

Student's  
kit

# BiROBOOST!

## Bacteria Everywhere



Supporting presentation

Bi  
**ROBOOST**

# In which of these products has biotechnology been used?



Yogurt



Fruit plantation



Beer



Drugs



# In which of these products has biotechnology been used?



Cosmetic creams



Insulin injections



Fuel



# Synthetic biology purposes

**Biofactory:** organism that can produce substances of human interest, with a sufficient quality and quantity for industrial production. Synthetic biology enables the design of biofactories.

## Energy



Microalgae

## Food



Vitamin production

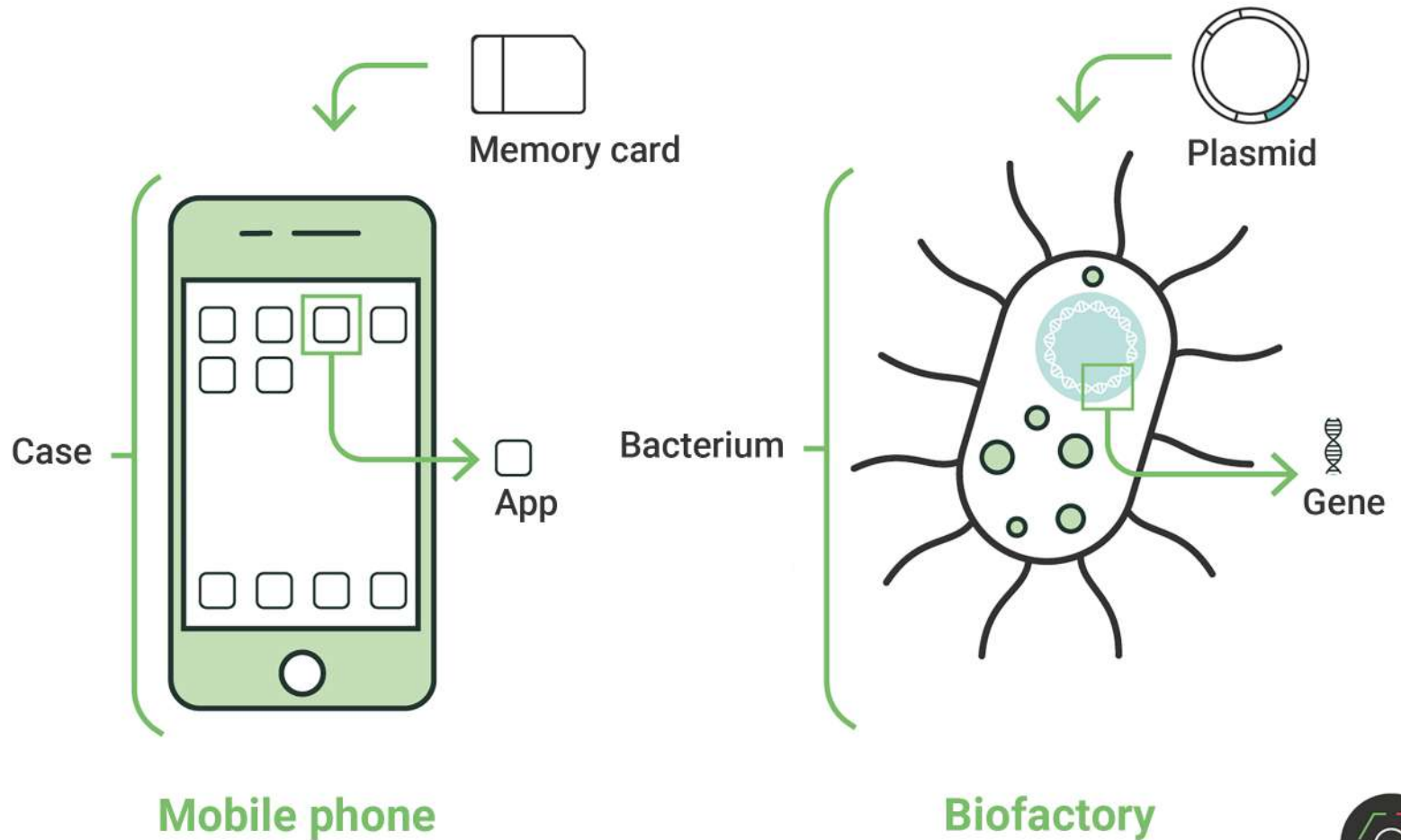
## Biorremediation



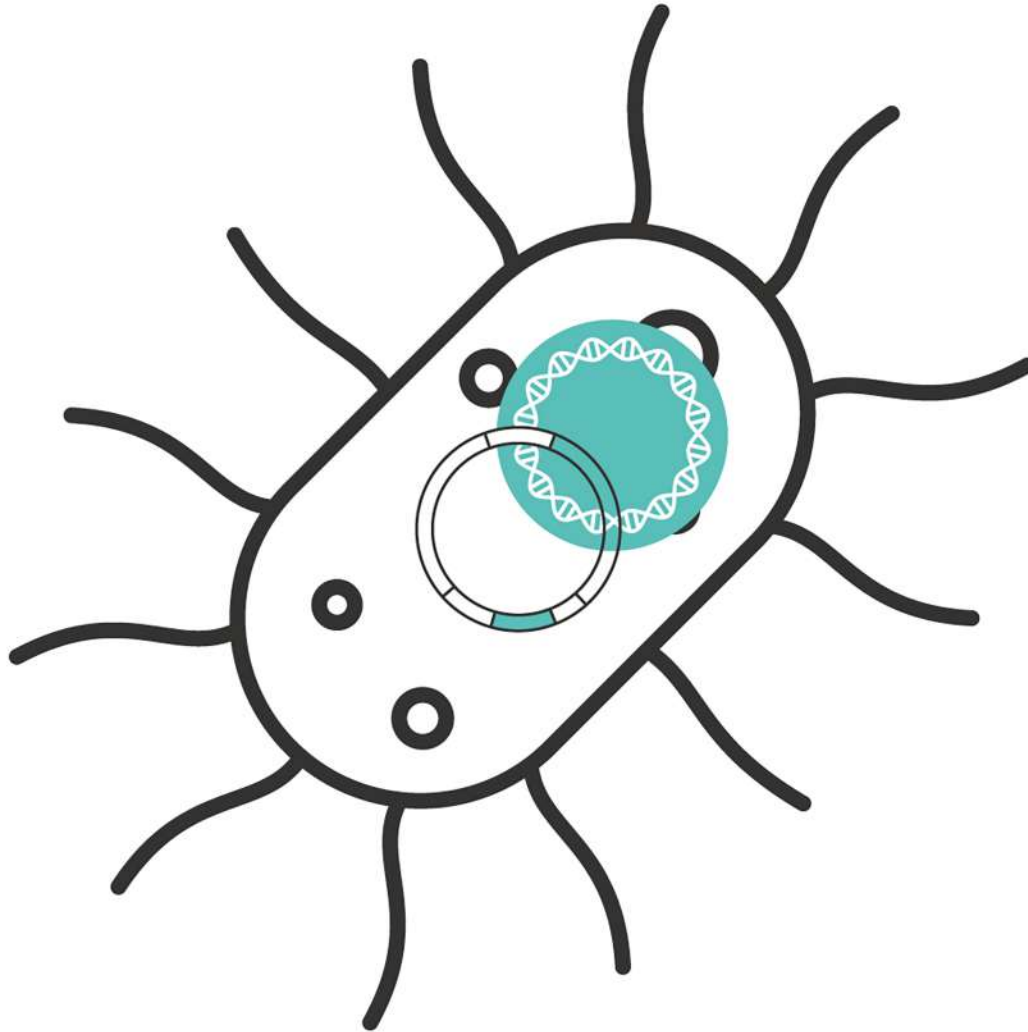
Oil spill cleanup



# Let's compare!



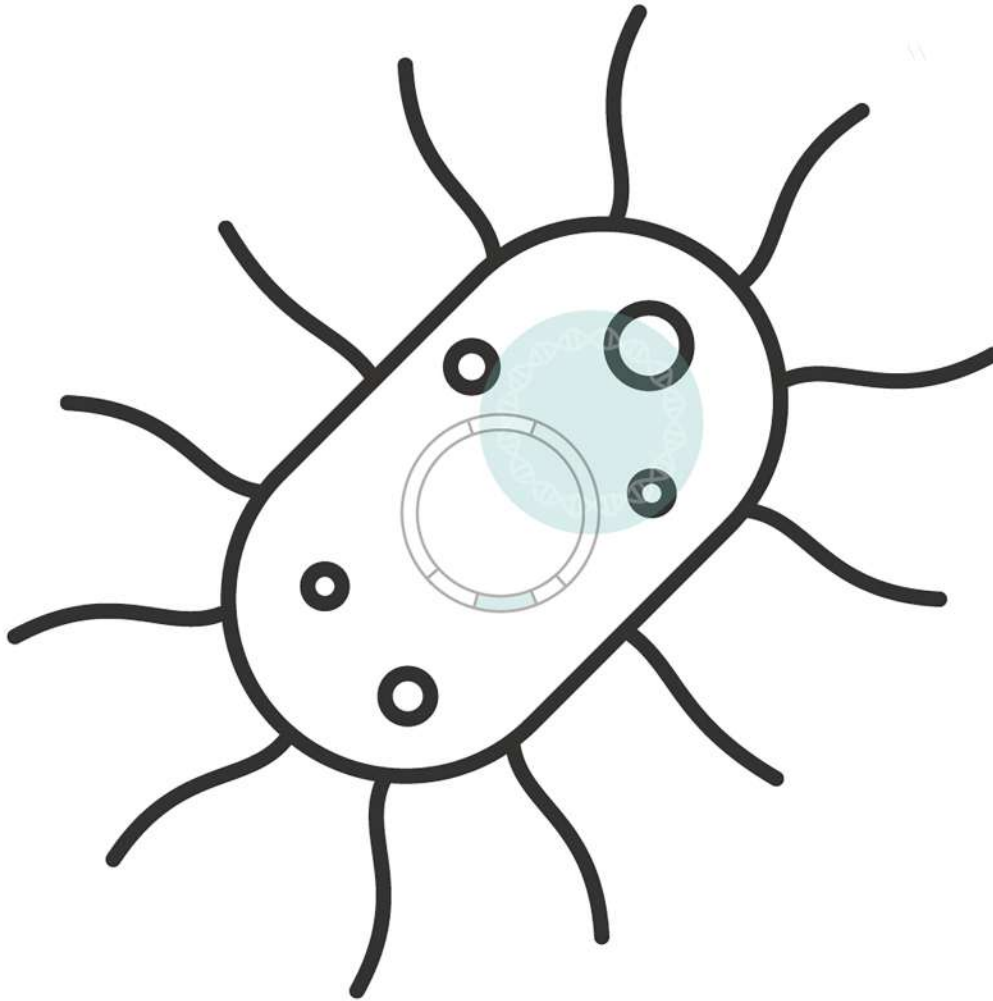


## The parts of a biofactory

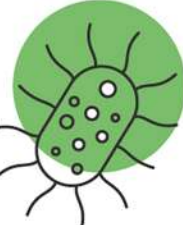





# Chassis



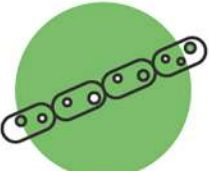
## ESCHERICHIA COLI



The apple of many scientists' eyes. These bacteria live within our gut and their genetics is well-known, so they are very useful for applications related to medicine and health.



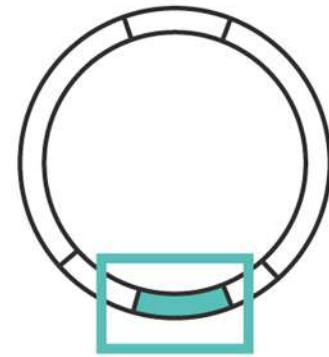
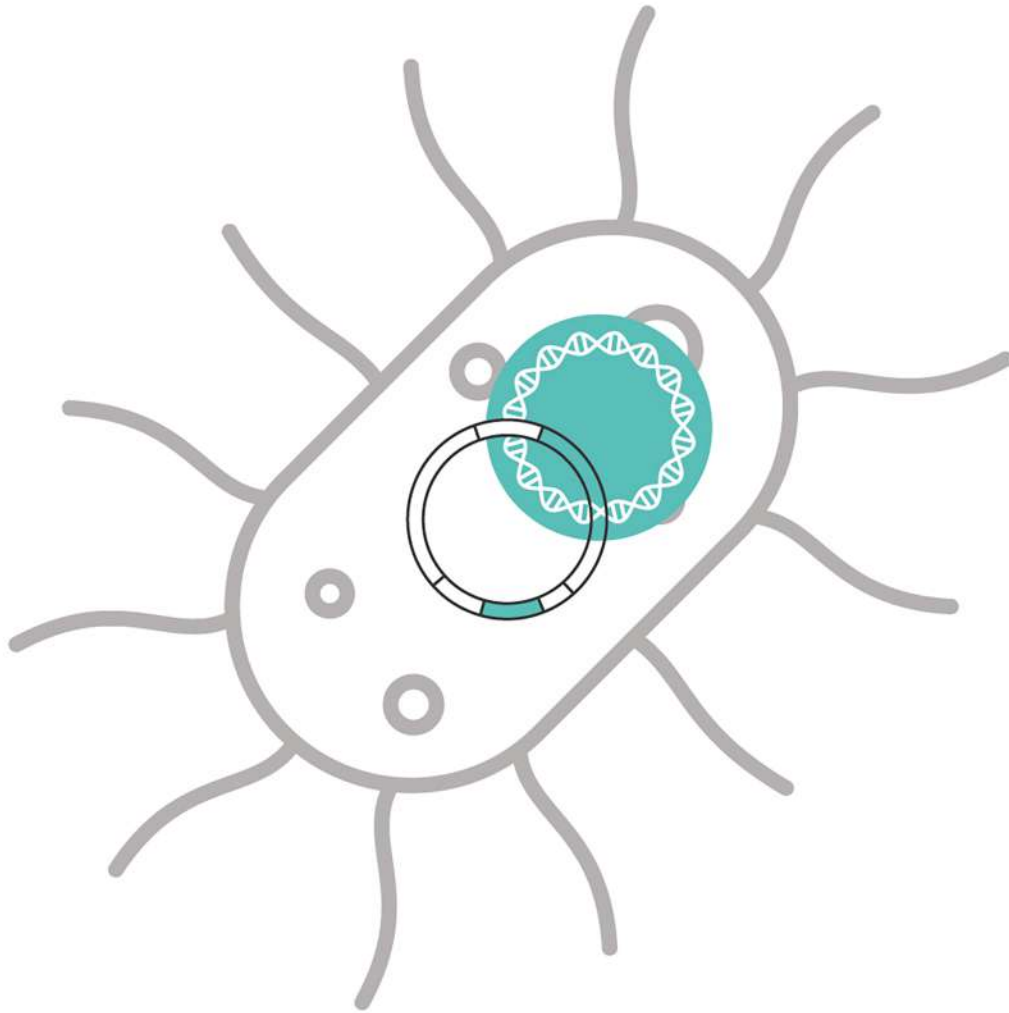
## BACILLUS SUBTILIS



These bacteria are "living factories". They are very easy to manipulate and can be engineered to produce many different molecules. That's why they are the best option for industrial applications.



# Gene



Gene





# Genetic circuit



Gene

1 2 3 4

### PROMOTER

The lactose promoter: a classic and classy way to start your genetic circuit. It can be induced by lactose, be careful if you are allergic!

1 2 3 4

### RIBOSOME BINDING SITE

This Shine-Dalgarno sequence is a cytosine-rich synthetic RBS created using a computer. It will work, but it's not optimised for all genes.

1 2 3 4

### CODING SEQUENCE

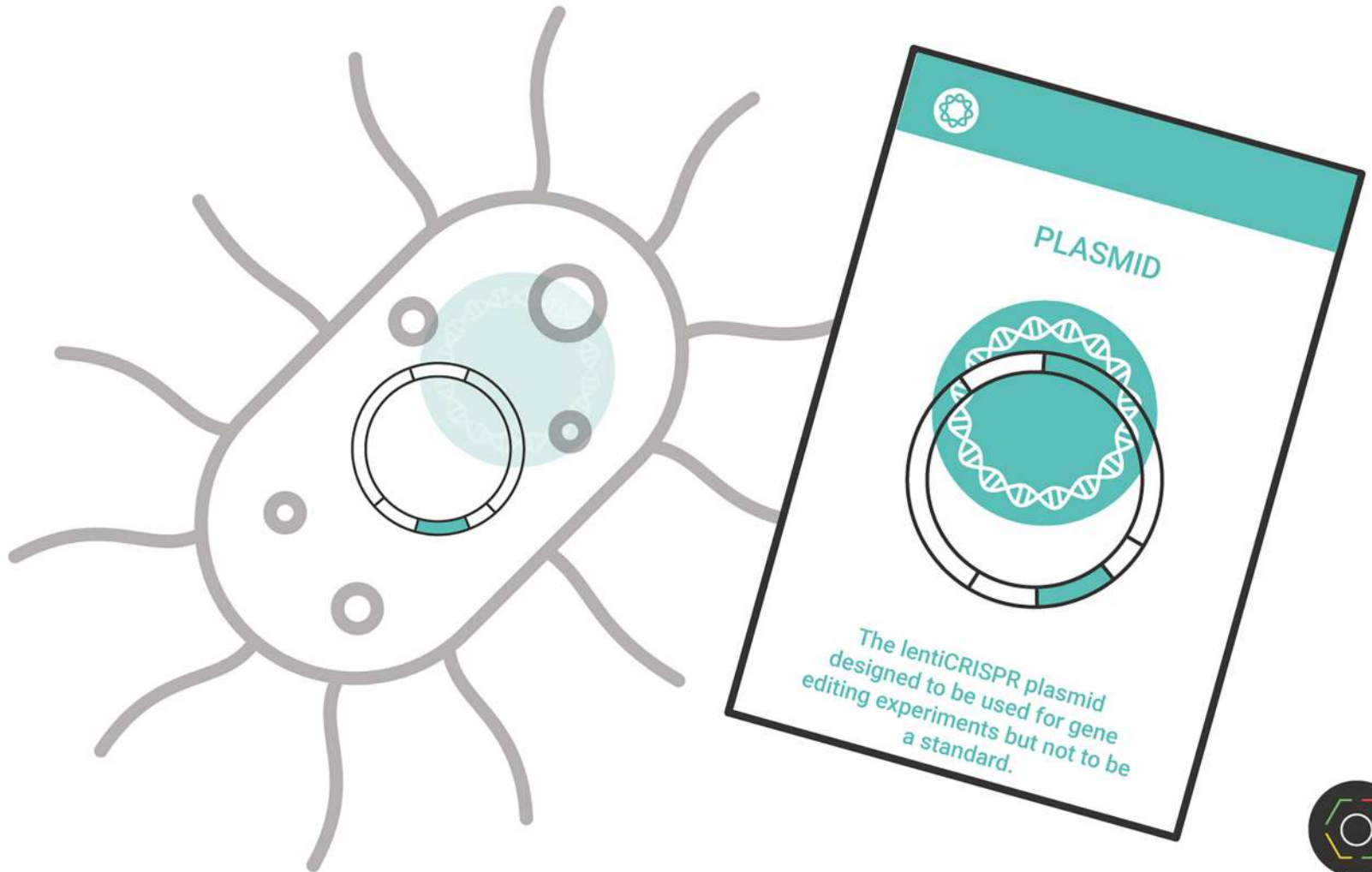
Insulin production

1 2 3 4

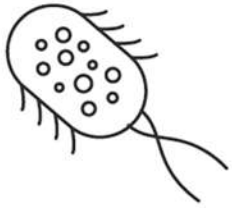
### TERMINATOR

UGA is one of the possible sequences to finish up a gene. Be careful, for some bacteria it's not an actual terminator!

# Plasmid

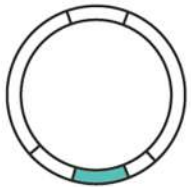


## Survey



How many bacterial species are known up to date?

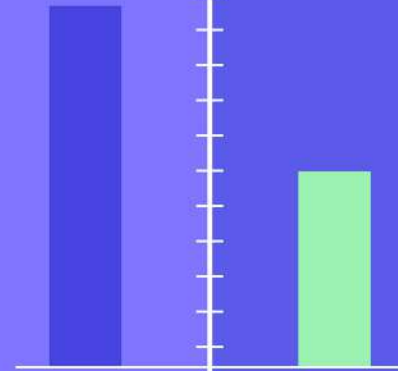
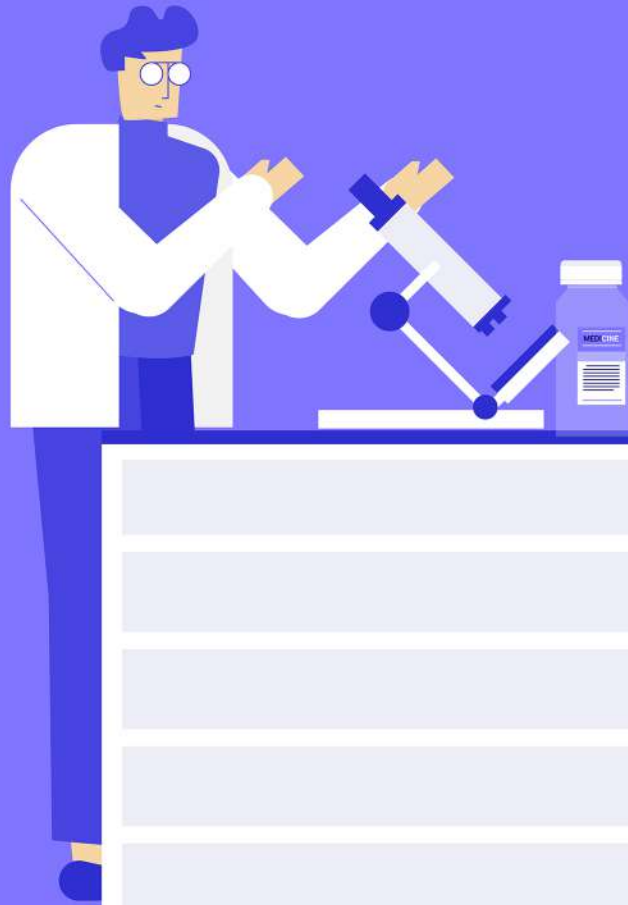
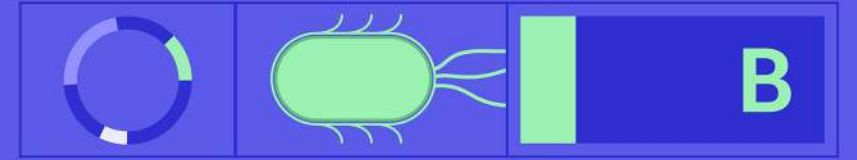
- a) 50
- b) 500
- c) Around 2.000
- d) Around 35.000



How many circular DNA sequences (plasmids) exist?

- a) 1.000
- b) 5.000
- c) 50.000
- d) Infinite number

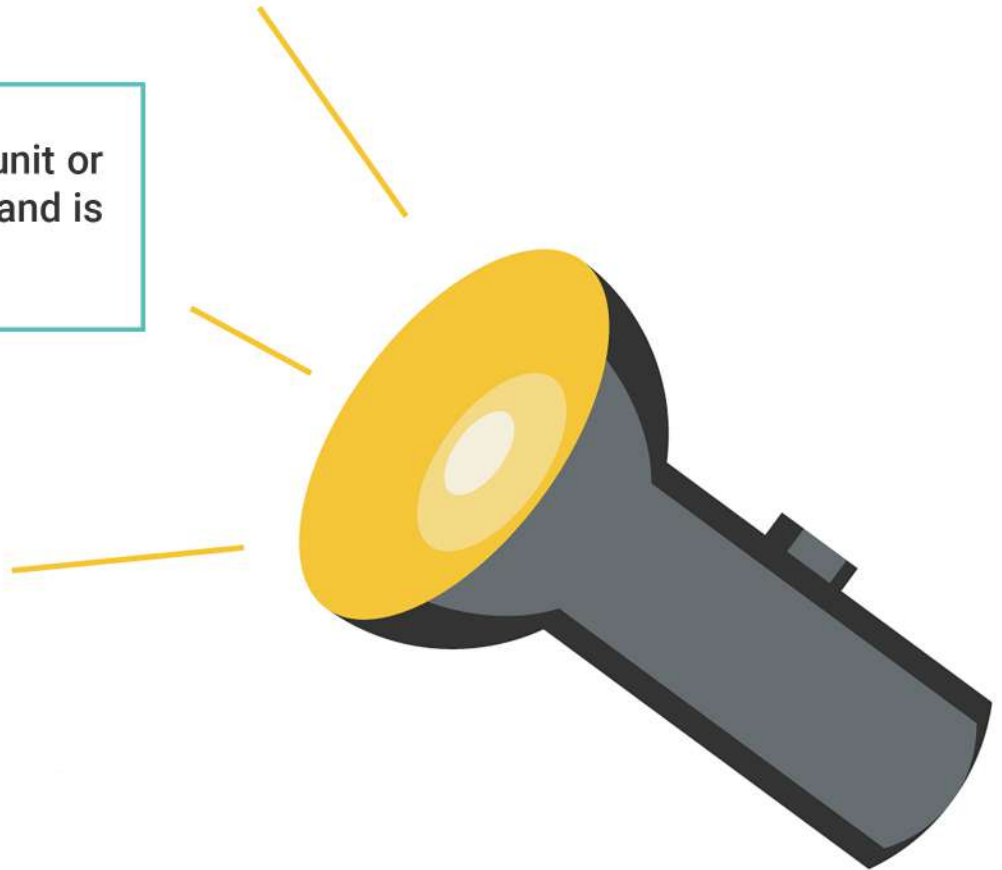




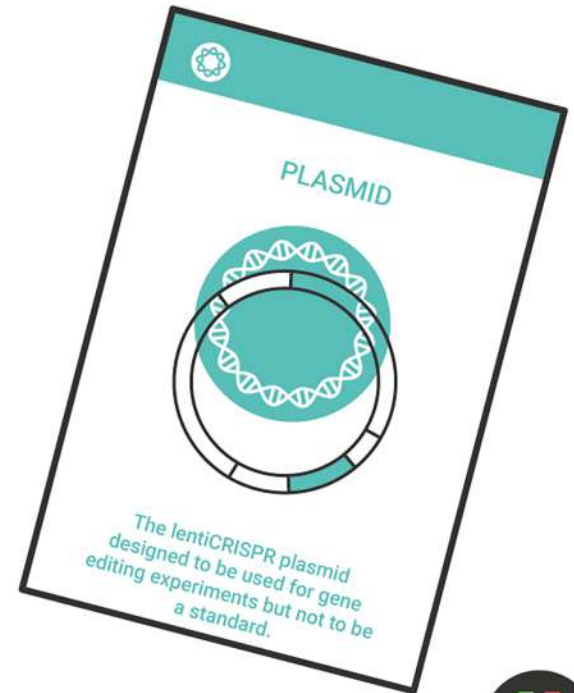
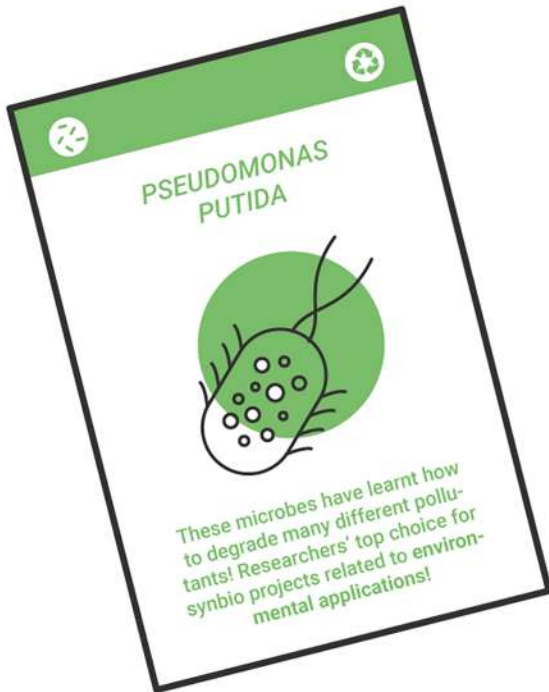
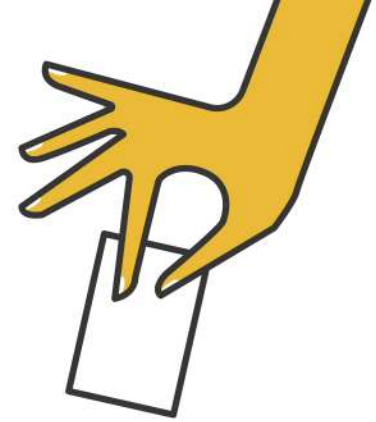


# Standards

A **standard** is a measurement unit or a parameter used in a system, and is always constant (consensus).

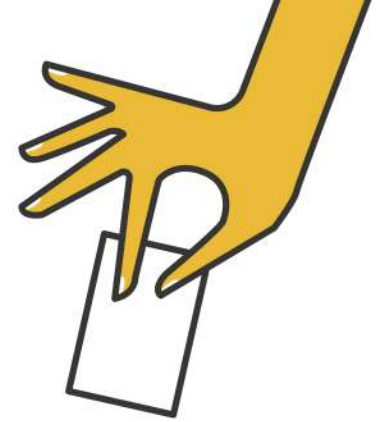


# Card game



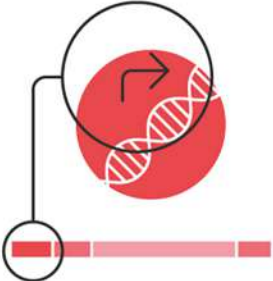


# Card game



1 2 3 4

## PROMOTER




The lactose promoter: a classic and classy way to start your genetic circuit. It can be induced by lactose, be careful if you are allergic!

The diagram shows a red circle containing a DNA double helix with a black arrow pointing to the right. A line connects this circle to a red horizontal bar representing a DNA sequence, with a small white circle at the start of the bar.

1 2 3 4

## RIBOSOME BINDING SITE

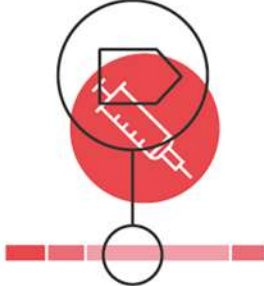


This Shine-Dalgarno sequence is a cytosine-rich synthetic RBS created using a computer. It will work, but it's not optimised for all genes.

The diagram shows a red circle containing a DNA double helix with a red box highlighting a specific sequence. A line connects this circle to a red horizontal bar representing a DNA sequence, with a small white circle at the start of the bar.

1 2 3 4

## CODING SEQUENCE

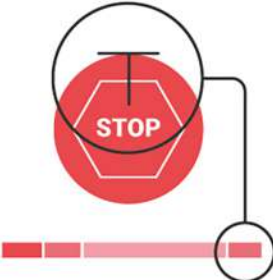


Insulin production

The diagram shows a red circle containing a DNA double helix with a red box highlighting a specific sequence. A line connects this circle to a red horizontal bar representing a DNA sequence, with a small white circle at the end of the bar.

1 2 3 4

## TERMINATOR

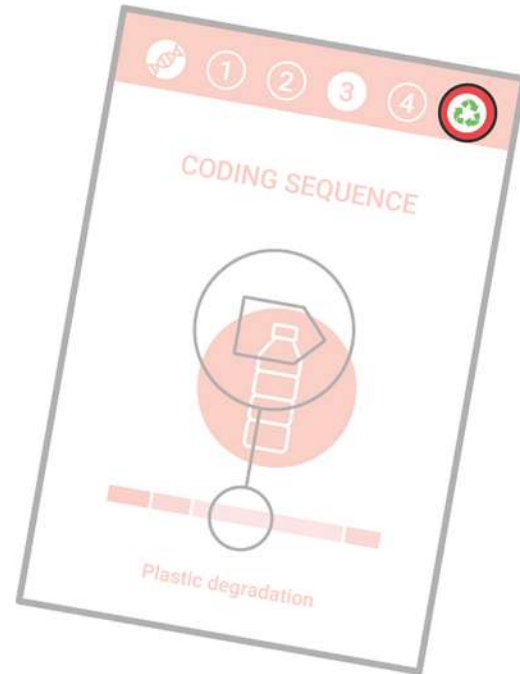
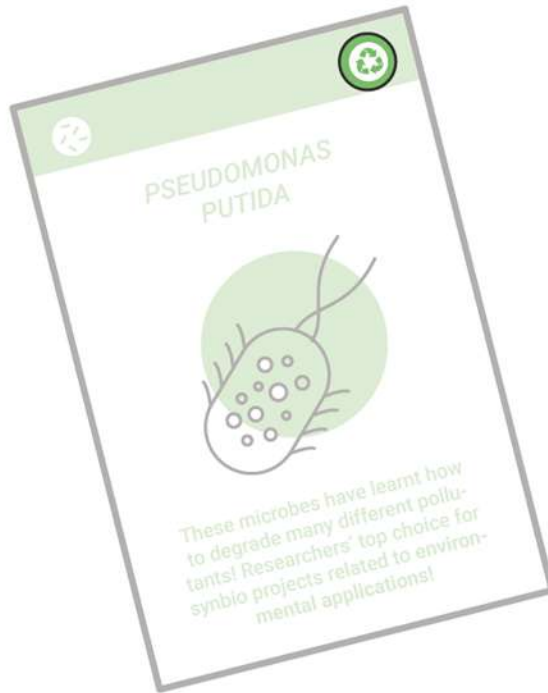
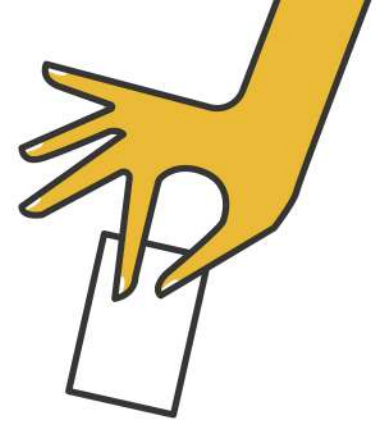


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# Card game



The **objective** of the BioRoboost! card game is to use synthetic biology pieces to design a bacterium that is capable of performing a specific function, and that contains more standard pieces than the rest of the players. Ages 14+.

## CARDS

**PIECES:** except for the coding regions and for the bacterial chassis, each of these cards has its standard version.


 **Genetic circuit:** these red cards have a linear DNA icon to identify them and a numbered line that identifies the position of each piece in the circuit.


**Promoter.**

**Ribosome binding site.**


**Coding sequence.** These cards have an extra icon that informs the type of application: industry, medicine or the environment.


**Terminator.**


 **Plasmid:** these cards have a circular DNA icon to identify them.


 **Bacteria:** these cards have a microbial icon to identify them. In addition, they have an extra icon that informs about the type of application: industry, medicine or the environment.

**ACTION CARDS:** these cards have a lightning bolt icon to identify them.

 **Biohacking:** take a random card from an opponent's hand and exchange it for another from your hand.

 **Turbo pipette:** draw three cards from the deck, choose one and discard the other two.

 **Toolbox assault:** draw the piece of your choice from the discard pile and add it to your hand.

 **Chitchat:** play this card to make the opponent who plays right after you lose their turn.

## GAME DYNAMICS

To begin, the cards are shuffled and each player receives 6 cards. On their turn, each player draws a card from the deck. Before ending the turn, each person is required to pass a face-up card of their choice to the next player. At the end of each turn, a player will have a maximum of 6 cards in hand.

At the beginning of the turn, before drawing or playing a card, a player must consider if he/she has built the best bacteria and may declare that the development process is complete. At this time, all the players must show their cards. All players who have failed to collect all the building blocks are disqualified.

Among the players that have completed the construction, the following rules apply to determine who wins the game:

- When the construction has all the pieces and, in addition, the coding region is suitable for the type of bacteria.
- The rest of the players compare their constructions, and the player with the highest number of standard cards is the winner. Several players can tie.

Enjoy!



# Card game instructions

**B**  
**ROBOOST**