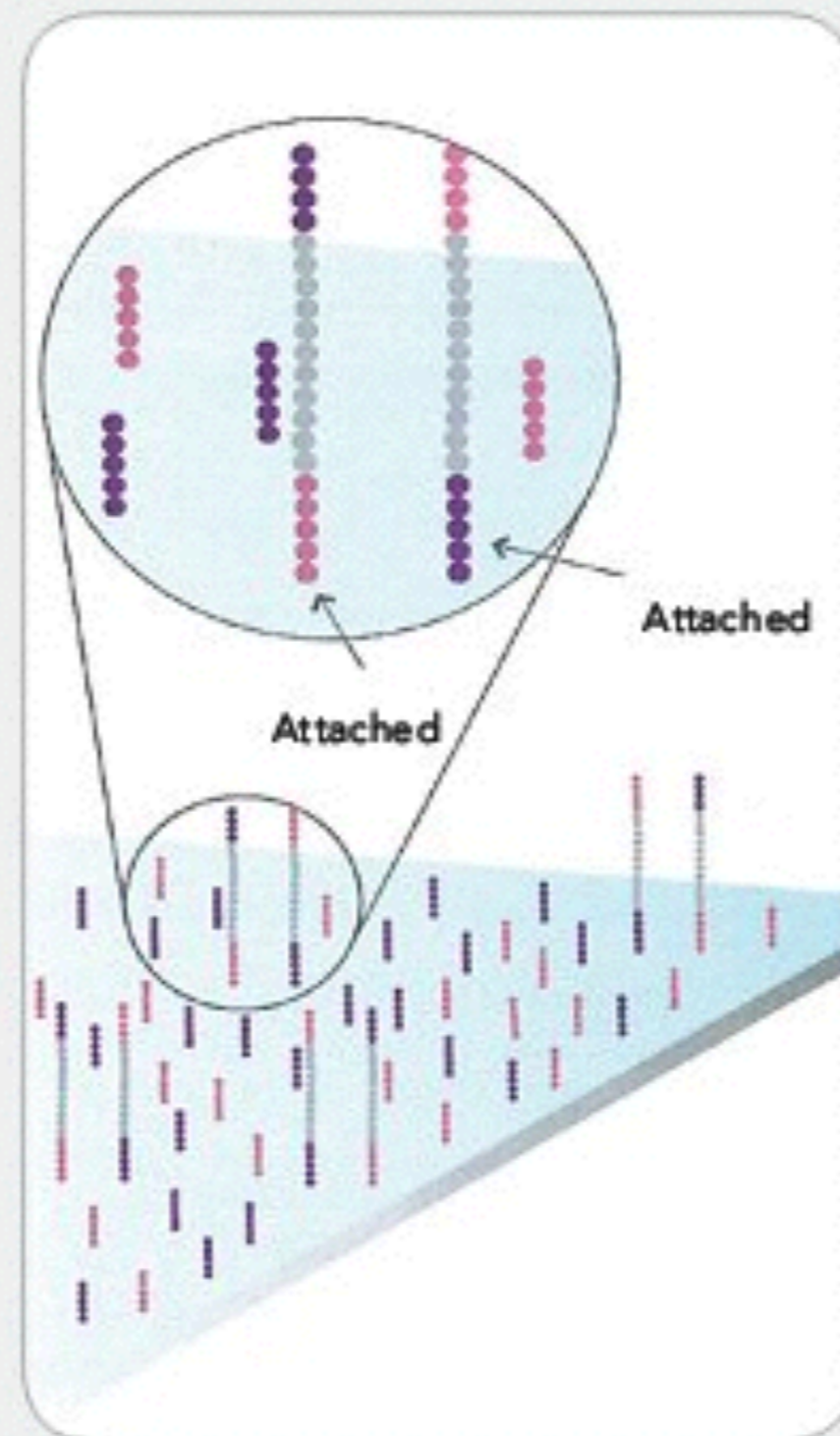




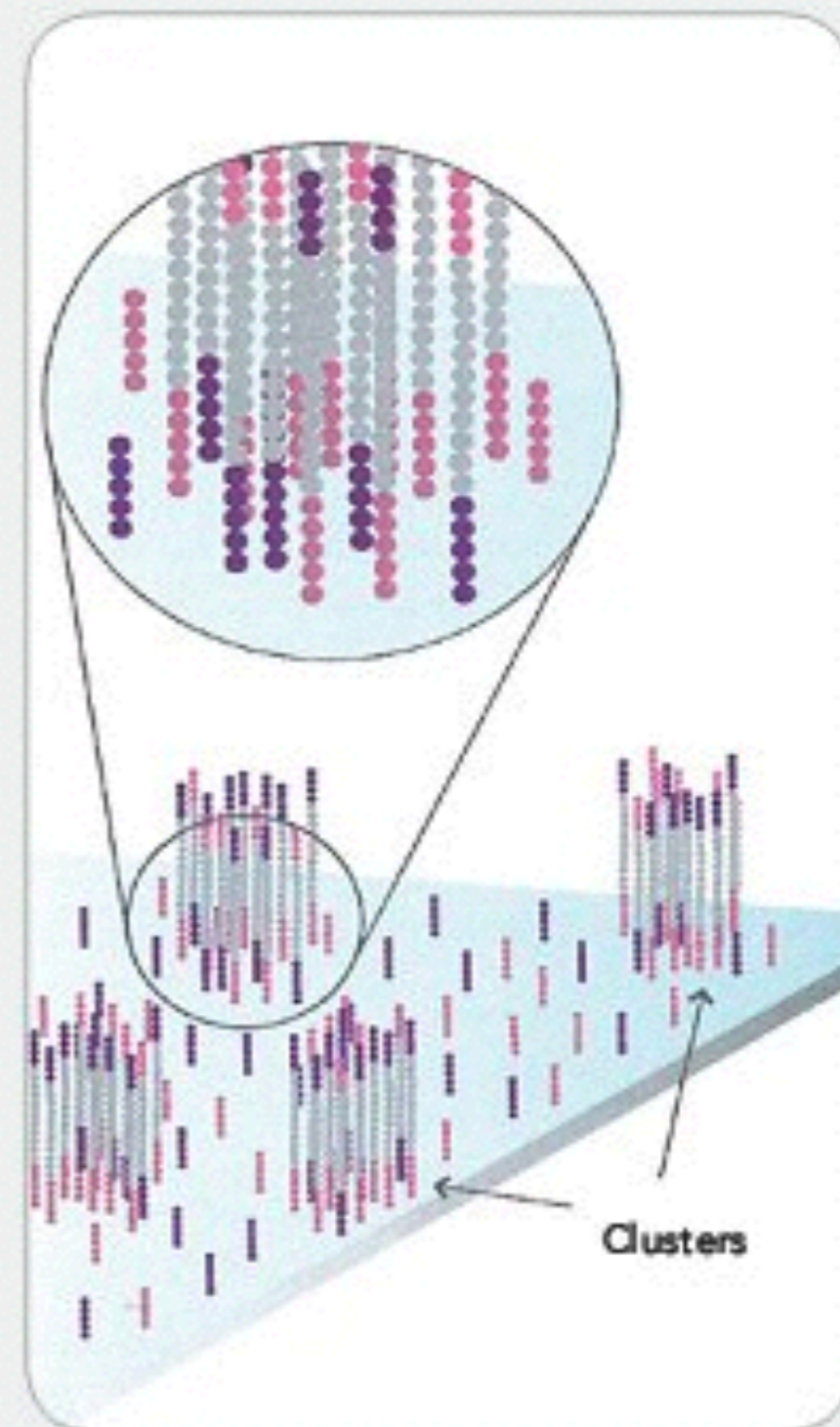
4. FRAGMENTS BECOME DOUBLE STRANDED



5. DENATURE THE DOUBLE-STRANDED MOLECULES

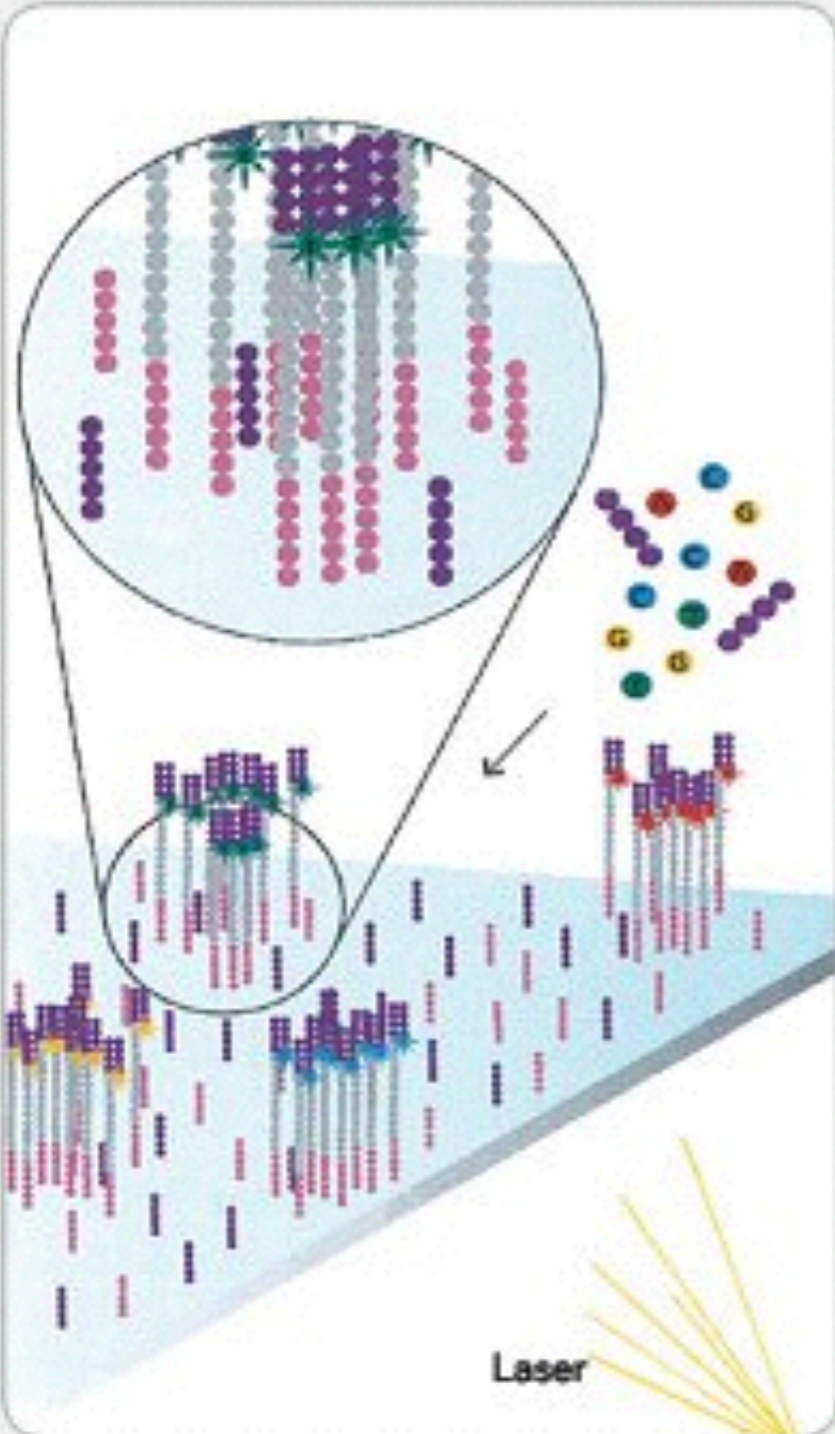


6. COMPLETE AMPLIFICATION

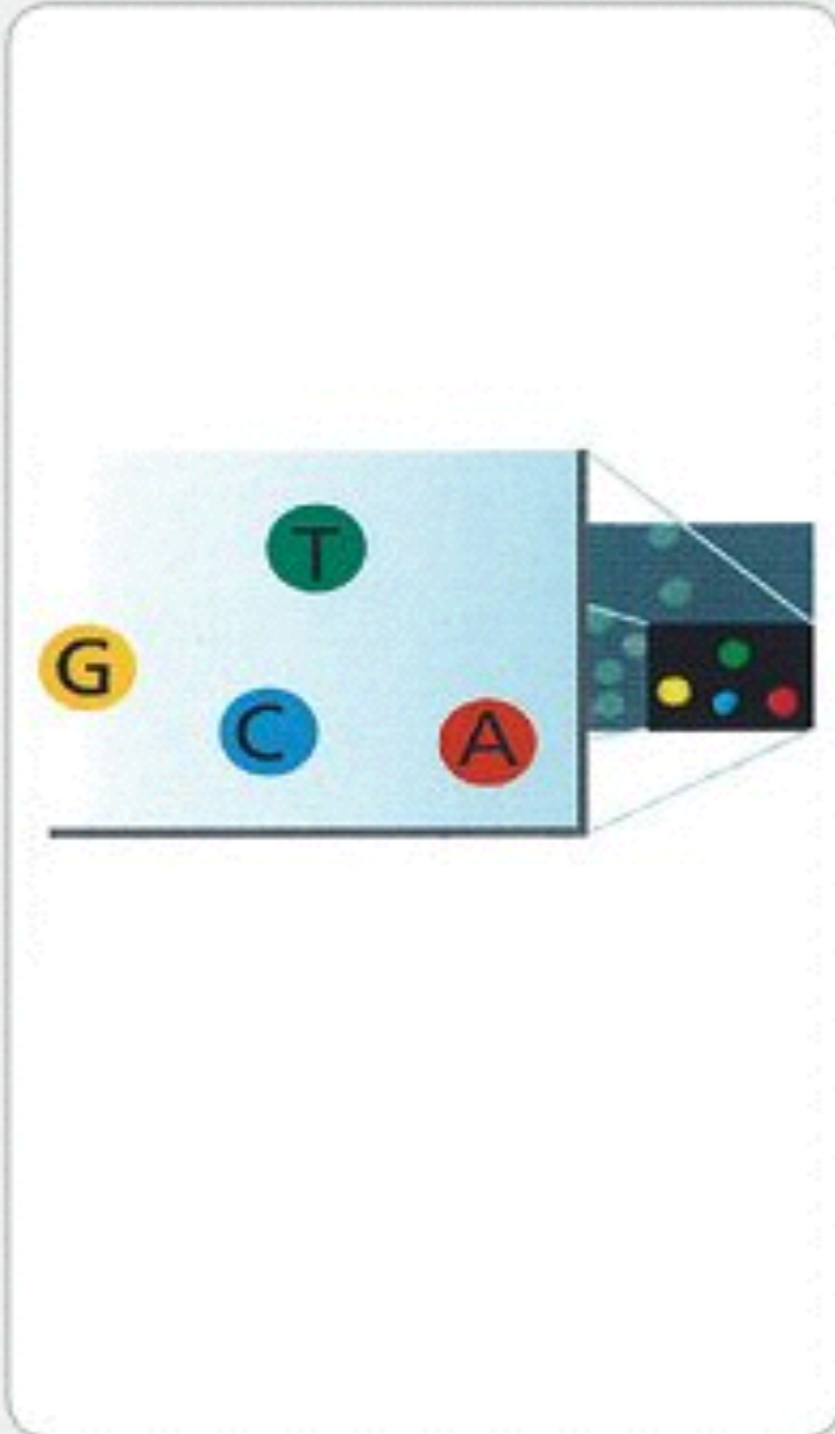




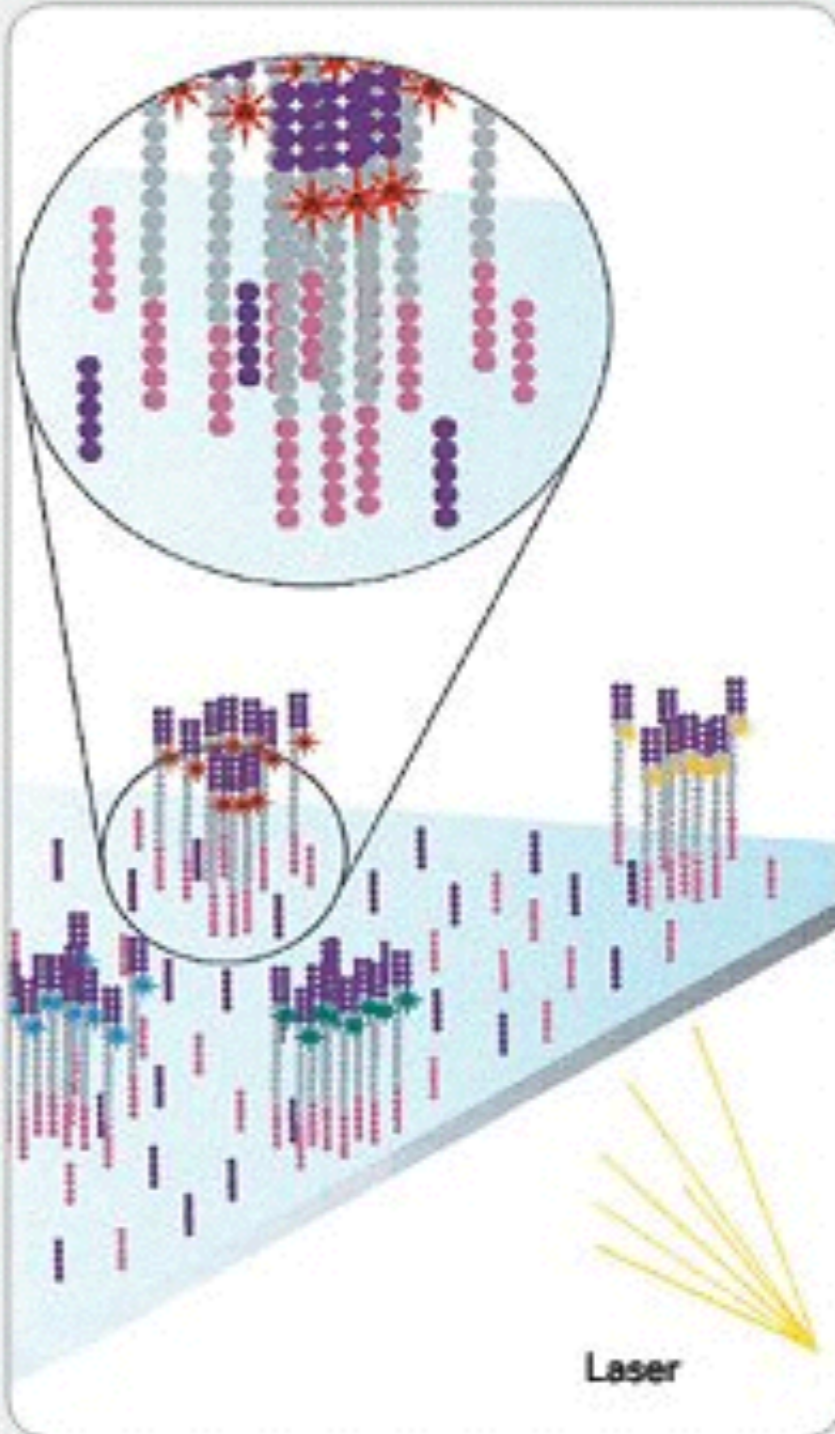
7. DETERMINE FIRST BASE



8. IMAGE FIRST BASE

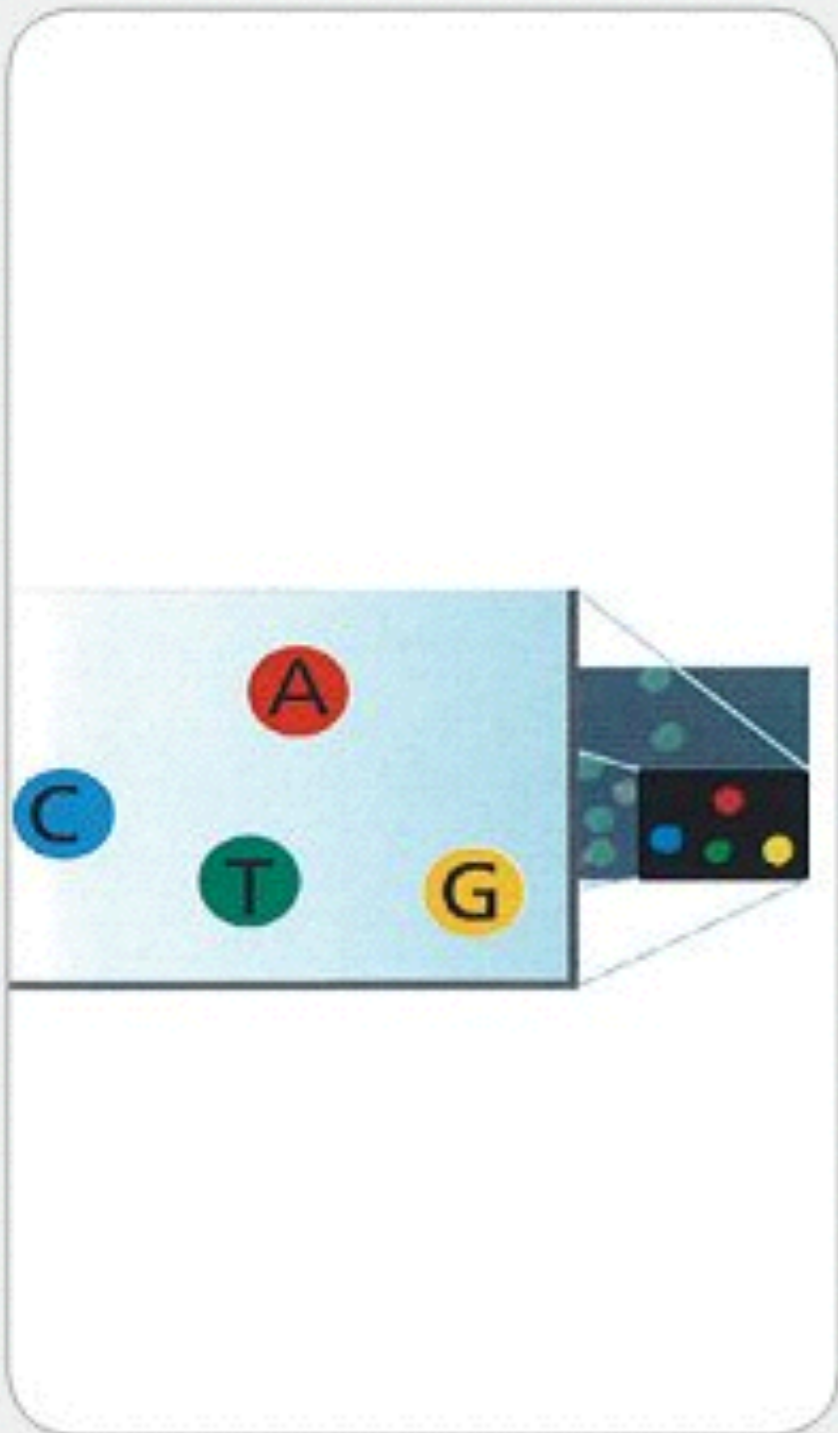


9. DETERMINE SECOND BASE

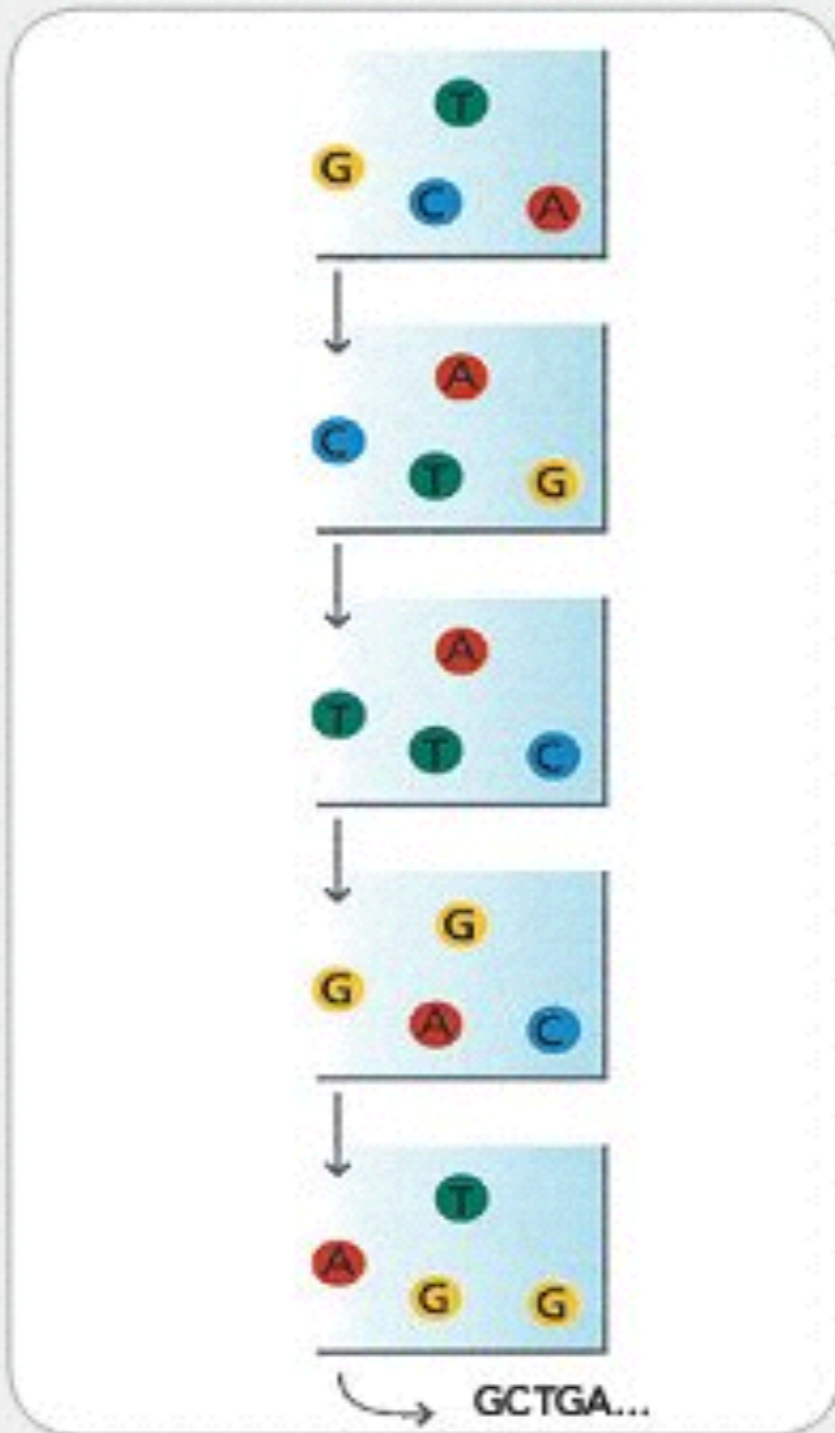




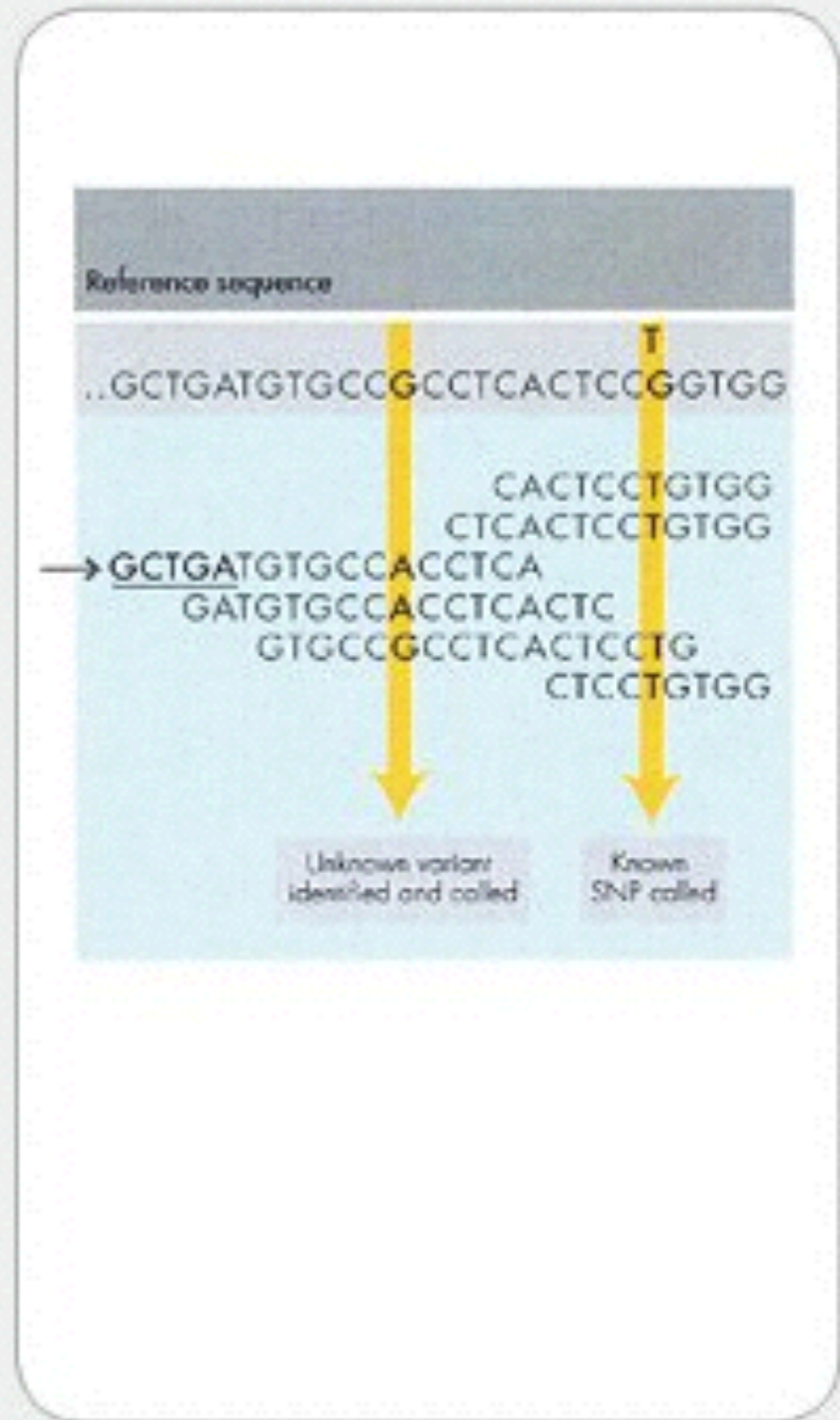
### 10. IMAGE SECOND CHEMISTRY CYCLE



### 11. SEQUENCE READS OVER MULTIPLE CHEMISTRY CYCLES

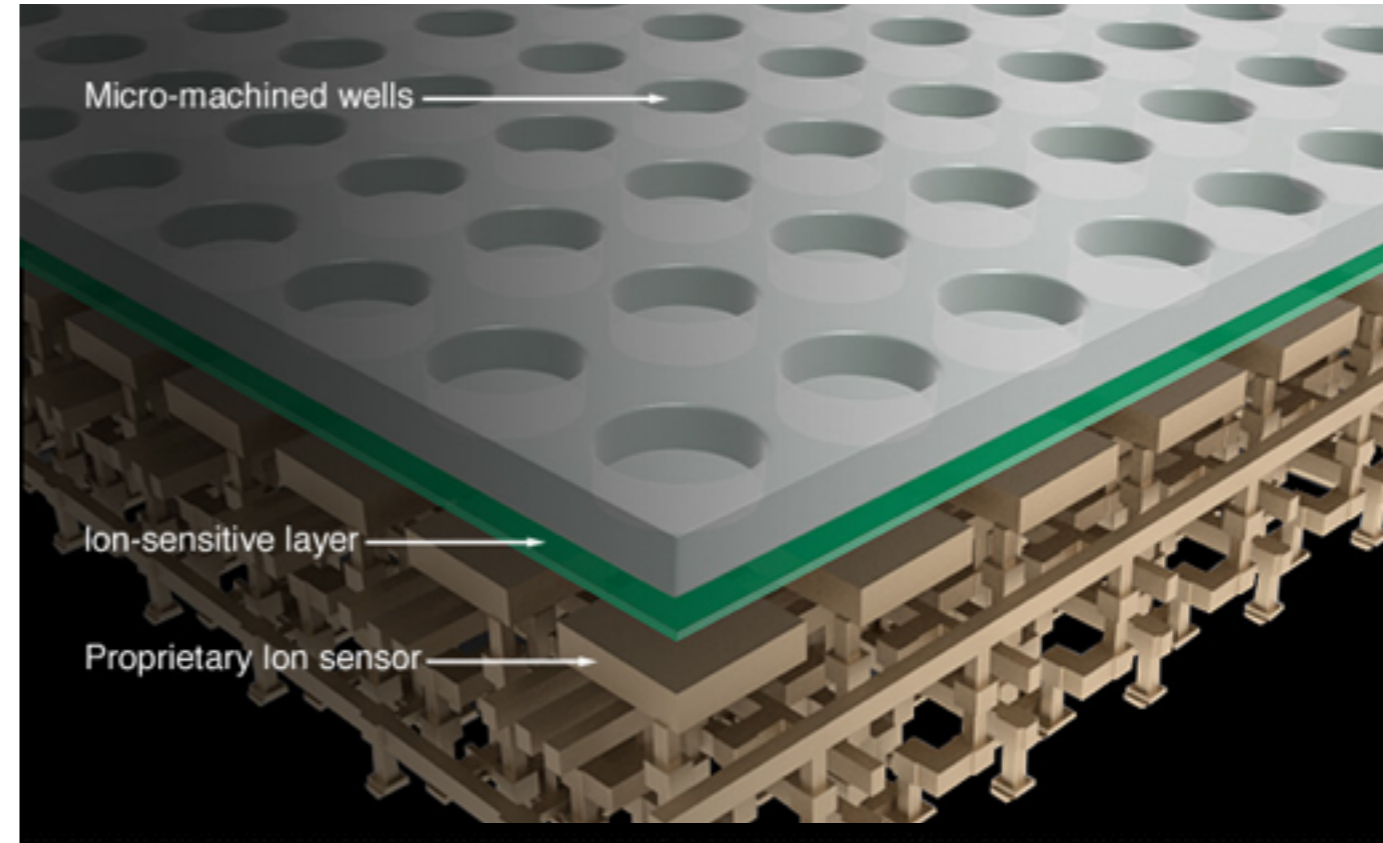


### 12. ALIGN DATA

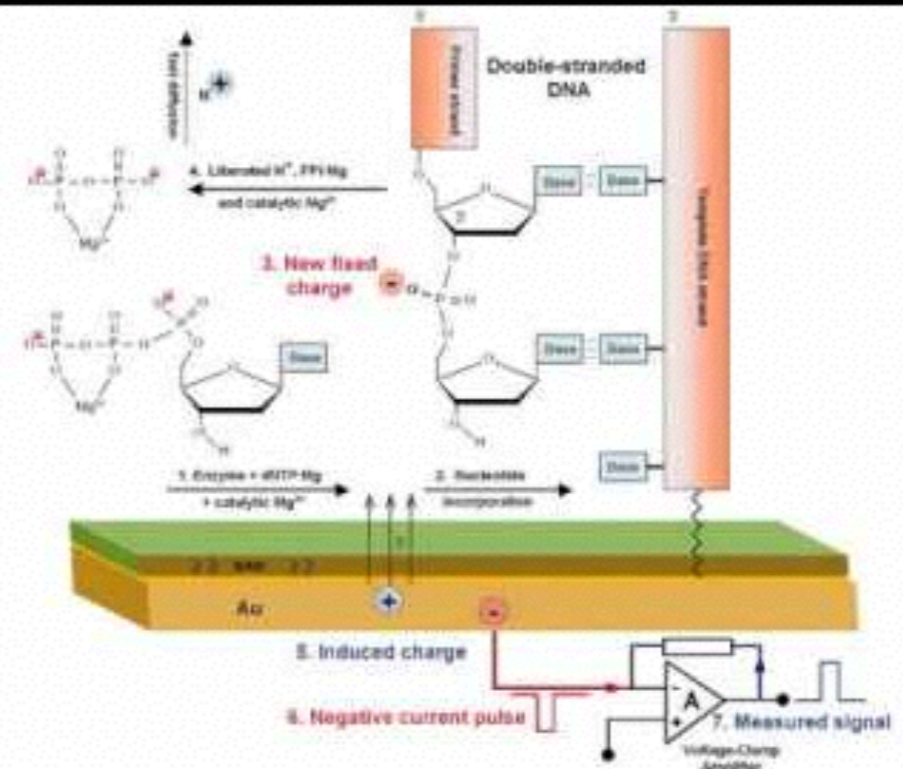
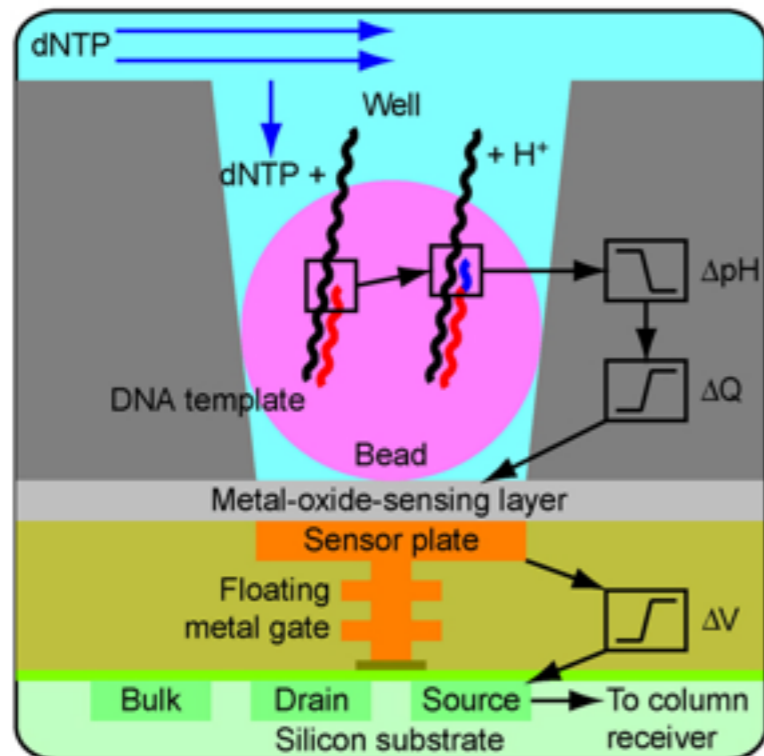




# IonTorrent sequencing

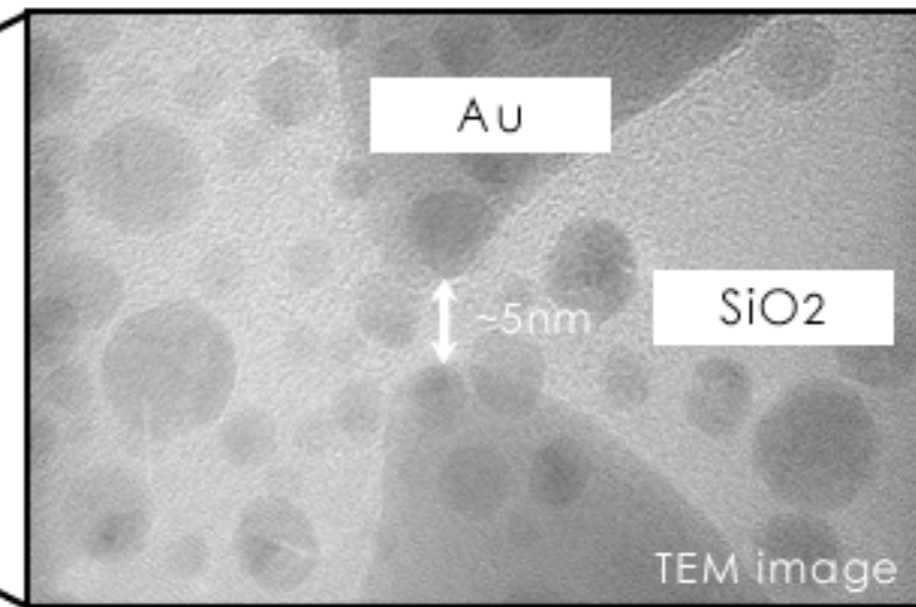
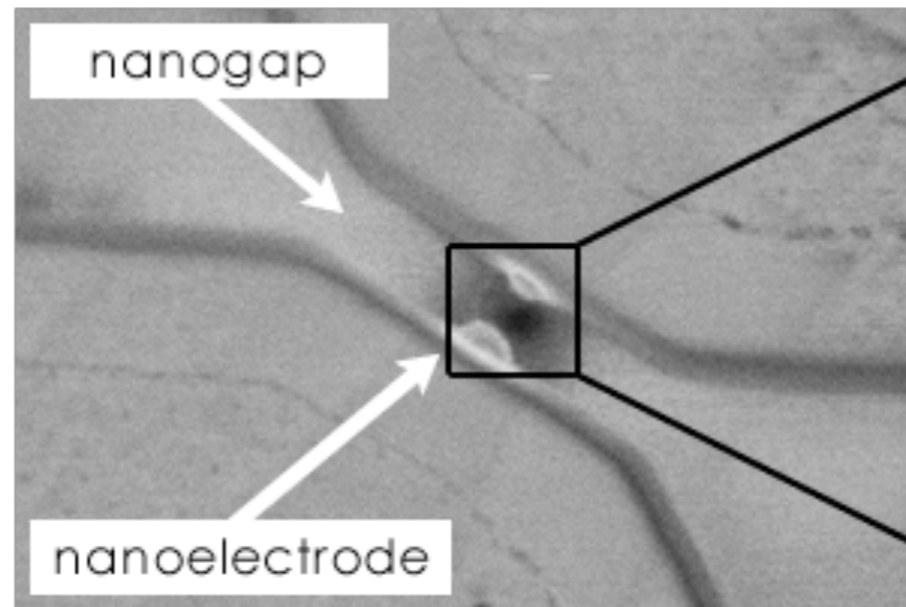
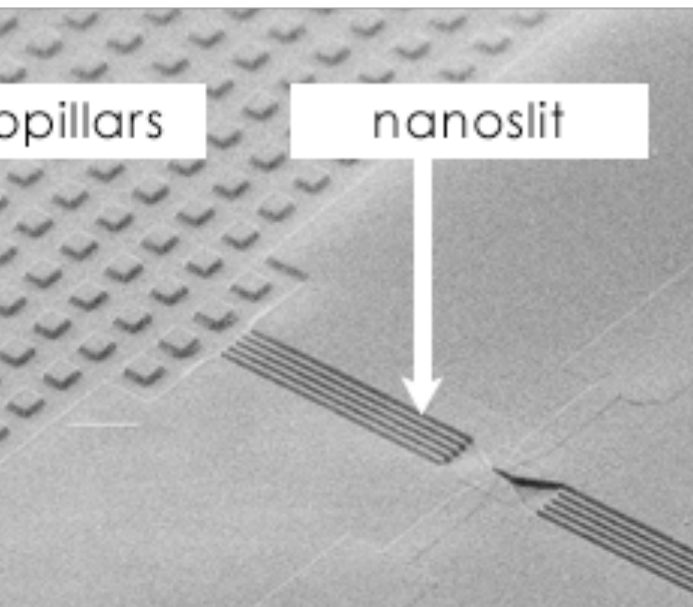
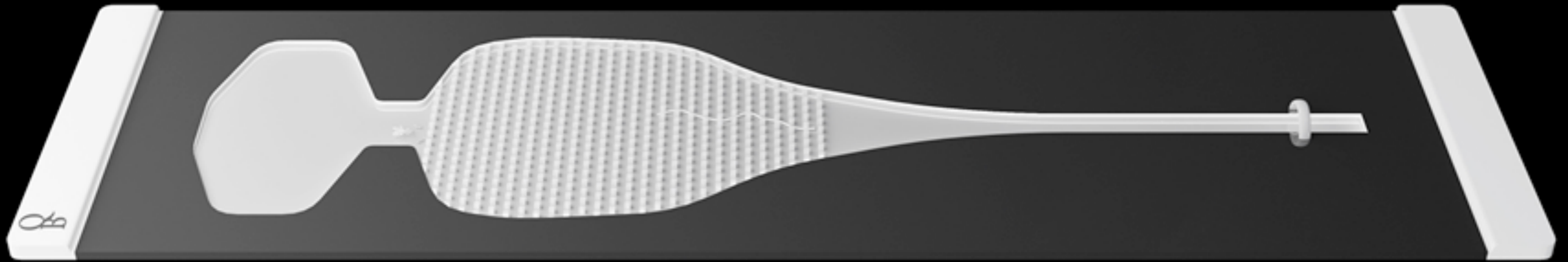


a



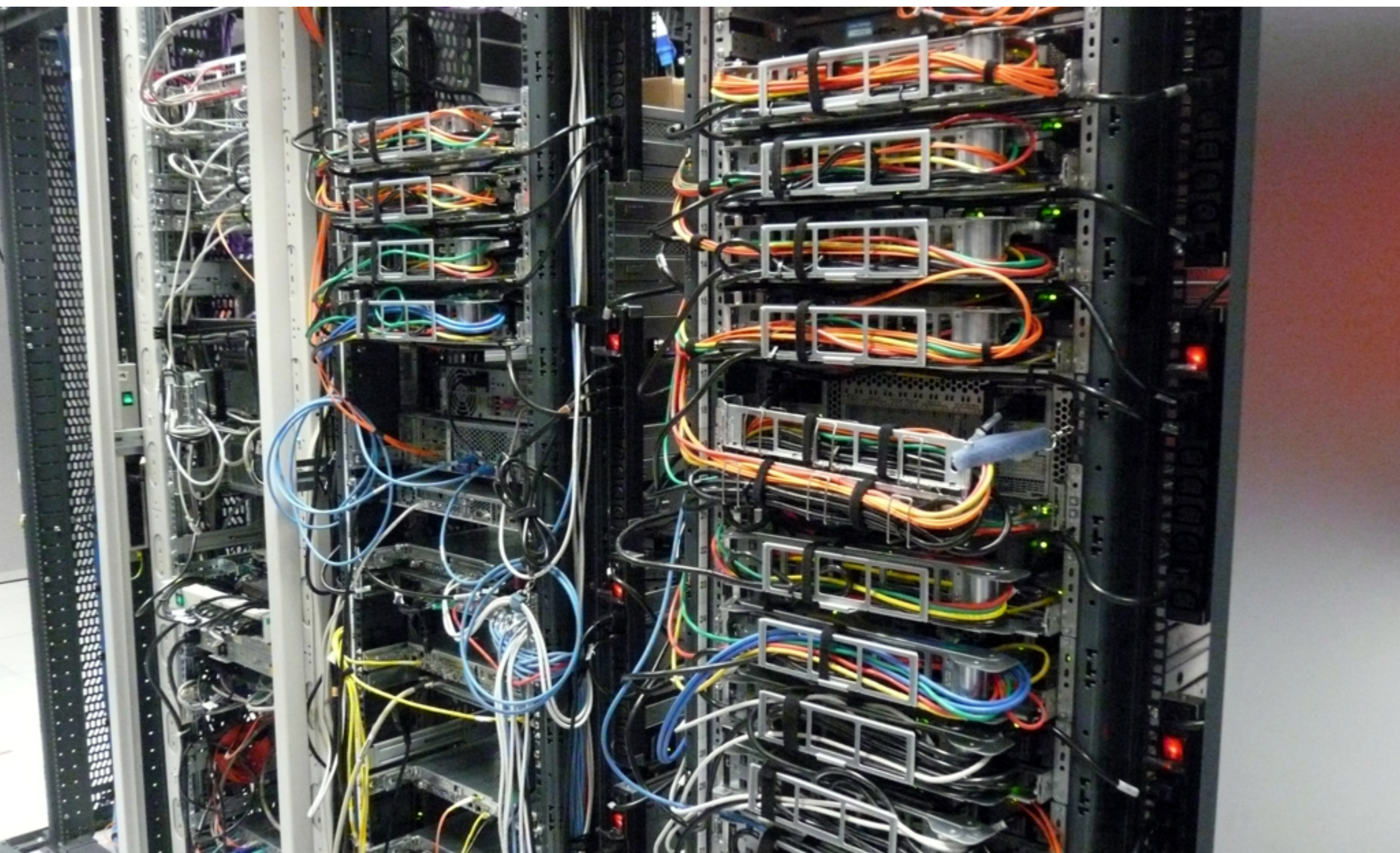


# Nanopore sequencing





# Bioinformatics





DIY?





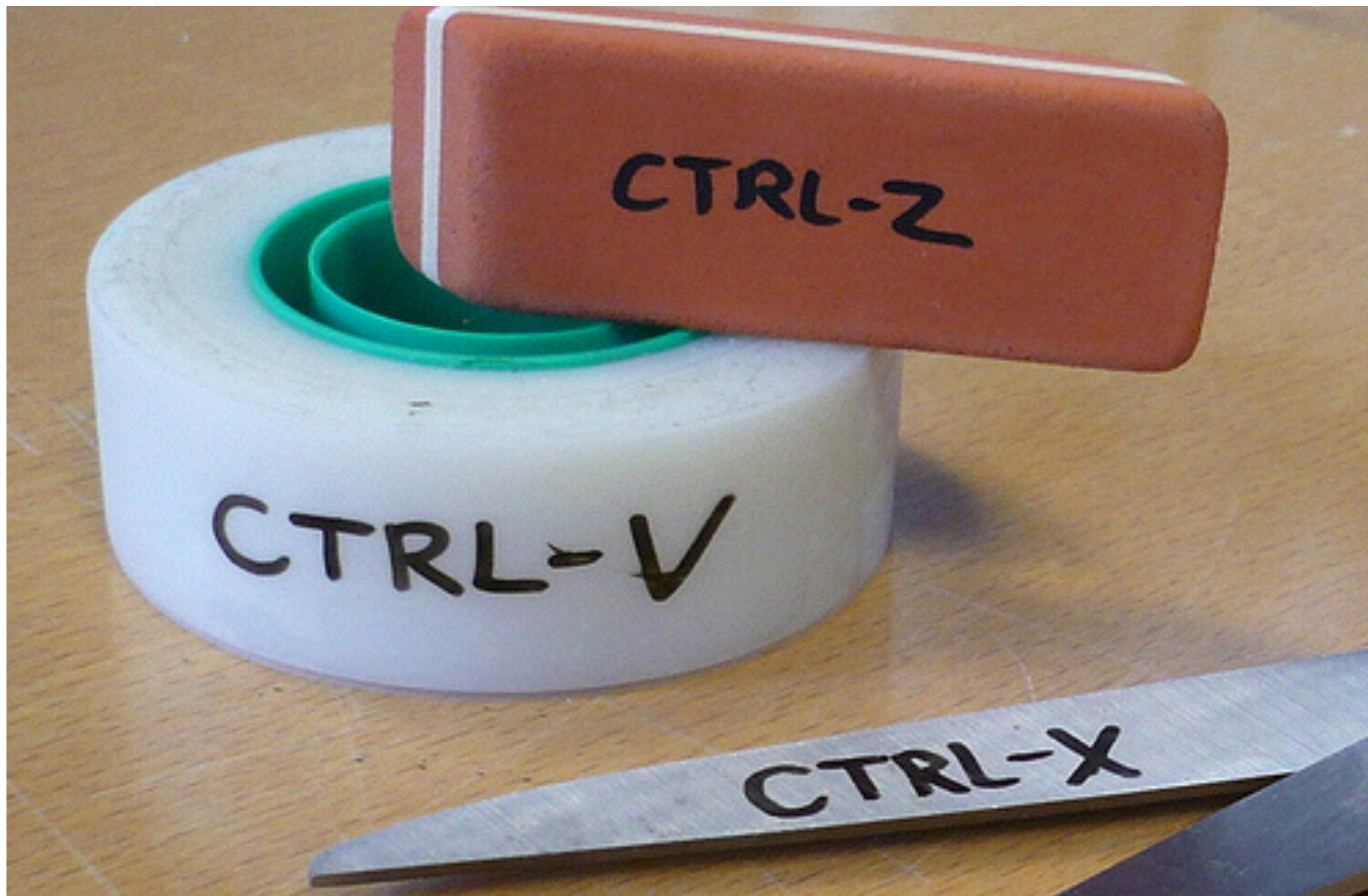
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# DNA editing

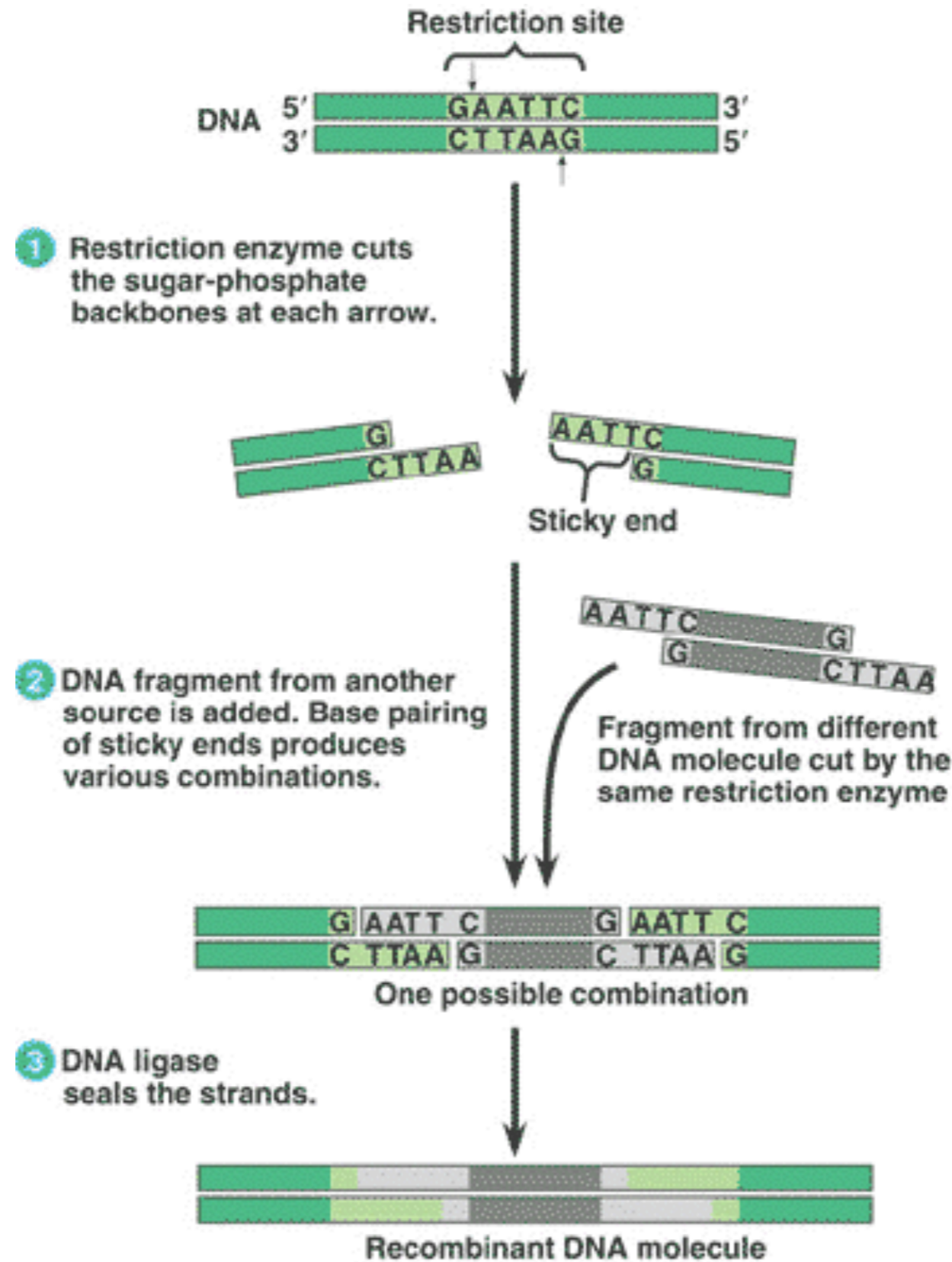


# Cutting & Pasting



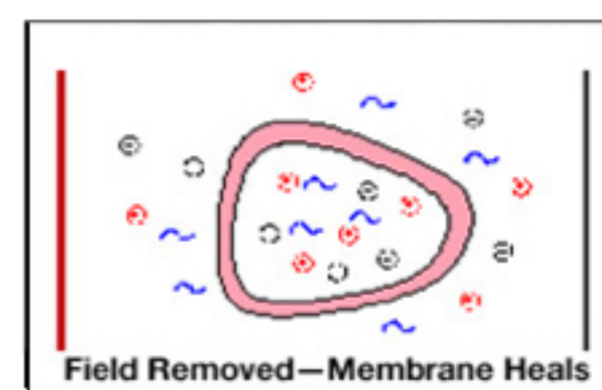
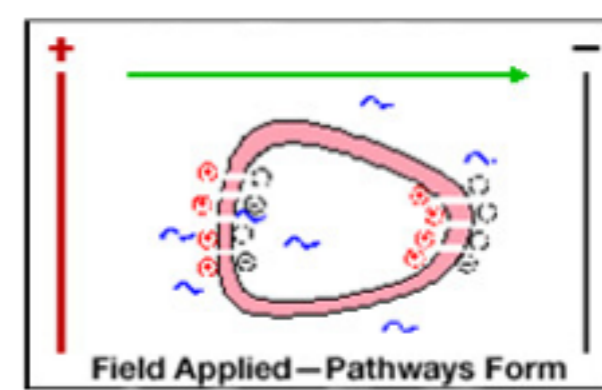
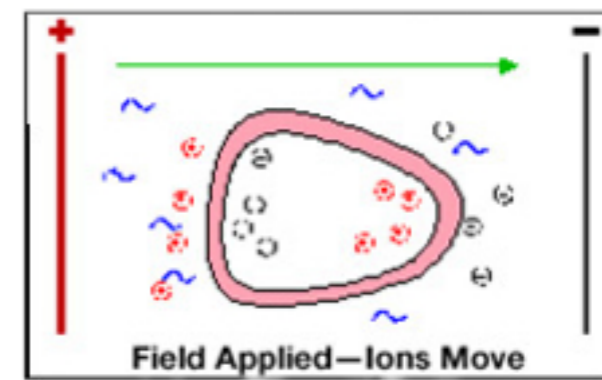
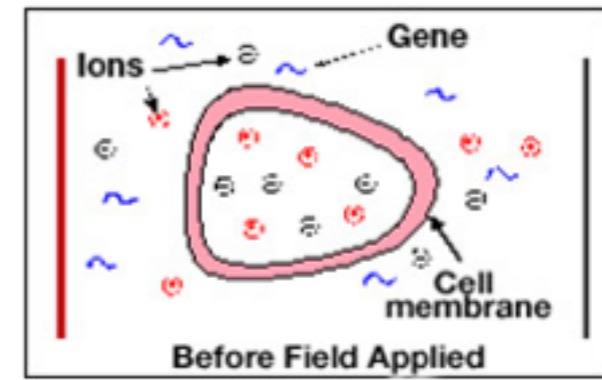


# DNA Restriction Ligation





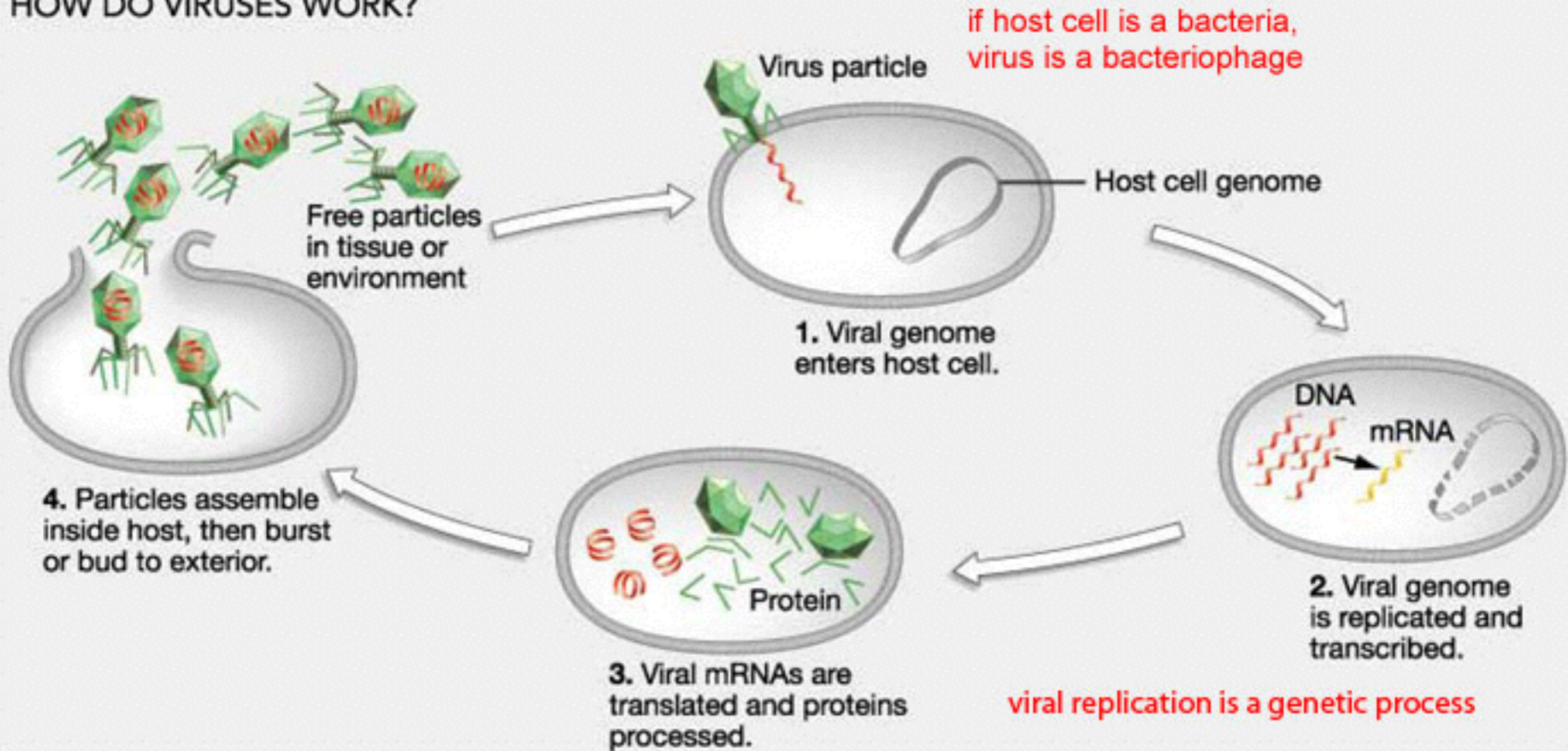
# GeneGun – Electroporation





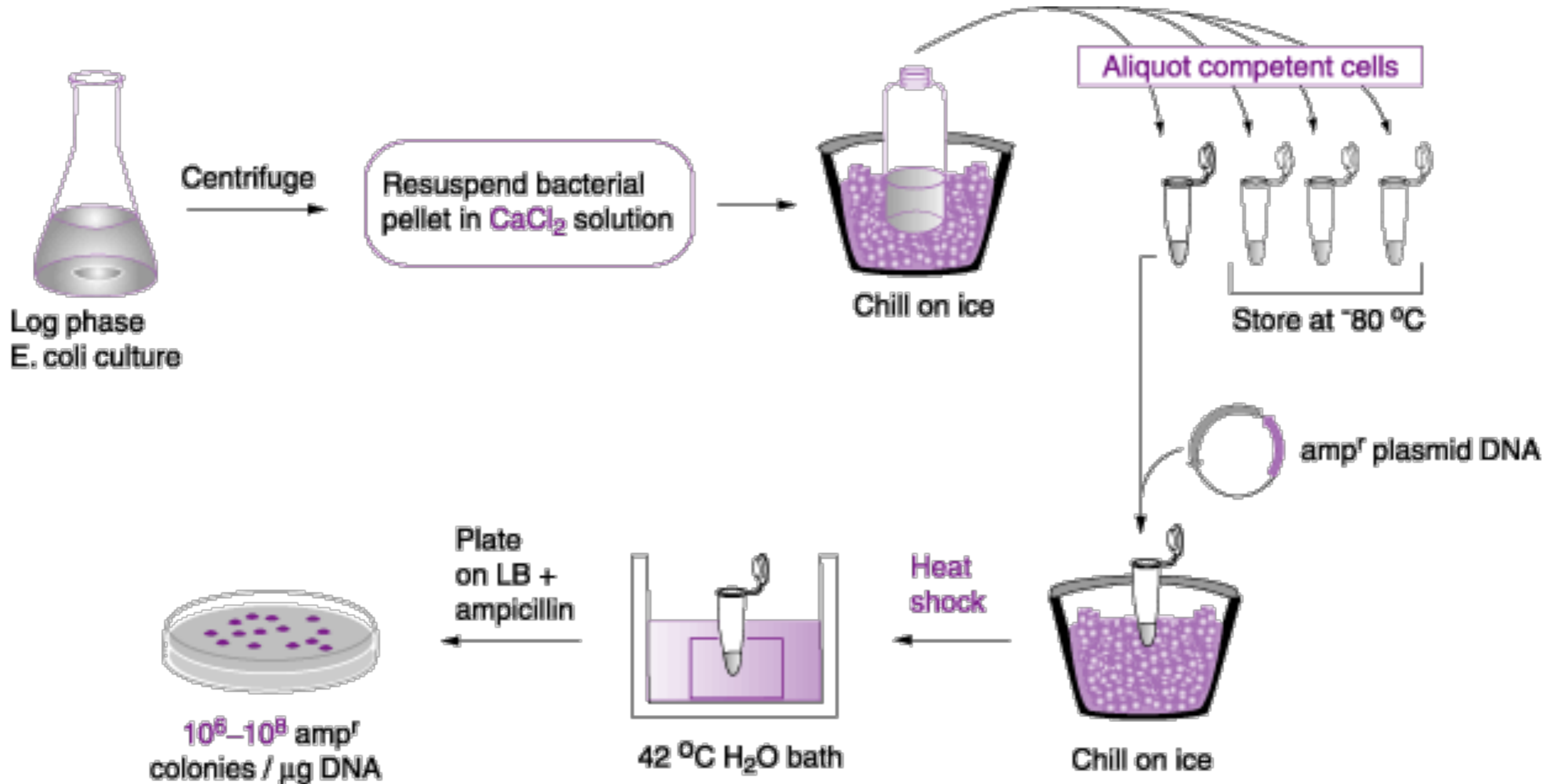
# Viral Transformation

HOW DO VIRUSES WORK?





# Heat Shock Transformation





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