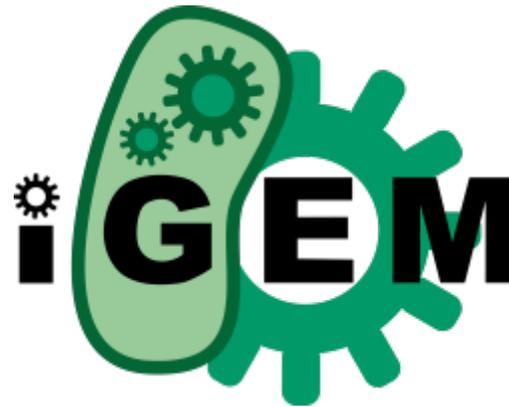




International



Synthetic Biology



Teamwork and  
Collaboration



Competition



International



Synthetic Biology



Teamwork and  
Collaboration



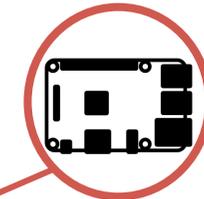
Competition



Software



Biology



Hardware



International



Software



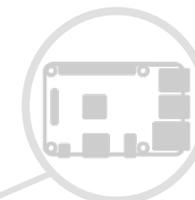
Biology



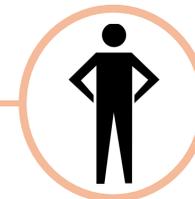
Synthetic Biology



Hardware



Human Practices



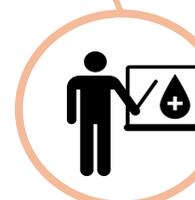
Teamwork and Collaboration



Competition



Education



Open source



# What is Synthetic Biology?



Bananish ?



Kiwange?

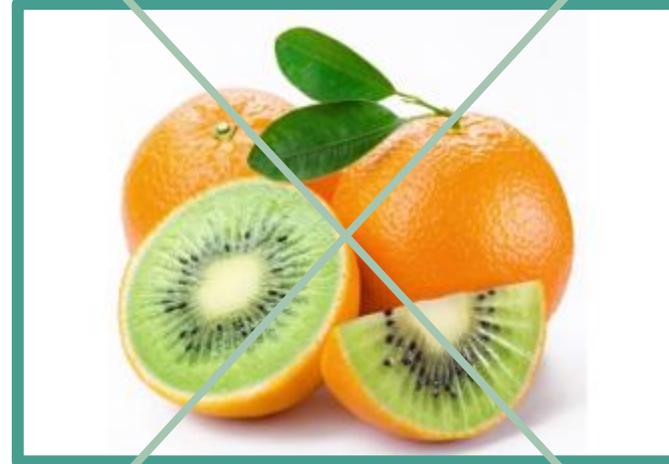


Zebaroo?

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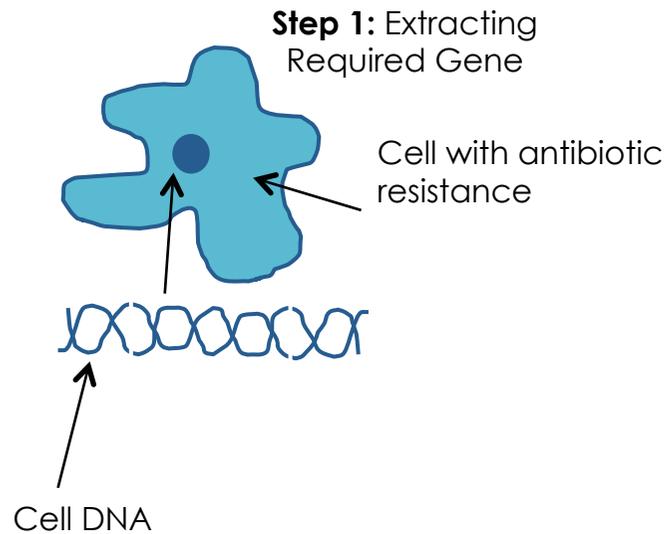
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# What is Synthetic Biology?

**Definition:** The design or redesign of new or existing biological parts, devices and systems for useful purposes.

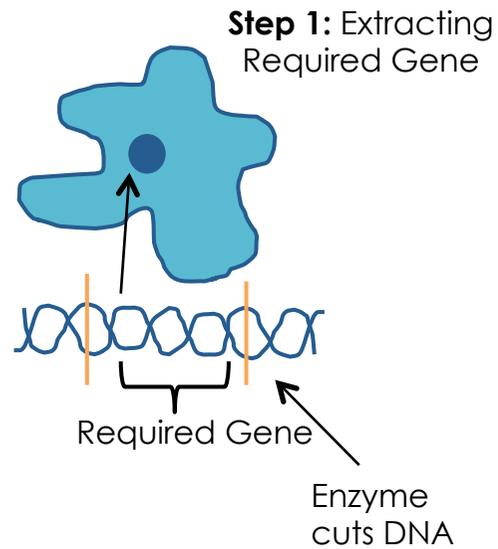
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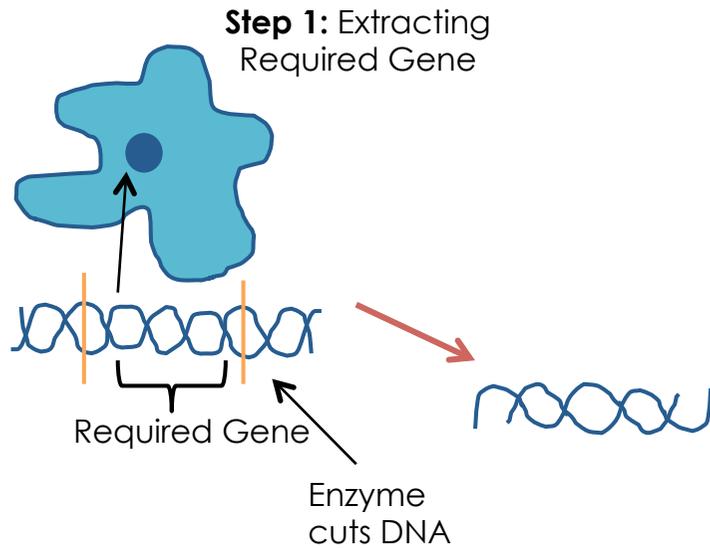
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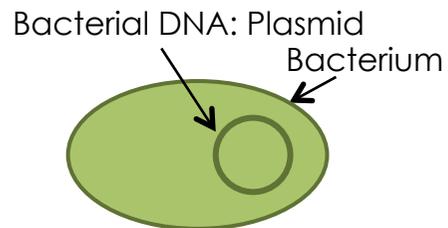
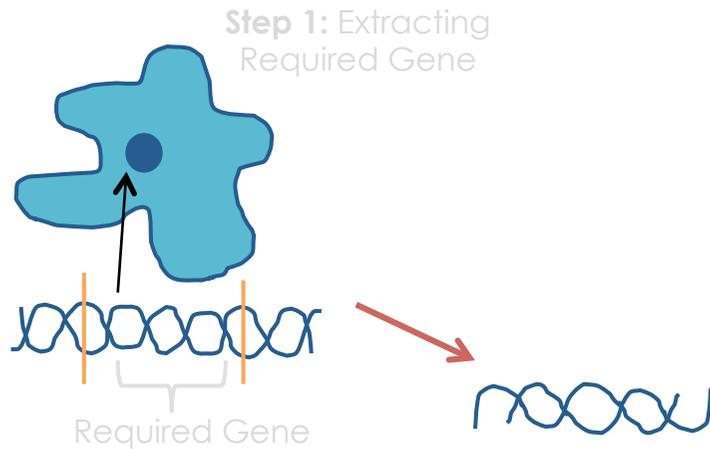
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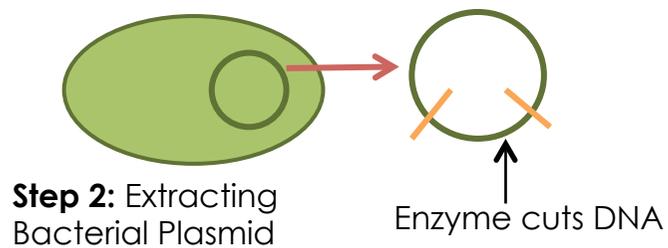
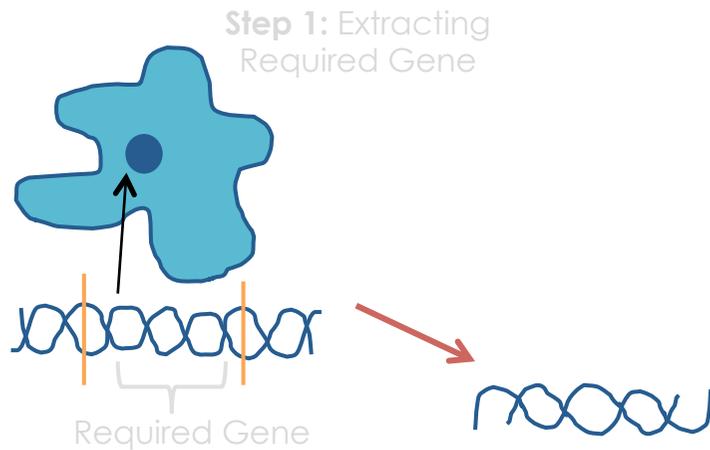
**Definition:** The design or redesign of new or existing biological parts, devices and systems for useful purposes.



**Step 2:** Extracting Bacterial Plasmid

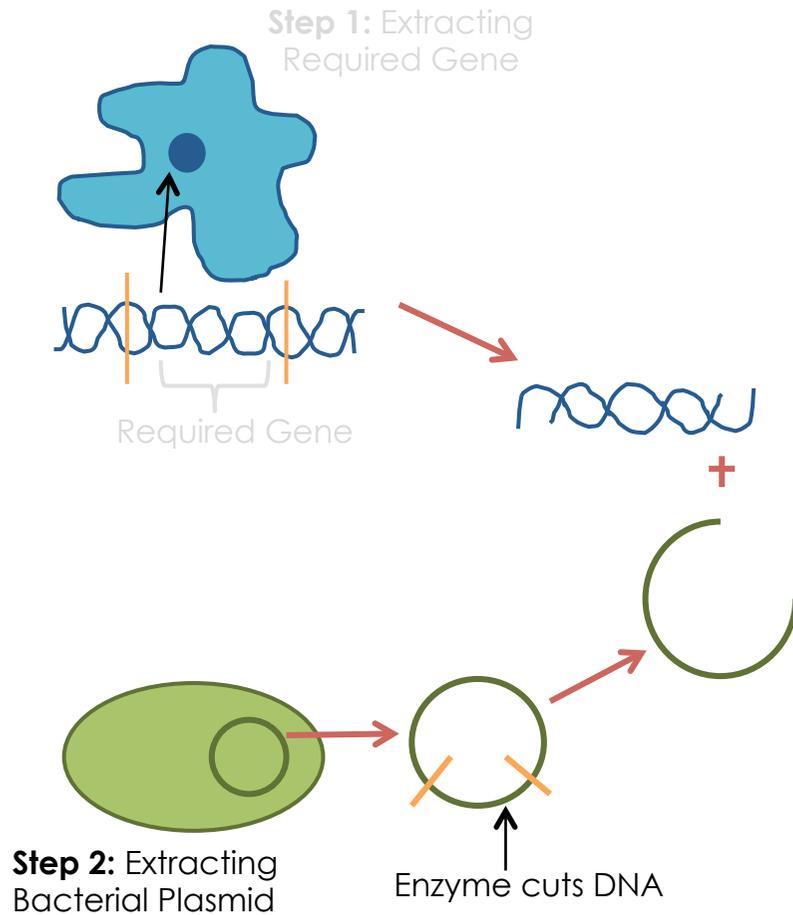
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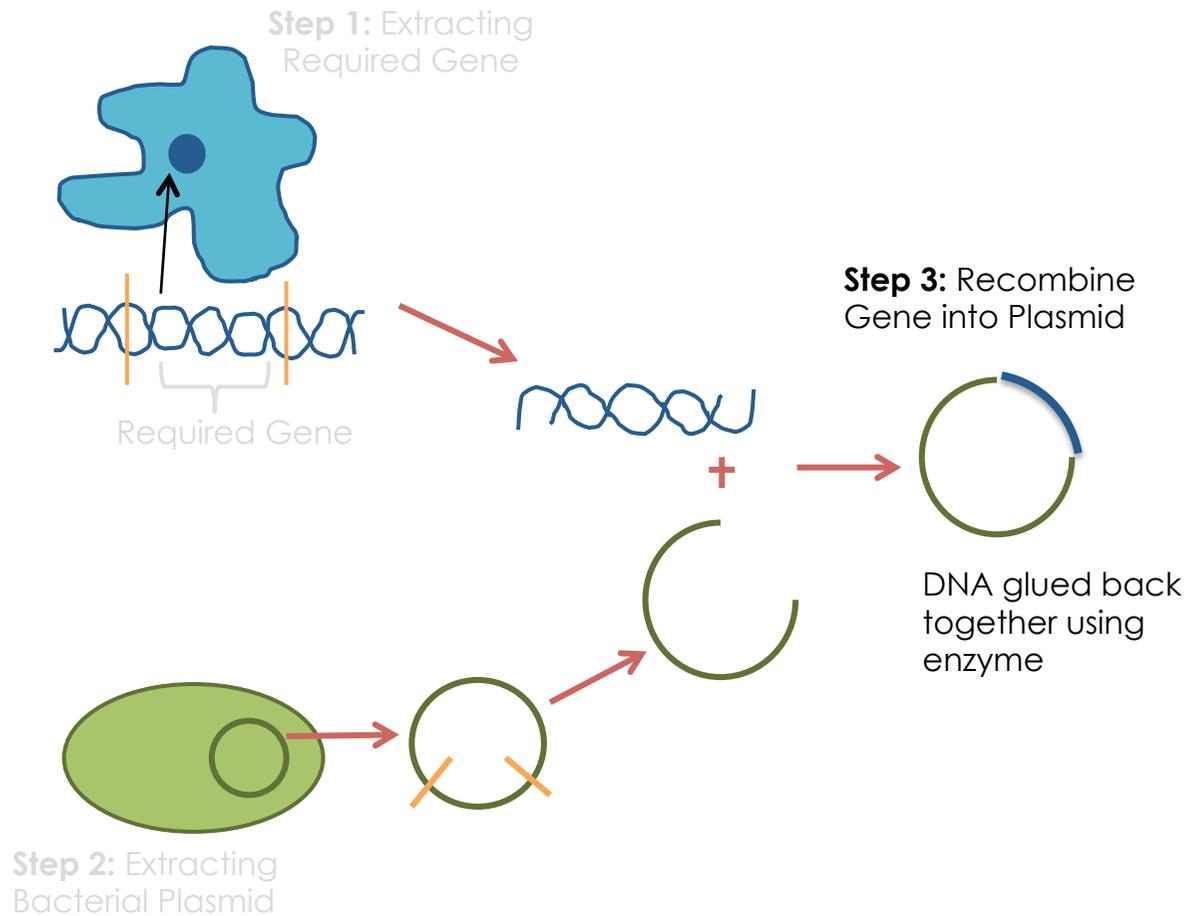
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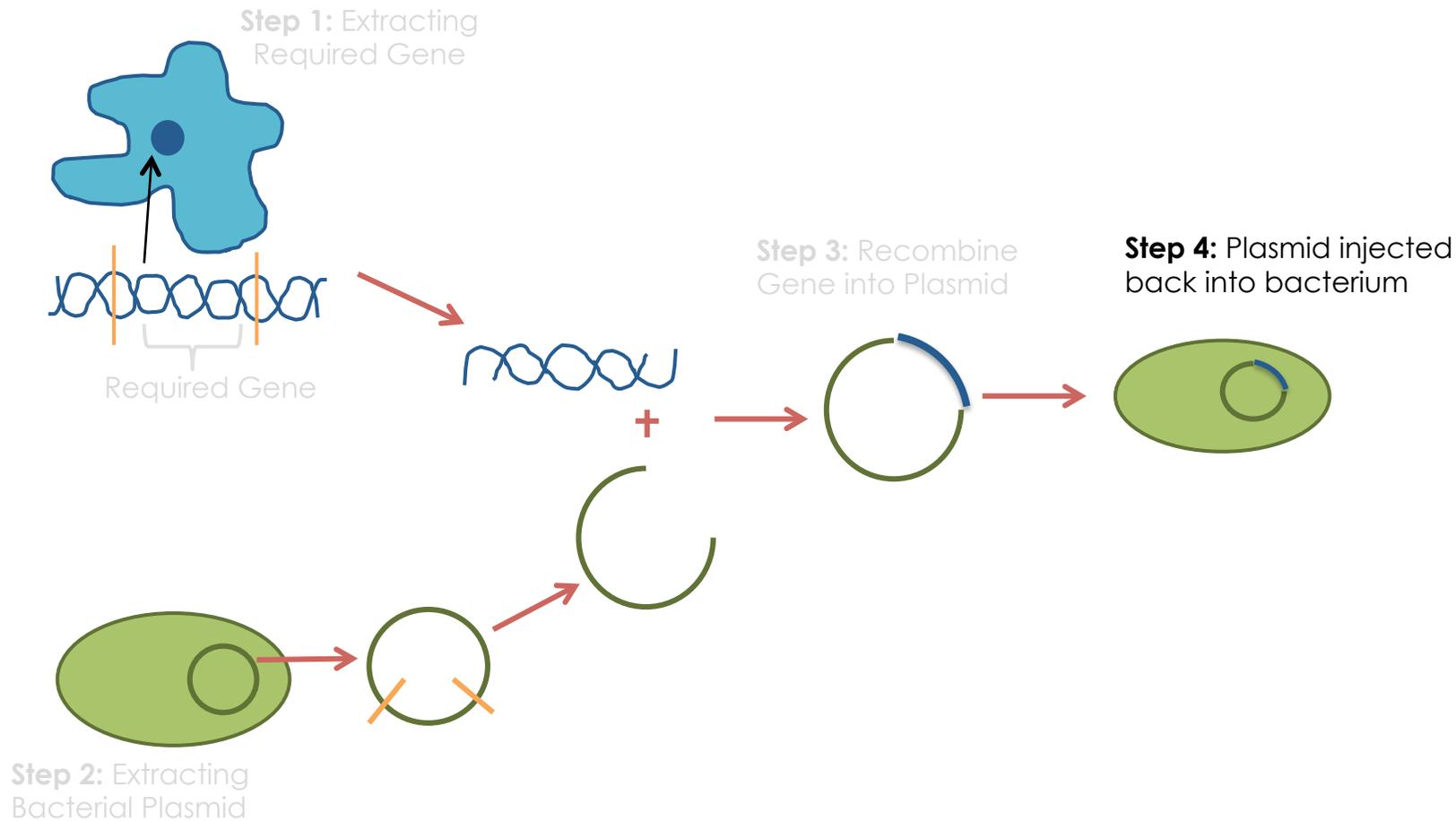
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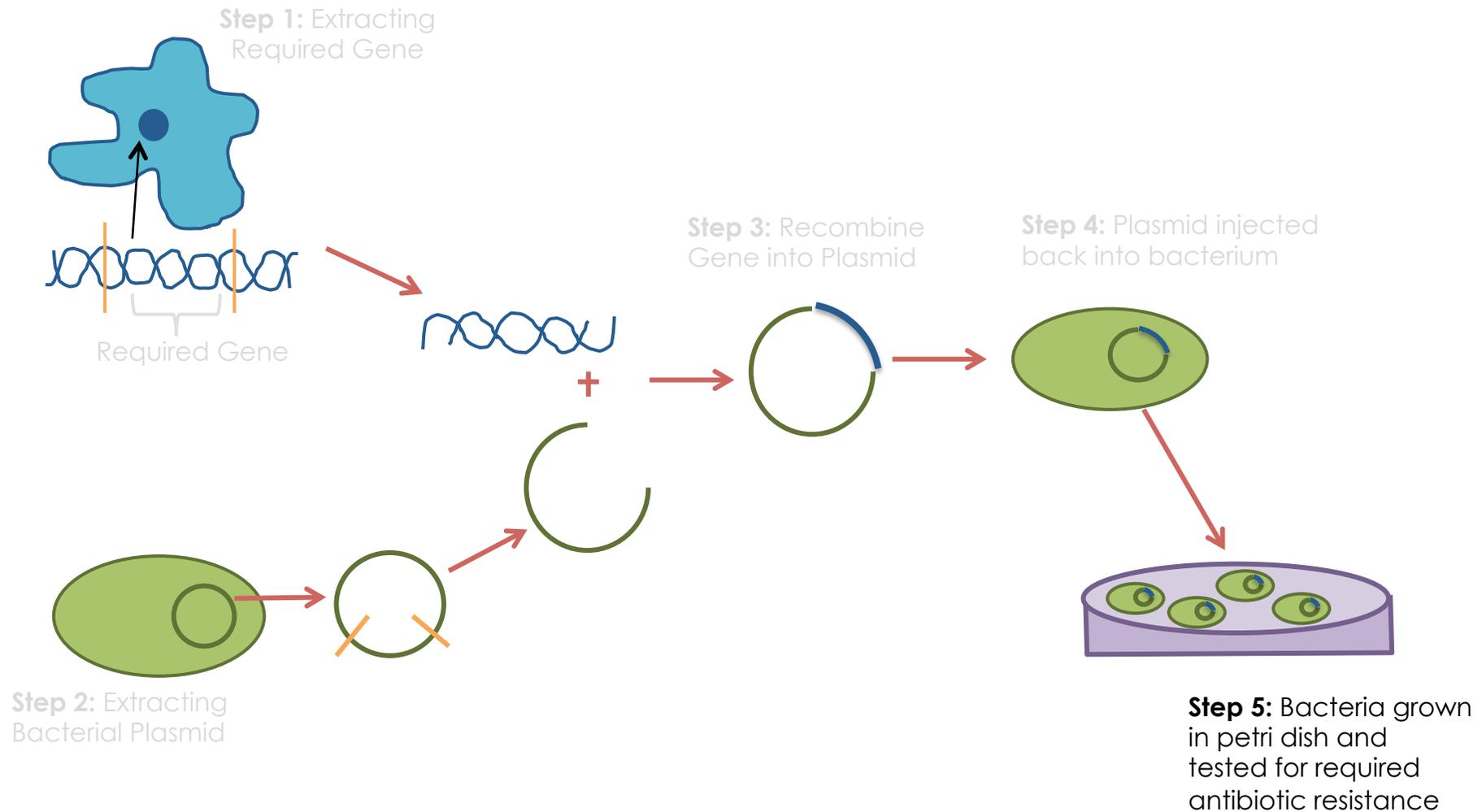
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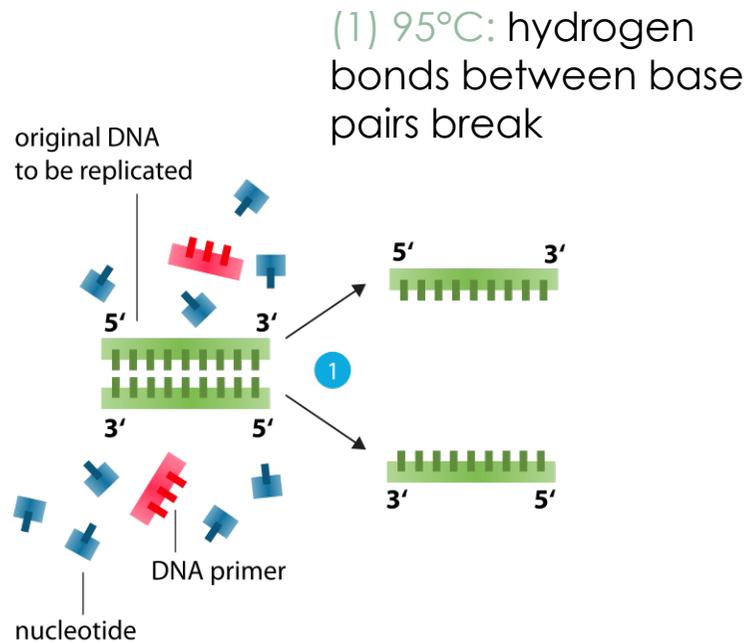
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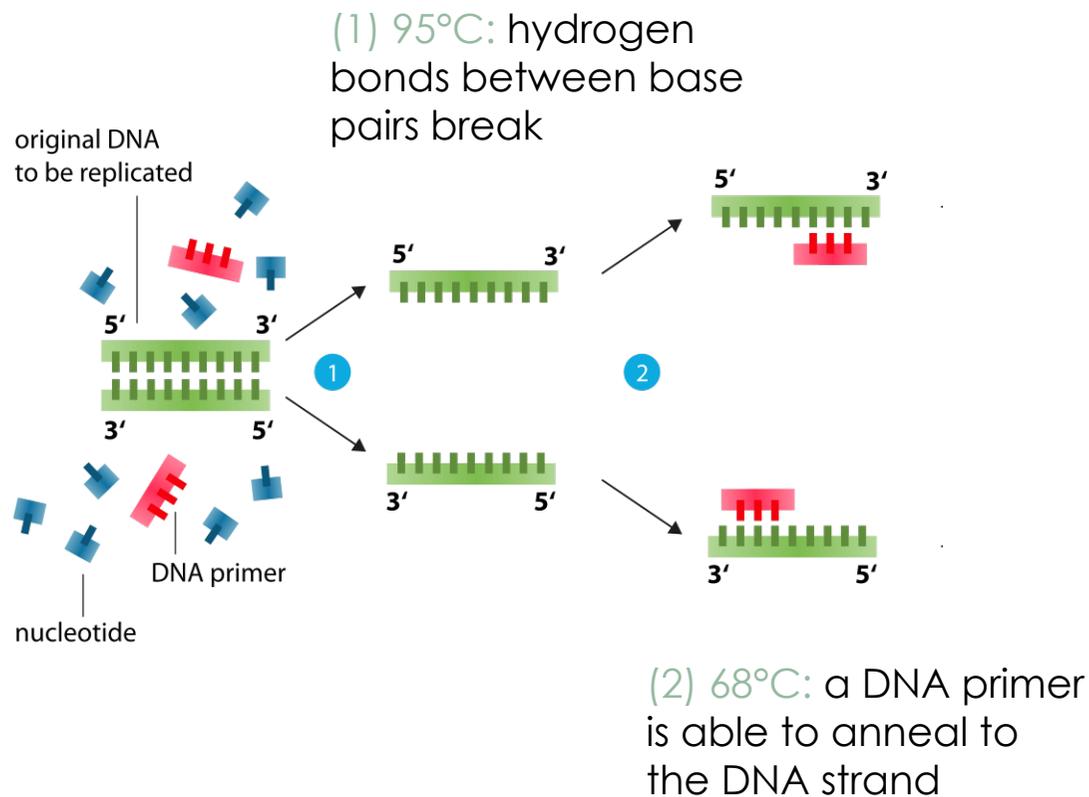
# How is this done on a larger scale: PCR

**PCR (Polymerase Chain Reaction):** Process by which a single piece of DNA is replicated to produce millions of copies.



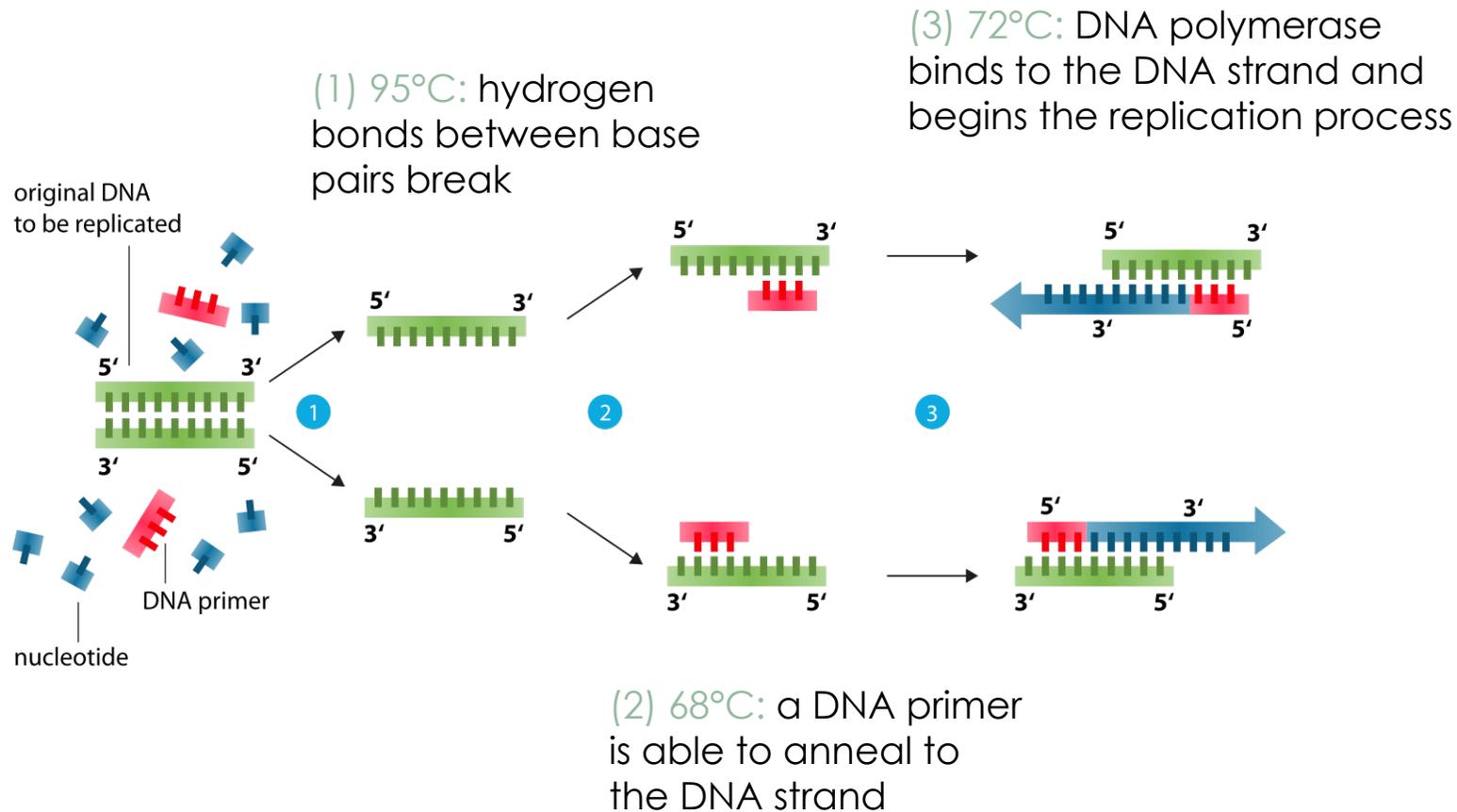
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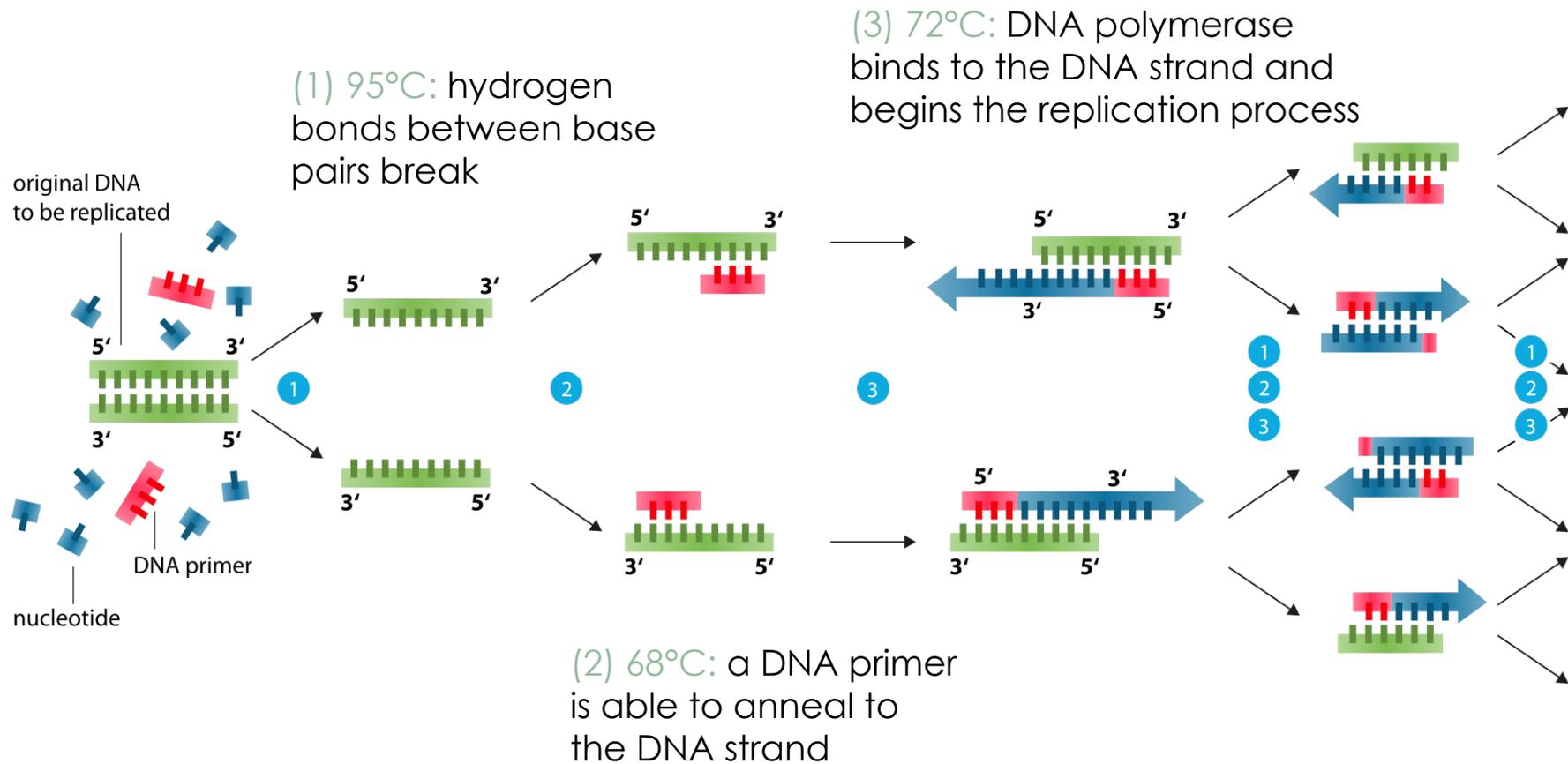
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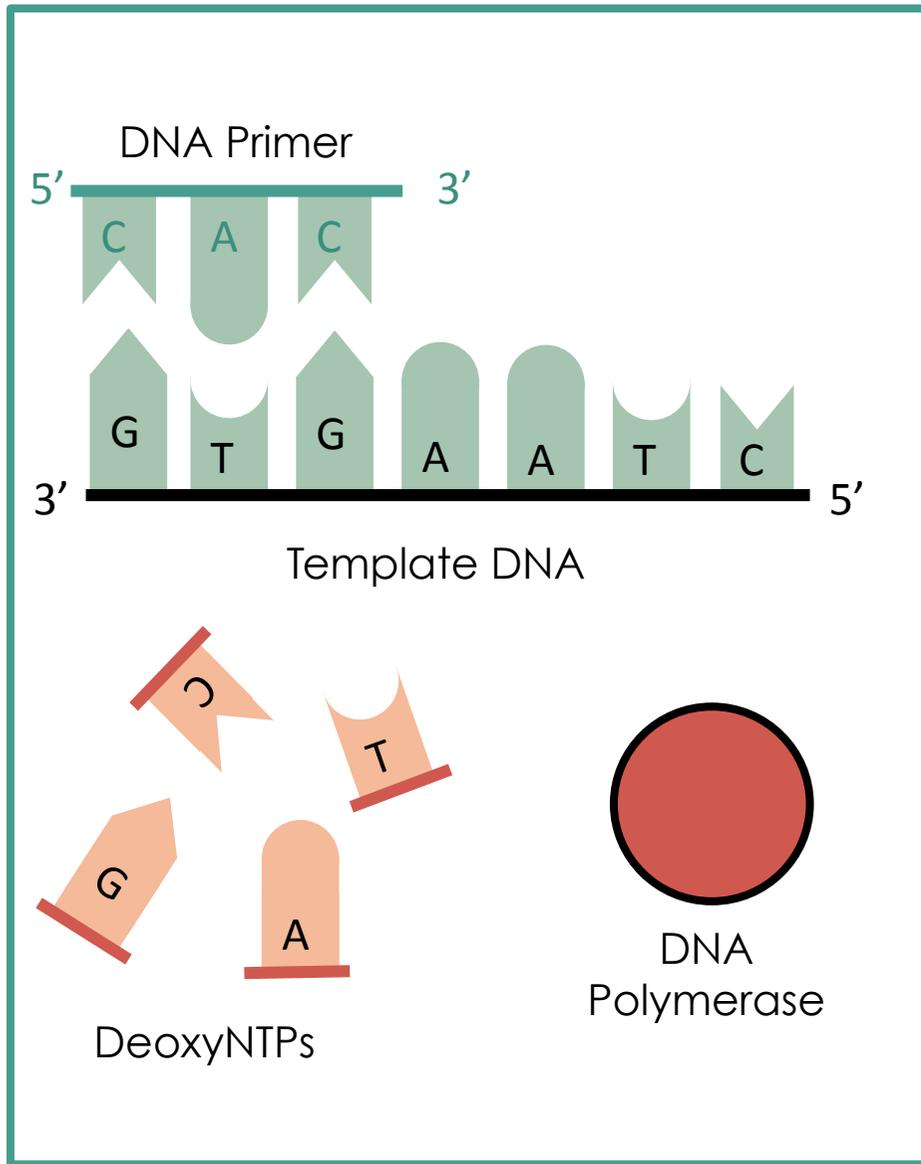


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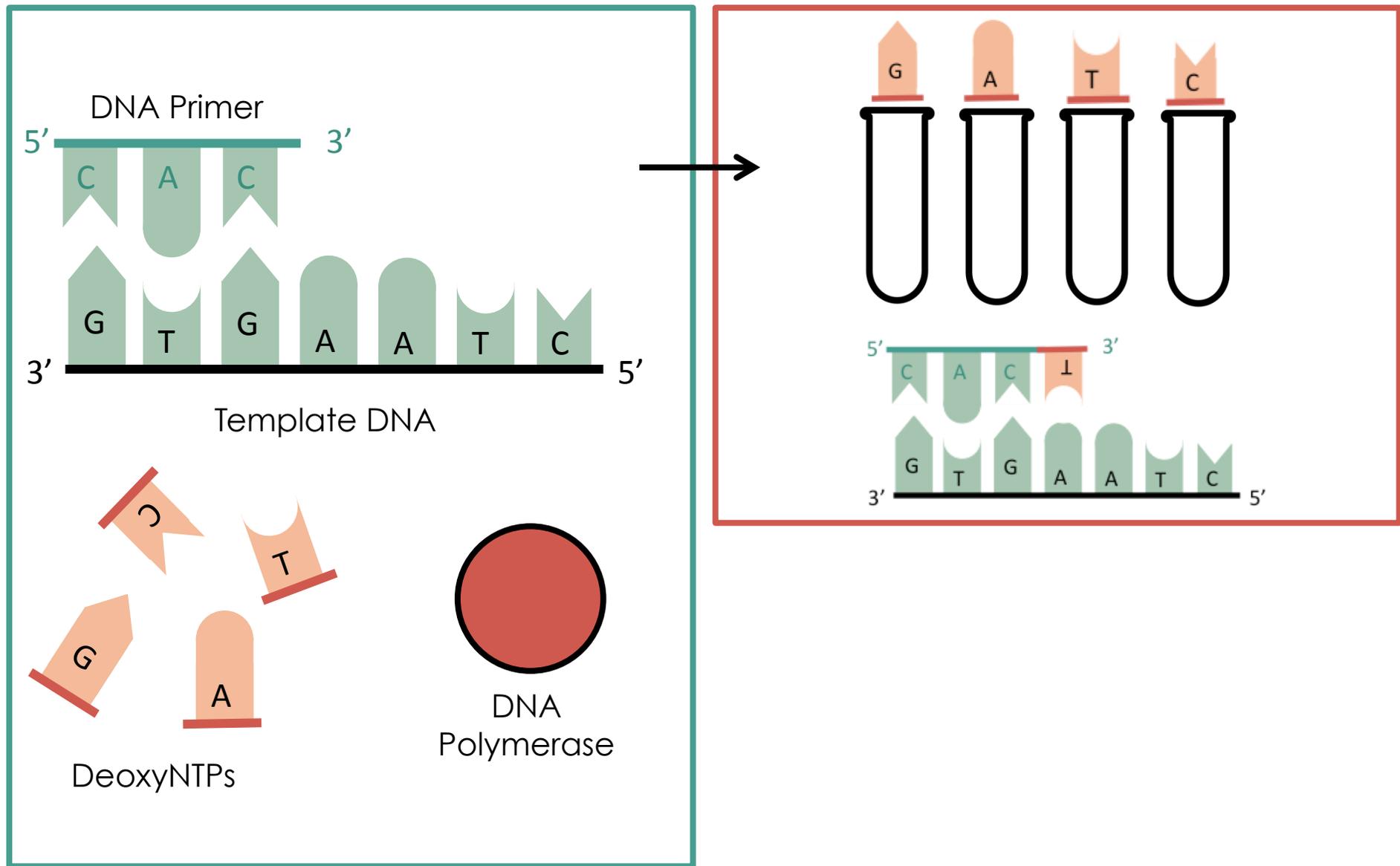
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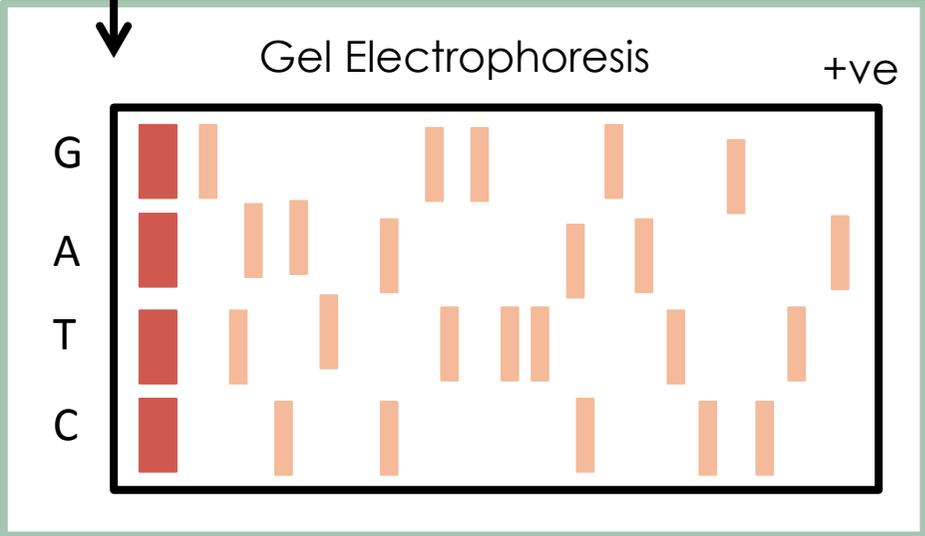
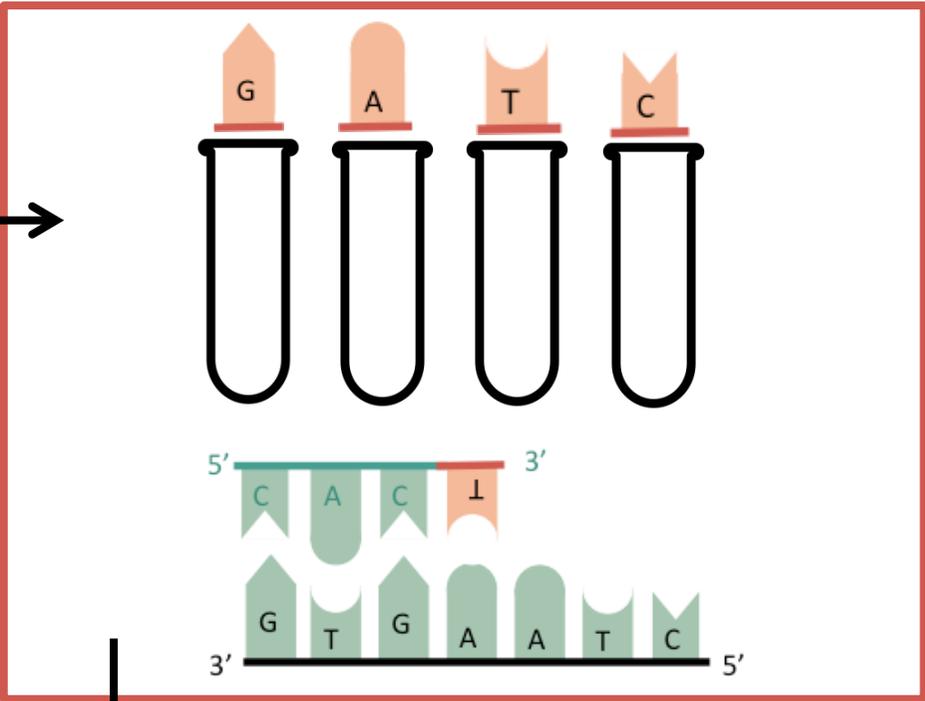
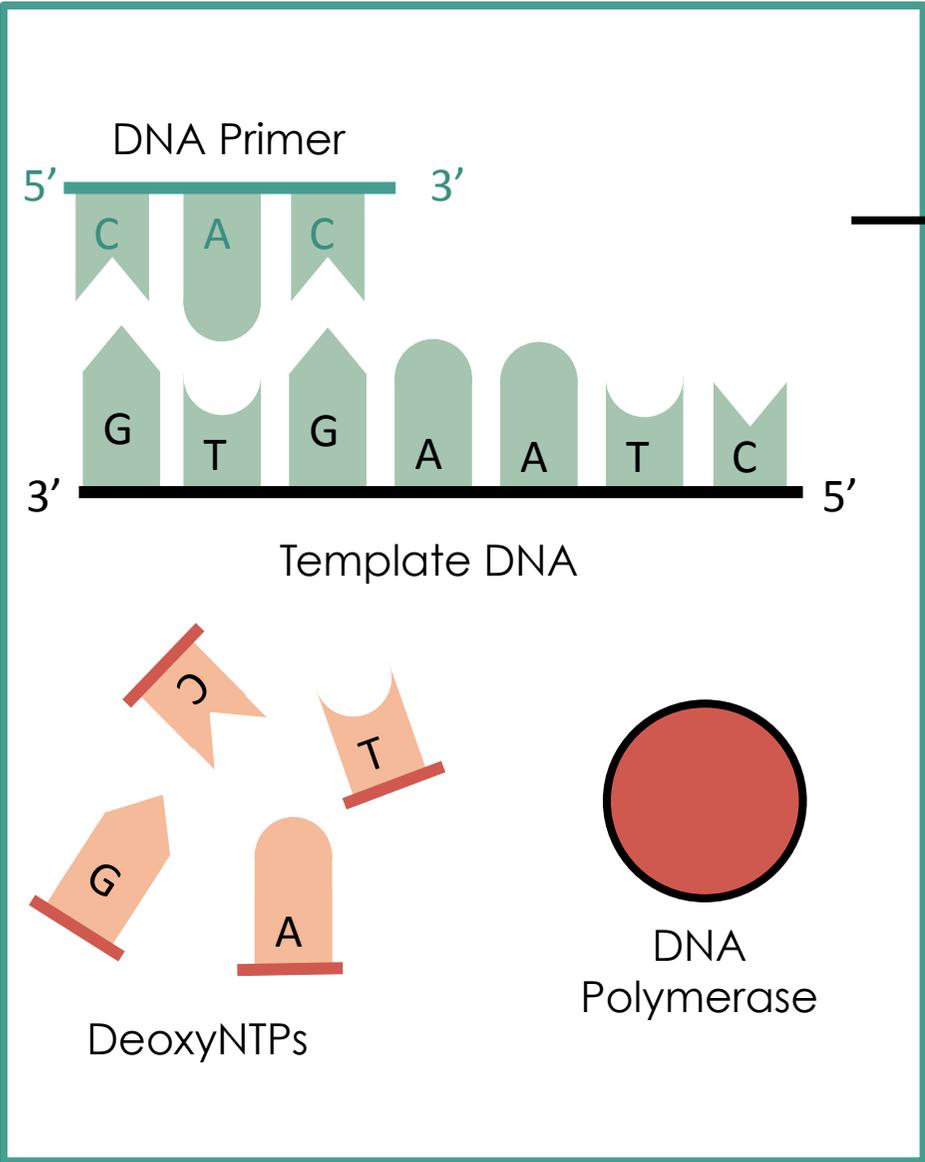
# Sequencing Genes



# Sequencing Genes



# Sequencing Genes



# Why is Synthetic Biology Important?

## Problems

## Solutions

Food Shortage



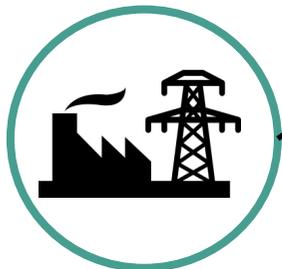
Climate Change



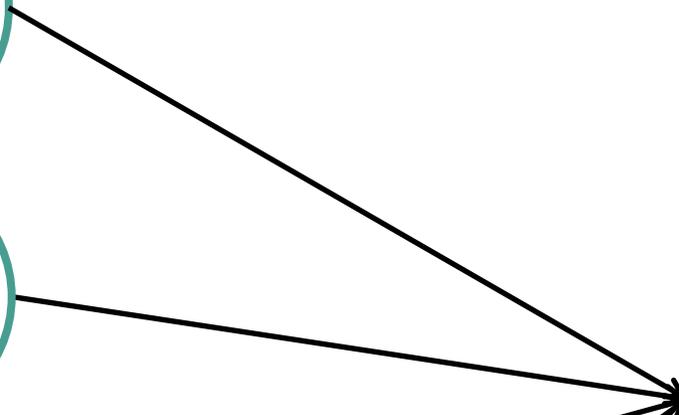
Need for New Medicines



Finite Power Supply



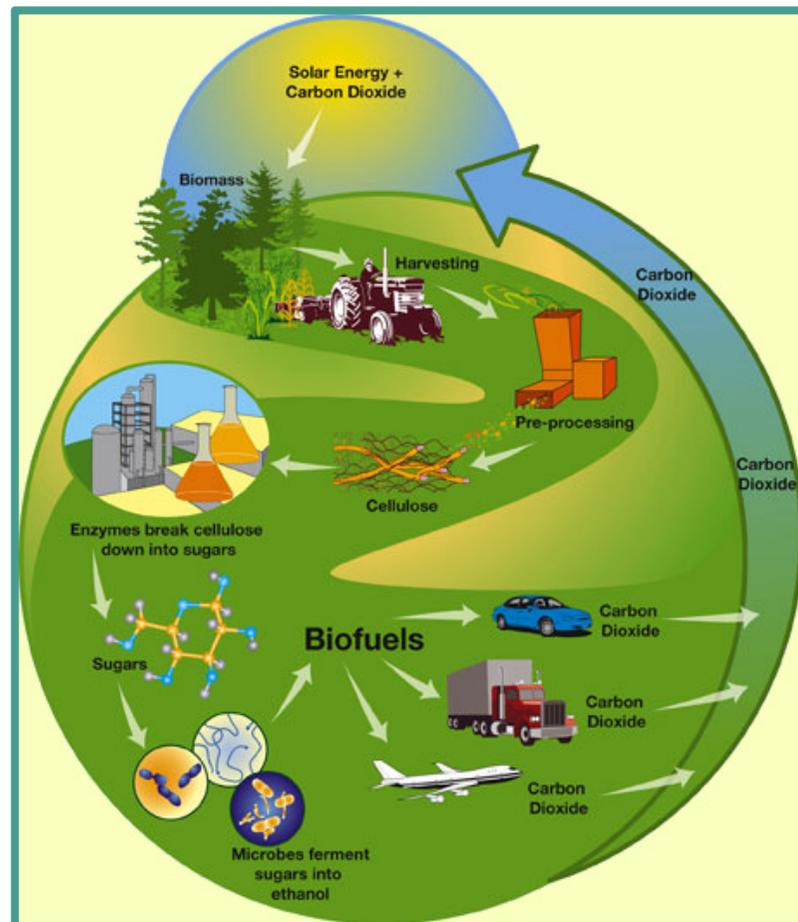
Synthetic Biology



# Finite Power Supply: Biofuels

## What are they?

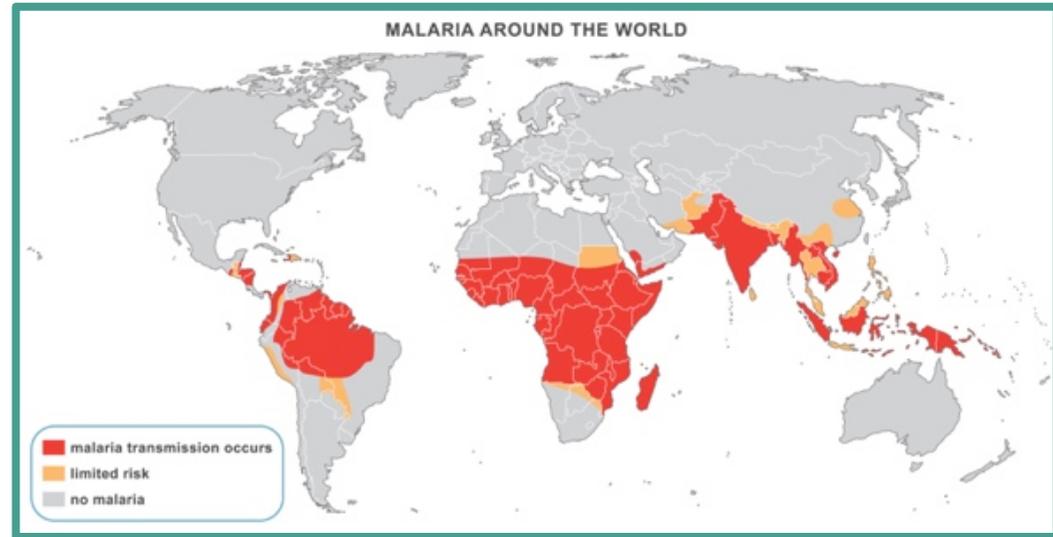
Fuels extracted from plants and crops.



1. Renewable
2. Reduce Greenhouse Gases
3. Less Pollution
4. Lower Cost

# Need for New Medicines: Artemisinin

- In 2008 there were 247 million cases of malaria, with 1 million resulting in death (World Health Organisation).
- Naturally artemisinin is produced by a plant, cultivated by farmers. This is unpredictable based on crop success.



Metabolic engineering provided an alternative method: a non-native pathway was created in yeast which contained the genes to make the drug.

# Material Production: Web Spinning Goats



- Spider silk is a **very strong** material, stronger than kevlar.
- This and its **flexibility** allow for its use in many potential applications. E.g. **artificial ligaments**.
- Spiders cannot be farmed, they just eat one another.

By combining genes from the spider's DNA and goat embryos it is possible for normal goats to **produce the spider silk protein in their milk**. This is then extracted and spun into the silk.



# iGEM: Cambridge 2009



E. chromi:  
personalized disease  
monitoring



# iGEM: Imperial 2014

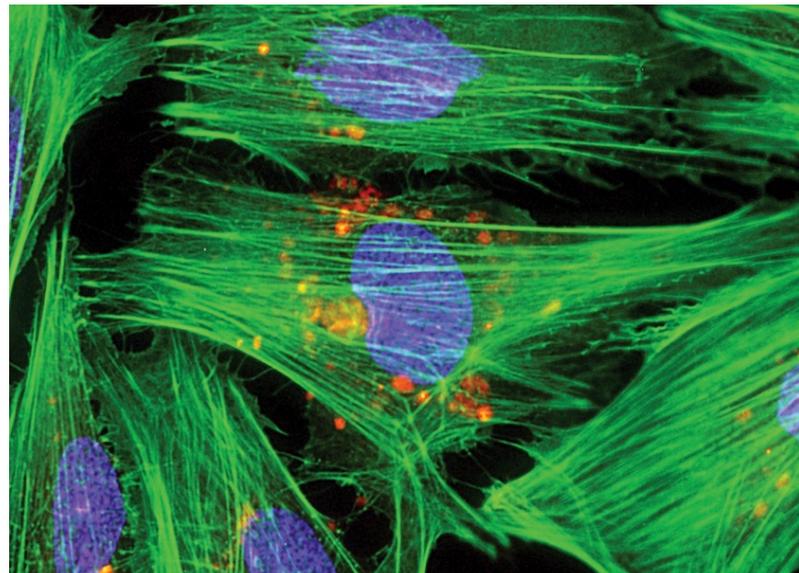
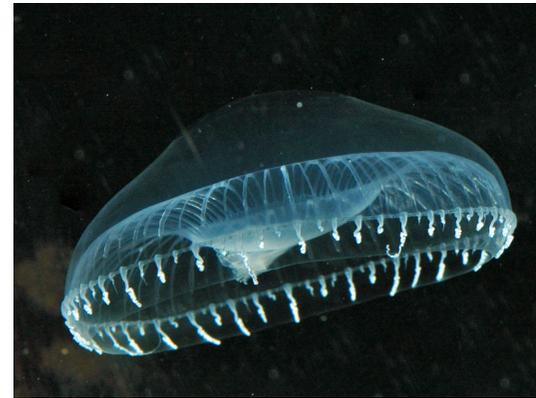


Aqualose: bacterial  
cellulose



# iGEM: Cambridge 2015

OpenScope: low-cost  
fluorescence microscope



# Cambridge 2015: OpenScope

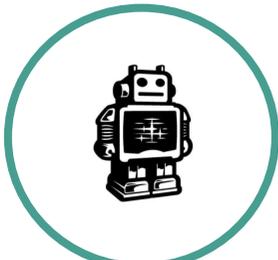
Low cost



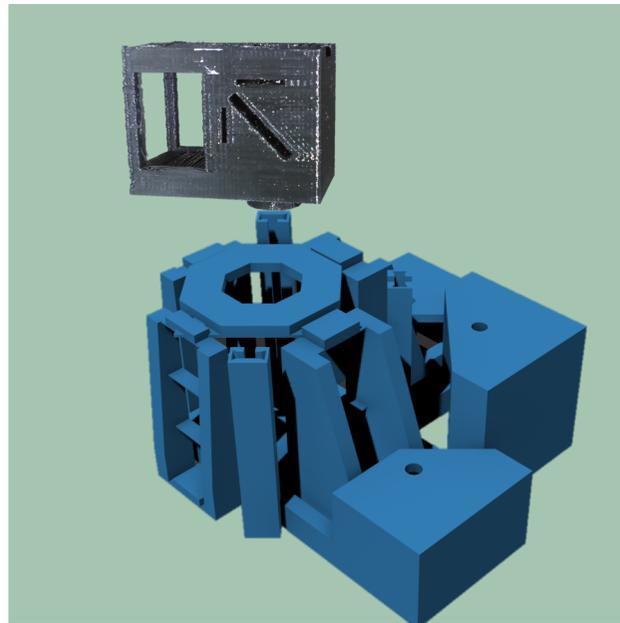
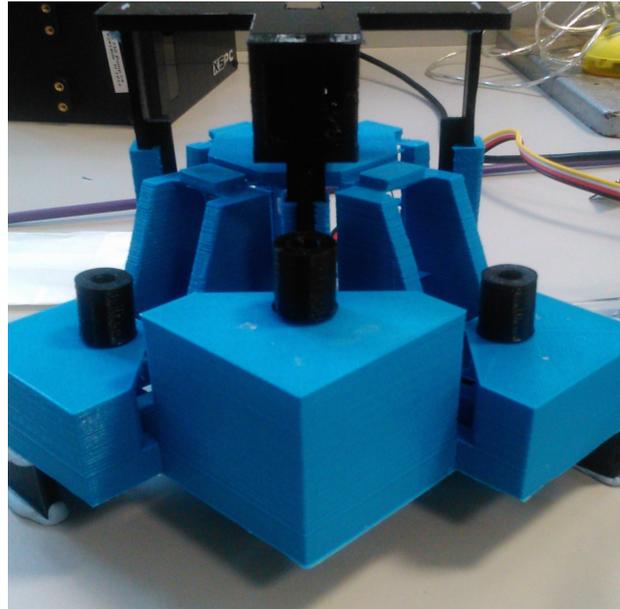
Portable



3D Printed



Easy to build/replicate



Education



Academics



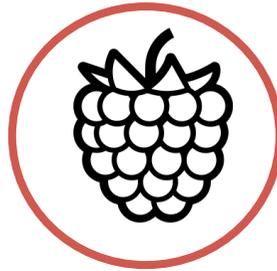
Developing Countries



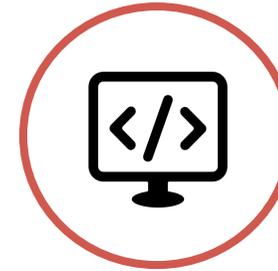
# Cambridge 2015: MicroMaps



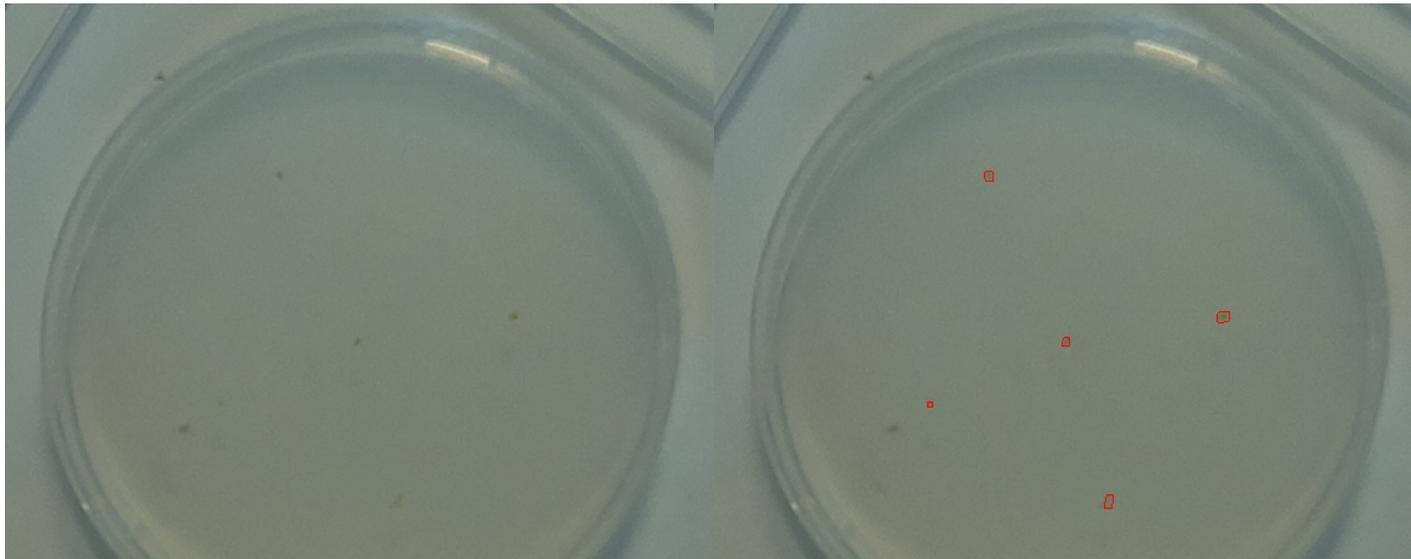
Remote Access



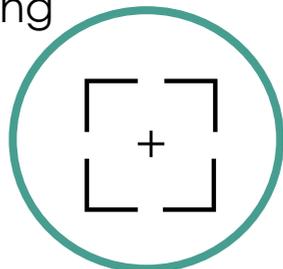
Raspberry Pi Control



Programmable



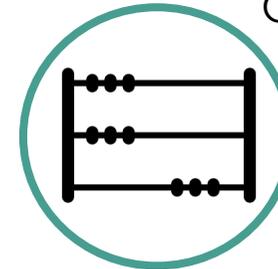
Automated  
Cell Screening



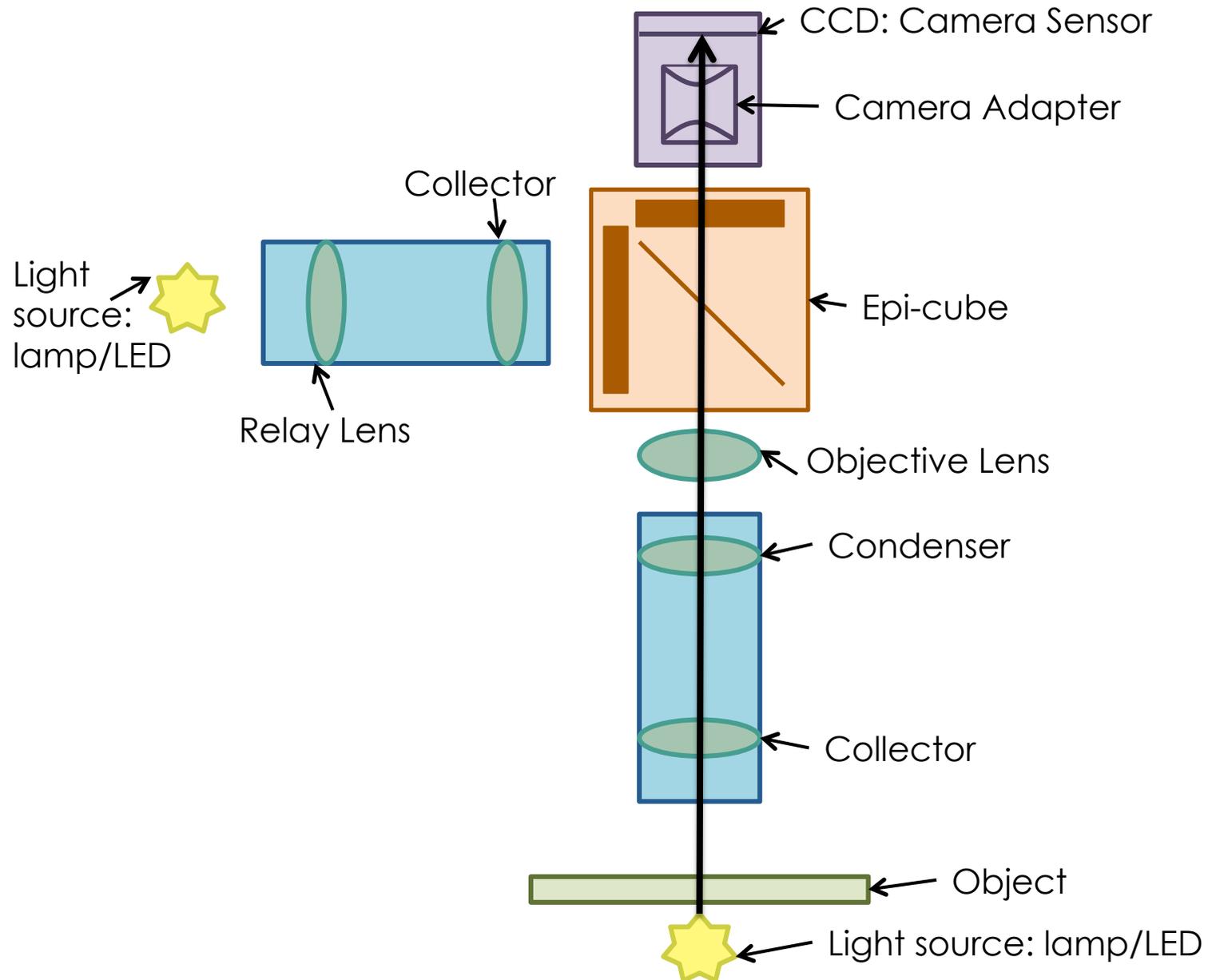
Time Lapse Imaging



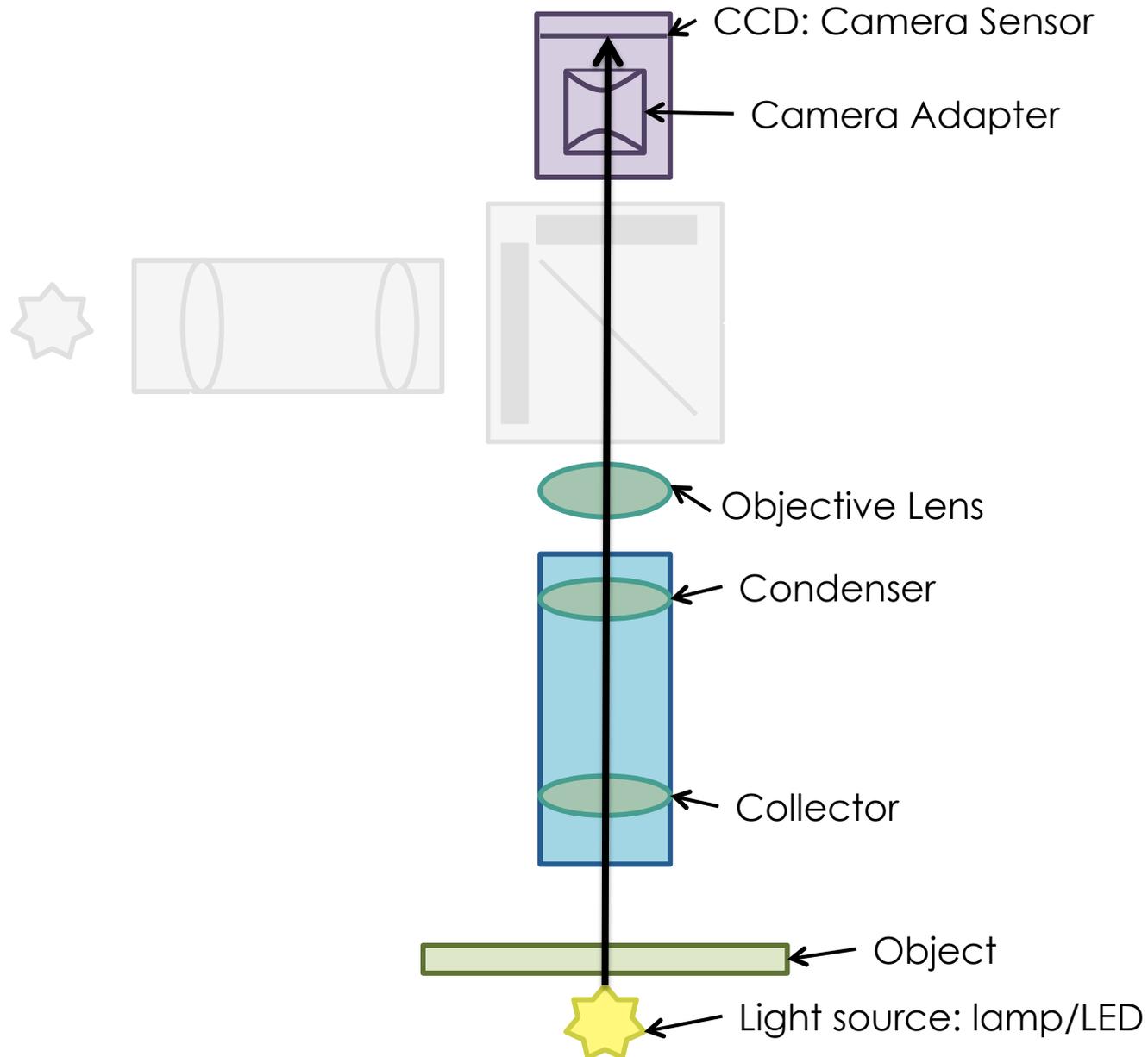
Cell  
Counting



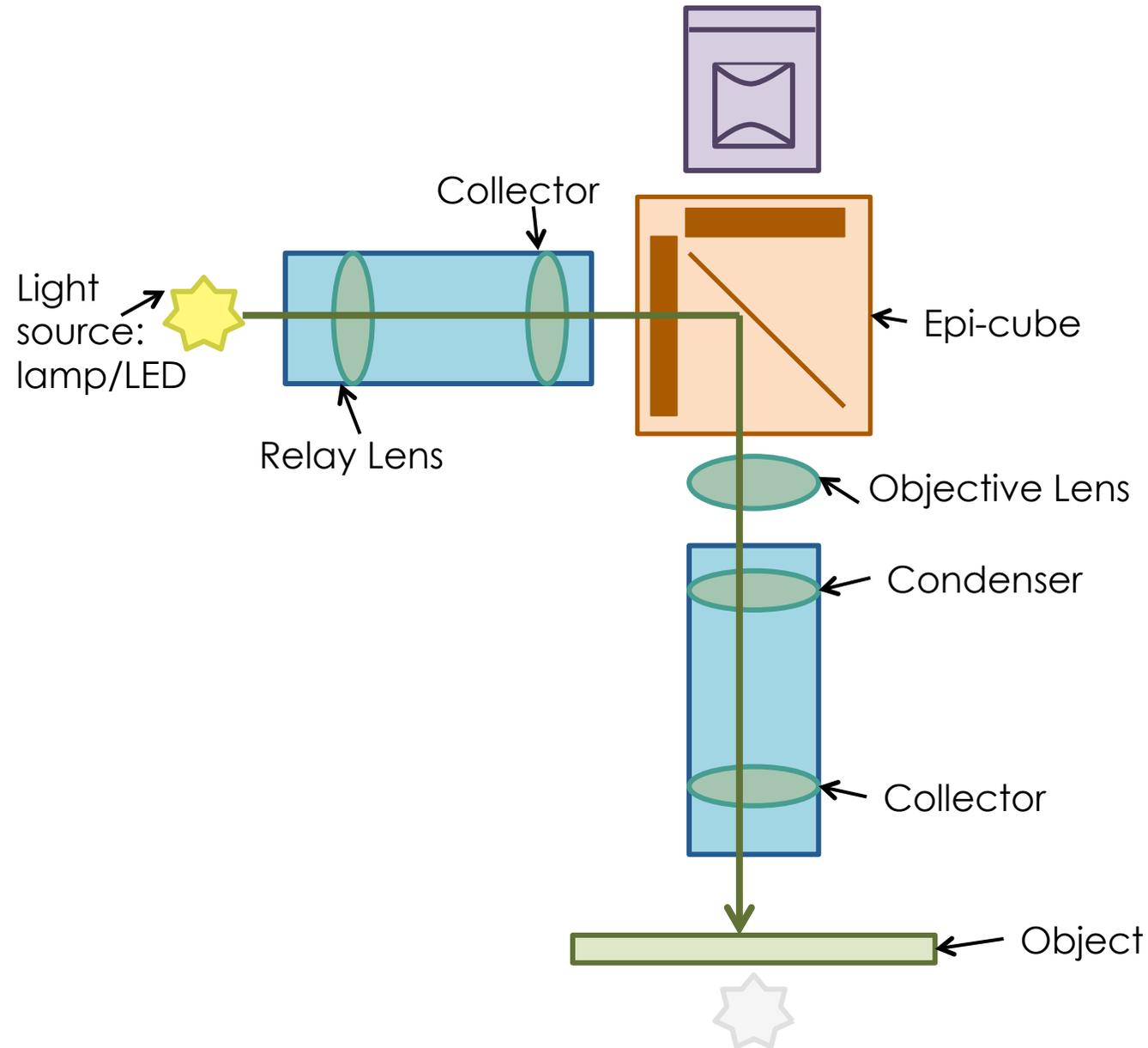
# How do microscopes work?



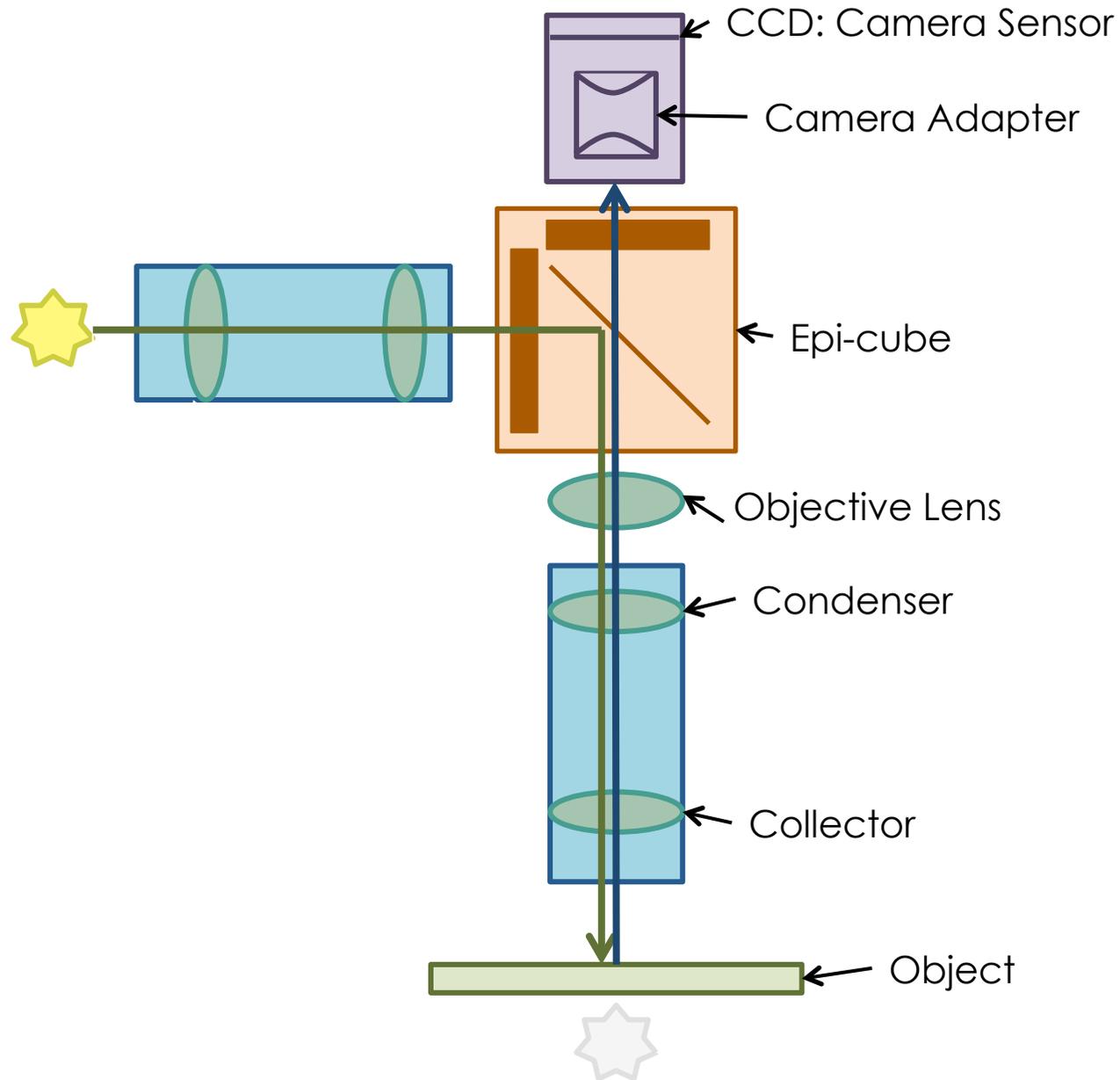
# Microscope: bright-field



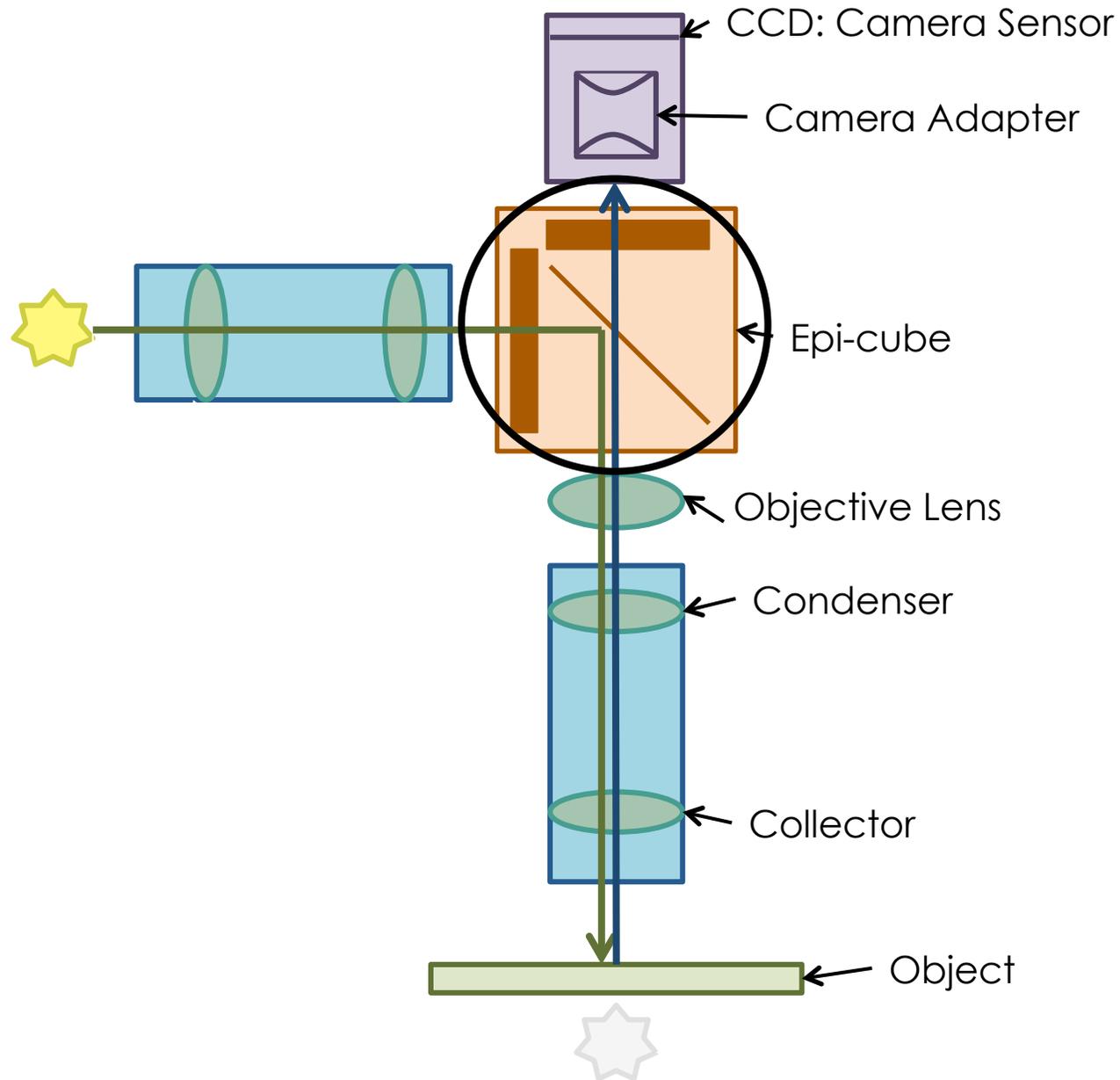
# Microscope: epi-fluorescence



# Microscope: epi-fluorescence



# Microscope: epi-fluorescence



# How does epi-fluorescence Work?

## Excitation Filter

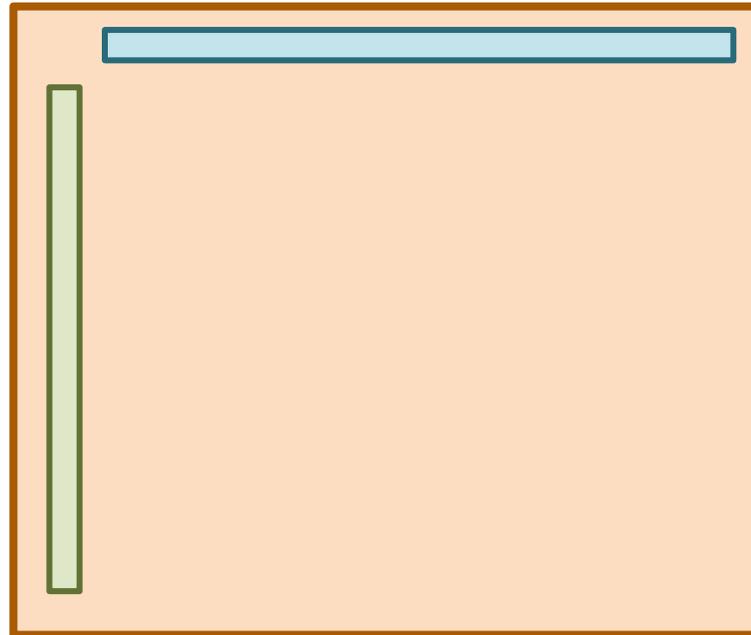
Allows wavelengths of light to be transmitted that will then excite the sample.



# How does epi-fluorescence Work?

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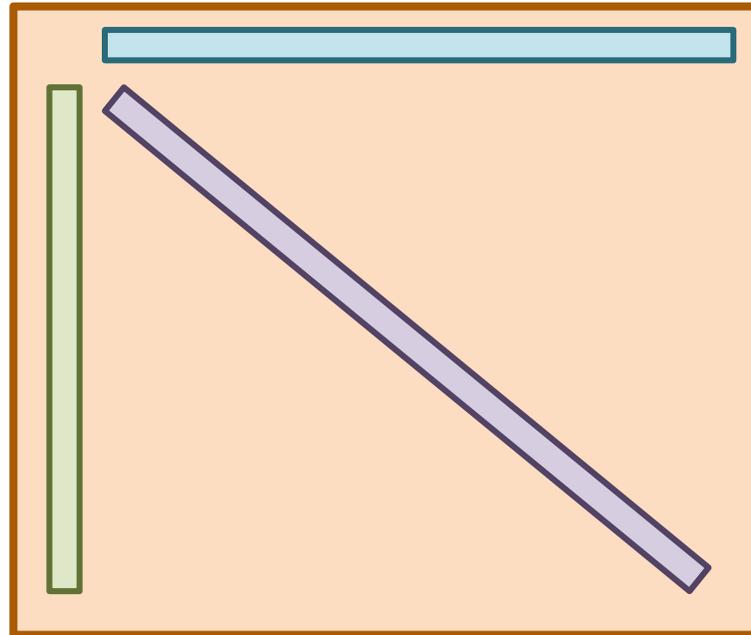
## Emission Filter

Allows wavelengths of light to be transmitted that will be detected by the camera sensor.

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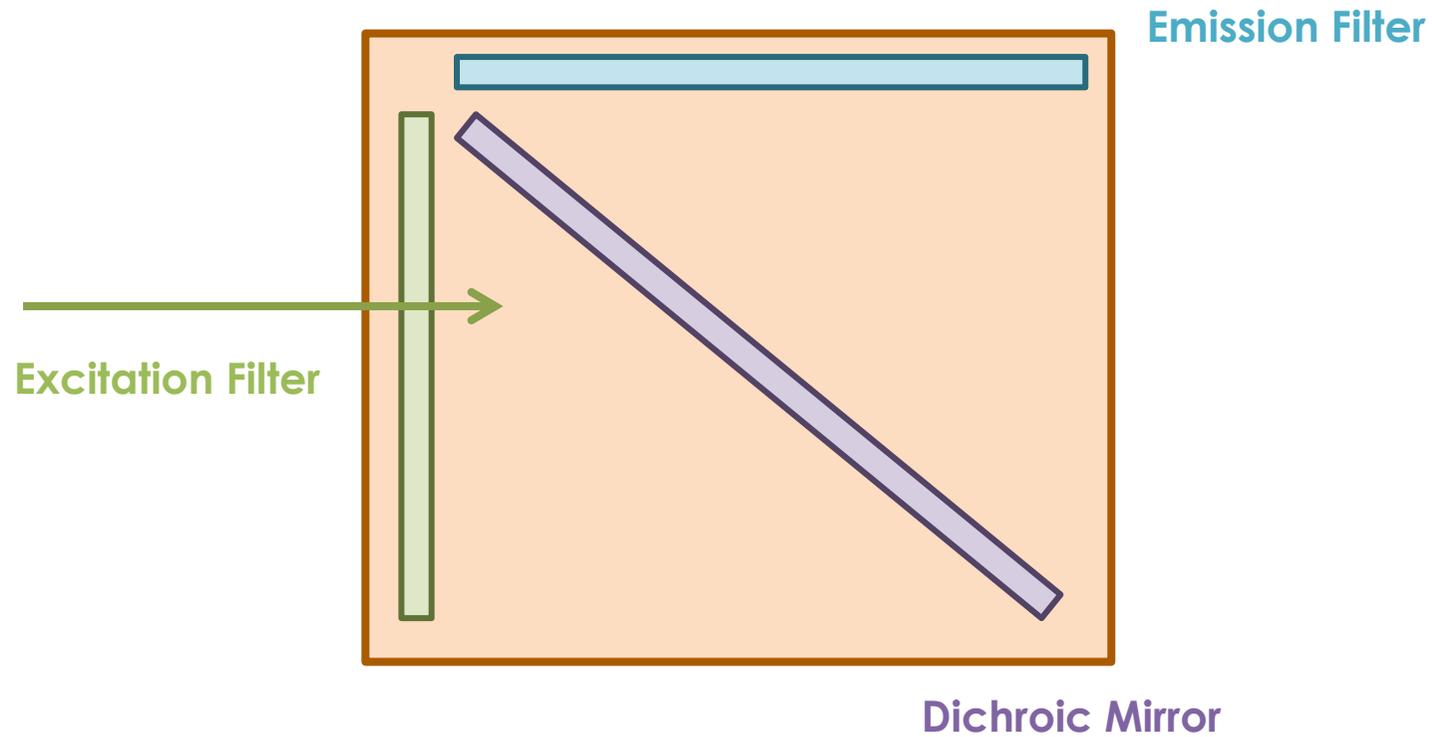
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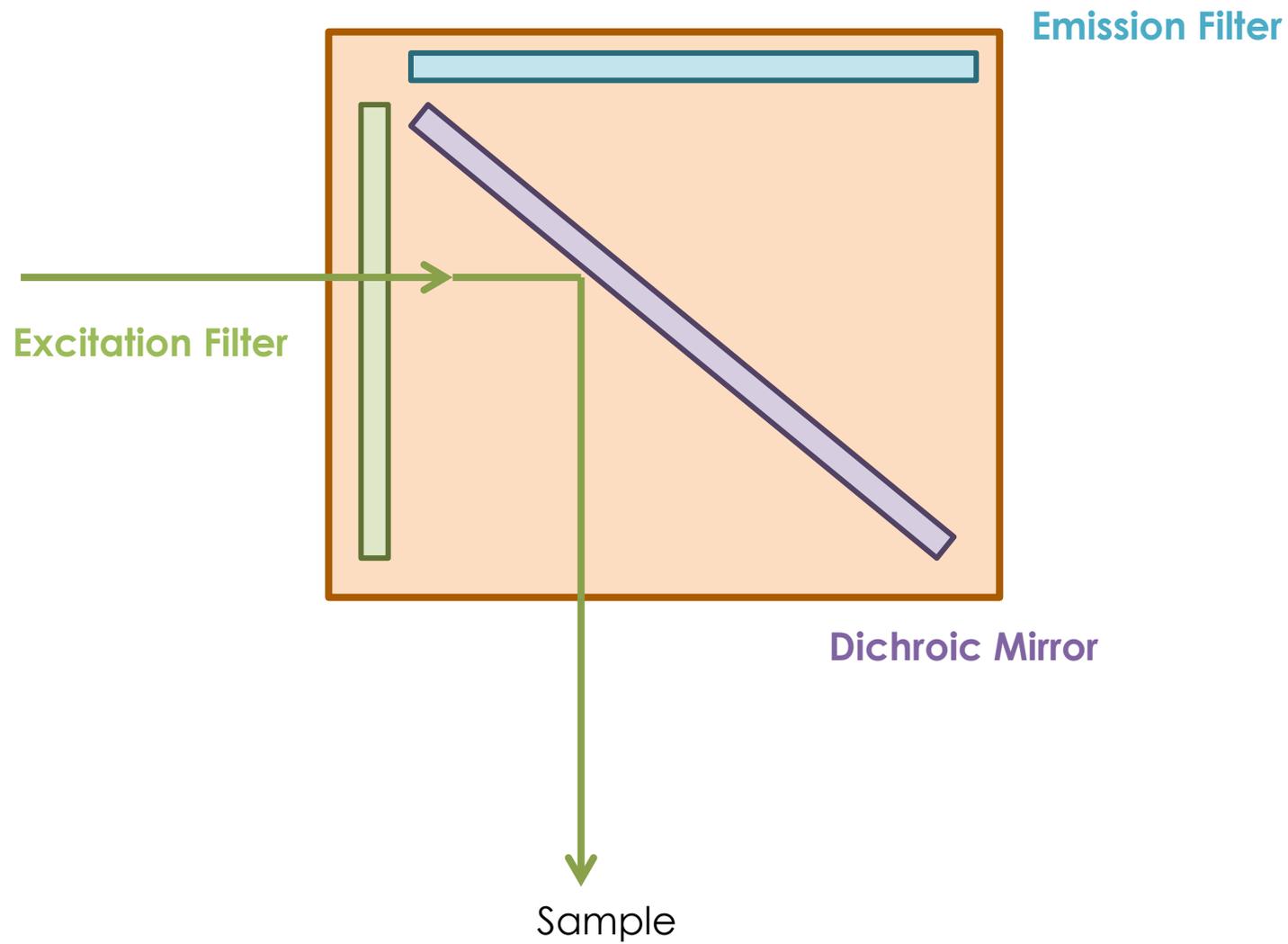
## Dichroic Mirror

Positioned at a 45° angle. It selectively transmits and reflects a certain range of light colours/wavelengths.

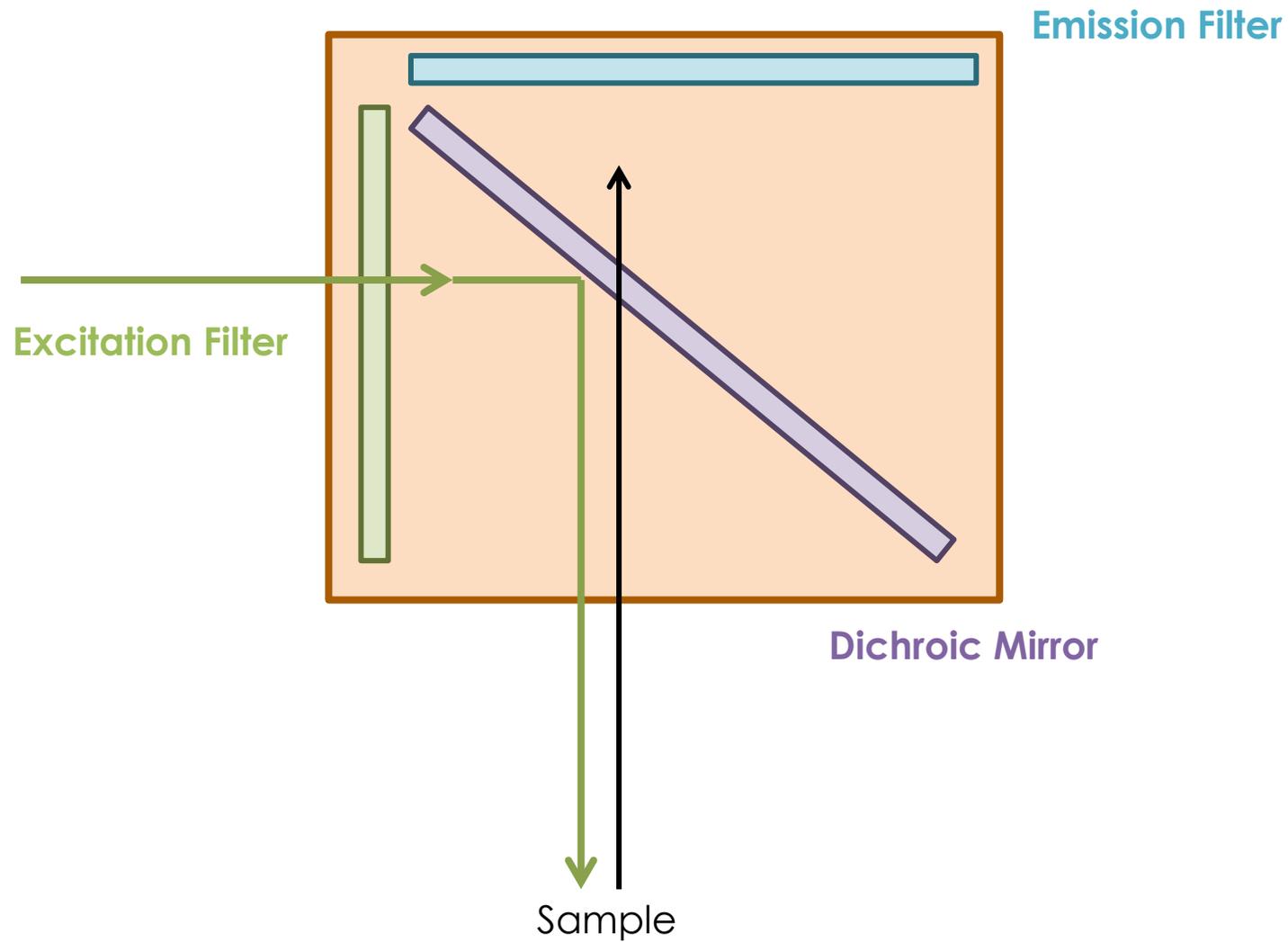
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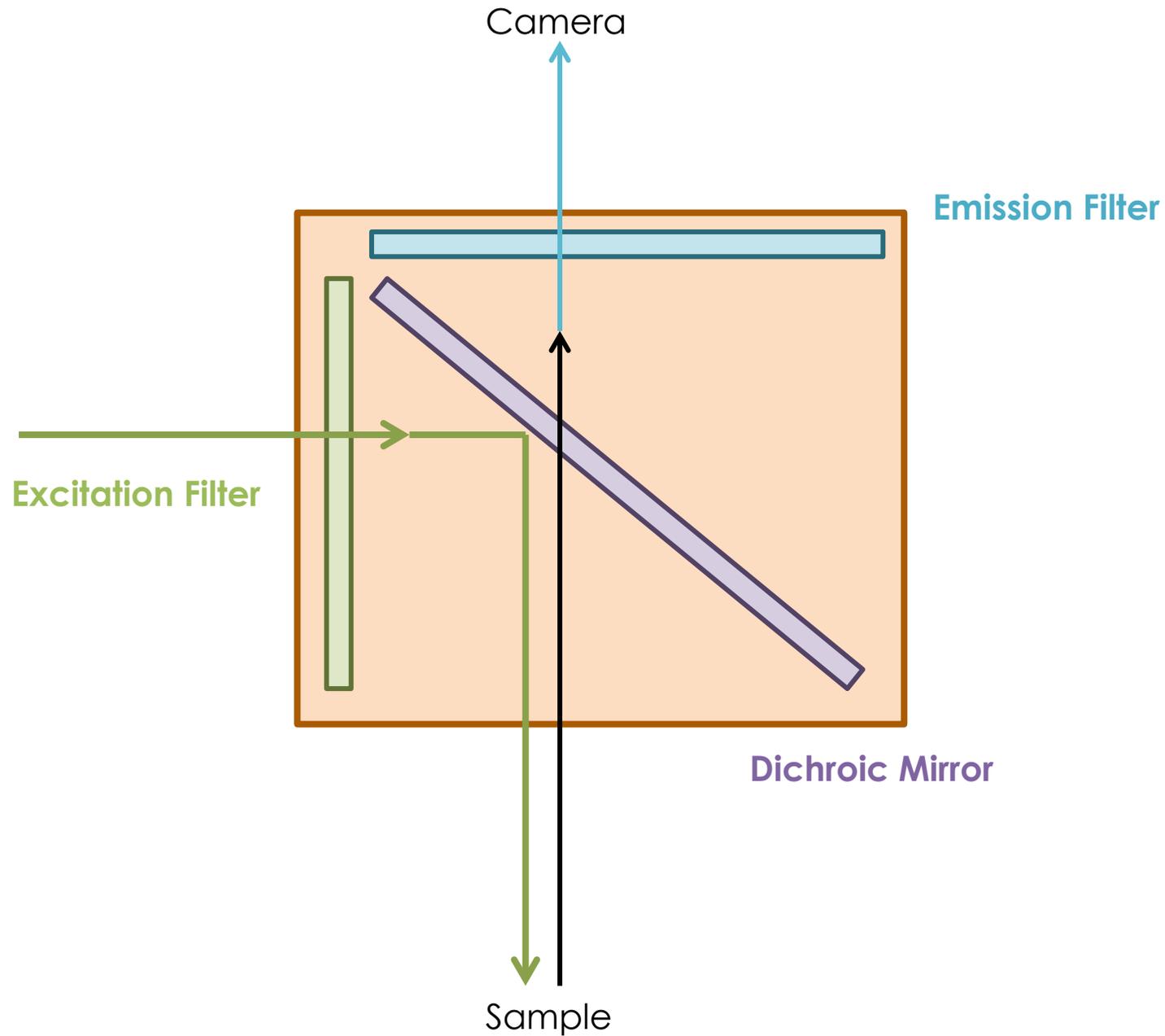
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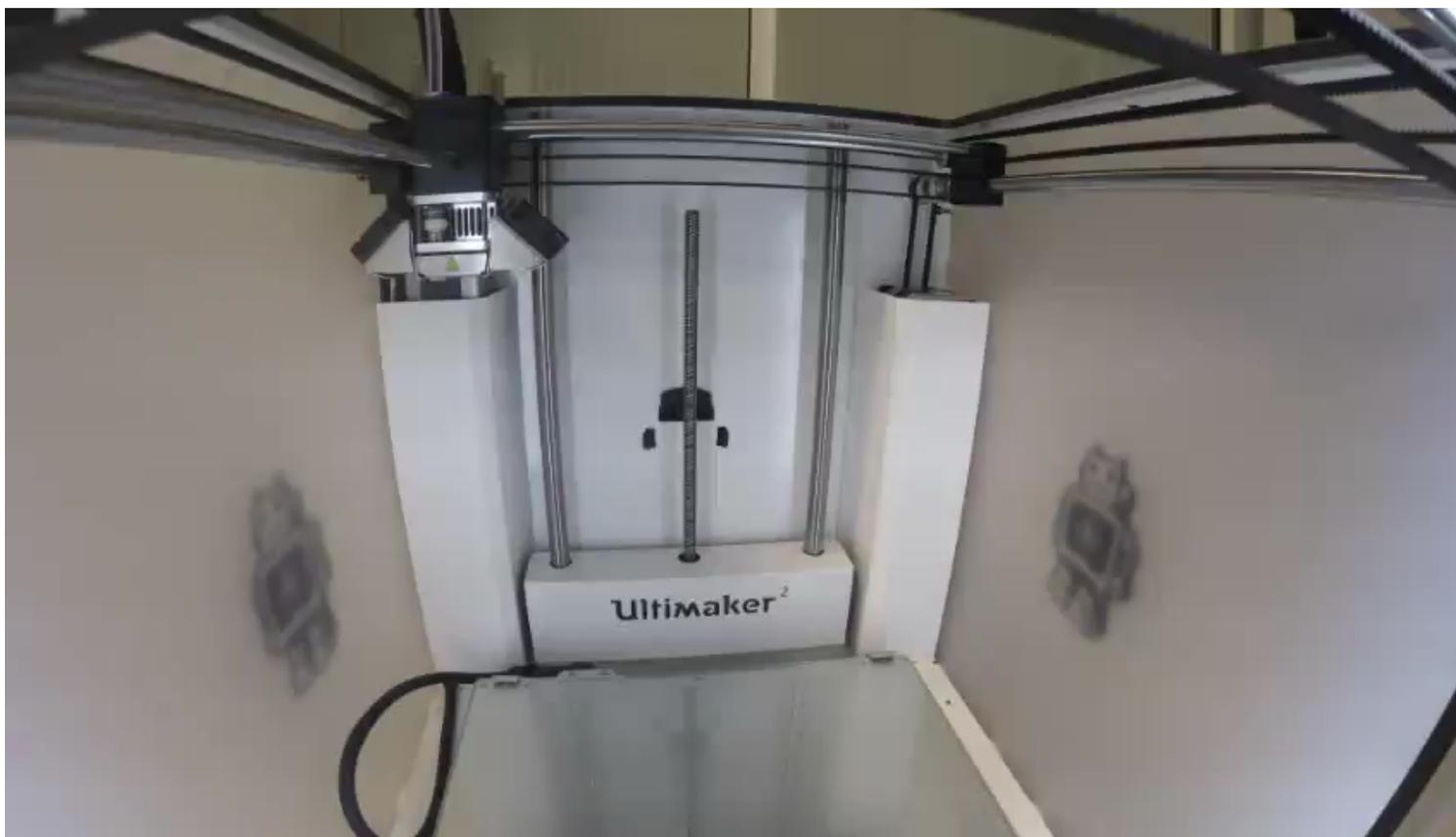
# How does epi-fluorescence Work?



# How does epi-fluorescence Work?



# 3D Printing



Thanks for your attention

Do you have any questions?