# "Adna's Lab" Booklet

Even though we consider "Adna's Lab" to be very easy to play and of straightforward understanding, **SciBoard Games wants you to make the most of this serious game**. We have prepared for you this booklet to guide you through the game and to help you make the most of this experience. The booklet is divided in 7 parts containing very useful information:



# About "Adna's Lab"

**Adna's Lab** is a **card-based board game** that mimics a molecular biology lab where DNA manipulation takes place. The game can help everyone become more familiar with basic techniques, reagents and machinery that are used in any genetics labs. "Adna's Lab" is SciBoard Games' debut creation and is designed to adapt to and challenge all levels of knowledge. SciBoard Games do not use dice in their games and **all progress is based on in-game acquired knowledge**.

# Understanding the game

**Objective** Be the first to complete a DNA chain of 25 bases (suggested chain length for a fast game) or any chain length agreed between players. Chains start from 5'-Start and finish at 3'-End. We also recommend games to be played to the best of 3 to 6 games, depending on chain length agreed.

**Cards** Each player uses cards from three different decks (Bases deck, Reactions deck and Enzymes deck). The **Bases** cards are divided in A, T, C, G and U cards and are used to enhance the chains from the 5'-Start to the 3'-End. The **Reactions** cards allow manipulating the DNA chain and change the temperature in the reaction thermometer. The **Enzymes** cards represent restriction enzymes that recognise sequences in the DNA chain, cut the chain and remove those bases from the chain.

# Understanding the game

**Number of players** We suggest 2 players (one-to-one game) or 4 players (in teams of 2 players). The only difference between these two game modes is that when playing as a team decisions are made by the team; all the rest remains exactly the same. The advantage in playing teams is that players recognise restriction sequences more easily in the opponent's chain and a spirit of cooperation is present.

**Scoring** In the board game version the number of points attributed to the winning player/team is equal to the length of the produced chain (suggested 25) minus the number of cards the winning player/team has in hand at the time of winning. In fact, a player/team can be awarded negative points if still has more than 25 cards in his hands.

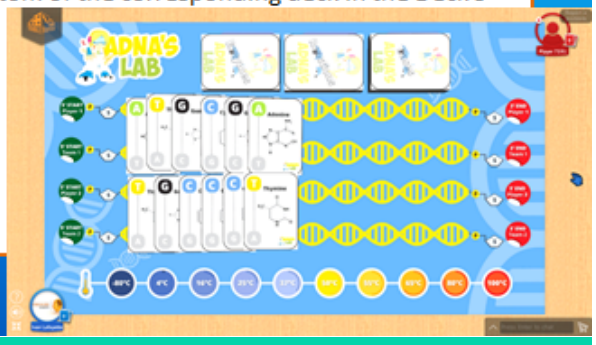
**Initial Temperature** The game always **starts at 25°C** considered to be the room temperature.

**Note:** From now on we will talk of players only, rather than teams; but keep in mind that the rules applied are exactly the same.

# Understanding the game

The game board or platform is **divided in 3 main areas**: 1) the Decks, 2) the Chains, and 3) the Thermometer.

The Decks' area is where the 3 different decks are placed and from where the cards are taken. The Chain's area is where the bases cards are played starting from 5'-Start to 3'-End. Unless stated otherwise in a reaction card, Bases cards are always played to the end of the chain. The Thermometer' area is where the Reactions cards and Enzymes cards are played, directly onto the corresponding colour circle. After being used, either Reactions card or Enzymes card is flipped backwards to show that it is no longer active and help players know what is the current Thermometer's temperature. Once replaced by a new Reactions or Enzymes card, the old one is placed on the bottom of the corresponding deck in the Deck's area.

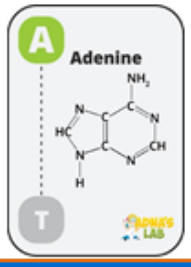



# Understanding the game

As mentioned before there are **3 different decks**, however **they contain different subtypes of cards**. The **Bases decks** contain only Adenine, Cytosine, Thymine, Guanine and Uracil cards. The **Reactions deck** contain cards representing lab equipment, typical reactions, and substances needed for the reactions to take place (like buffers, enzymes, dyes, etc.). The **Enzymes deck** is divided in four subtypes of cards: yellow, red, green and blue. This means that for playing an enzyme the player will need to use the correct colour buffer, e.g., a blue restriction enzyme requires a blue buffer.

Do not worry at all as every single card mentions exactly how to be played, what are the requirements to be played and what action does the card produce.

All cards have their corresponding deck name on the back of the card to make its identification easy and fast.

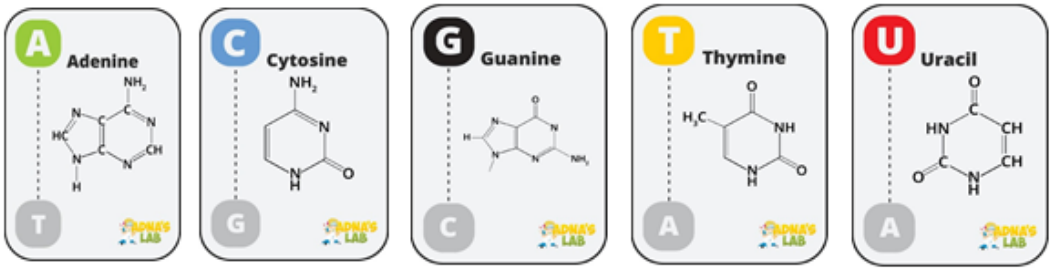




# Understanding the game

The Bases cards are composed of the **base name** (also known as nucleotide) on top of its **chemical structure**, **a colour circle representing the initial letter of the base** and a grey circle merely showing its complimentary base. The grey circle does not intervene in the game at any stage and is used purely in an informative way.

As mentioned before the Reactions cards are composed of equipment, reactions and substances.




# Understanding the game

The Reactions cards are composed of **equipment** (left), **reactions** (middle) and **substances** (right). They are usually divided in 5 areas: Title, playing requirements, image, action promoted by the card and sometimes temperature required to ply the card.

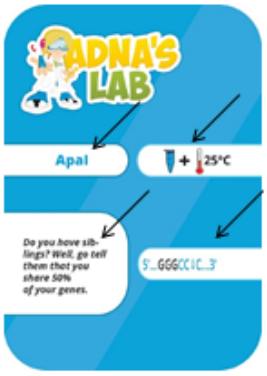
The playing requirements determine which conditions are necessary to play the cards, be it temperature, substances or a certain game situation:

- A string of four colour tubes means any buffer may be used
- One colour tube means that a specific colour buffer is to be used
- A white tube means bovine serum albumin (BSA) is to be used

# Understanding the game

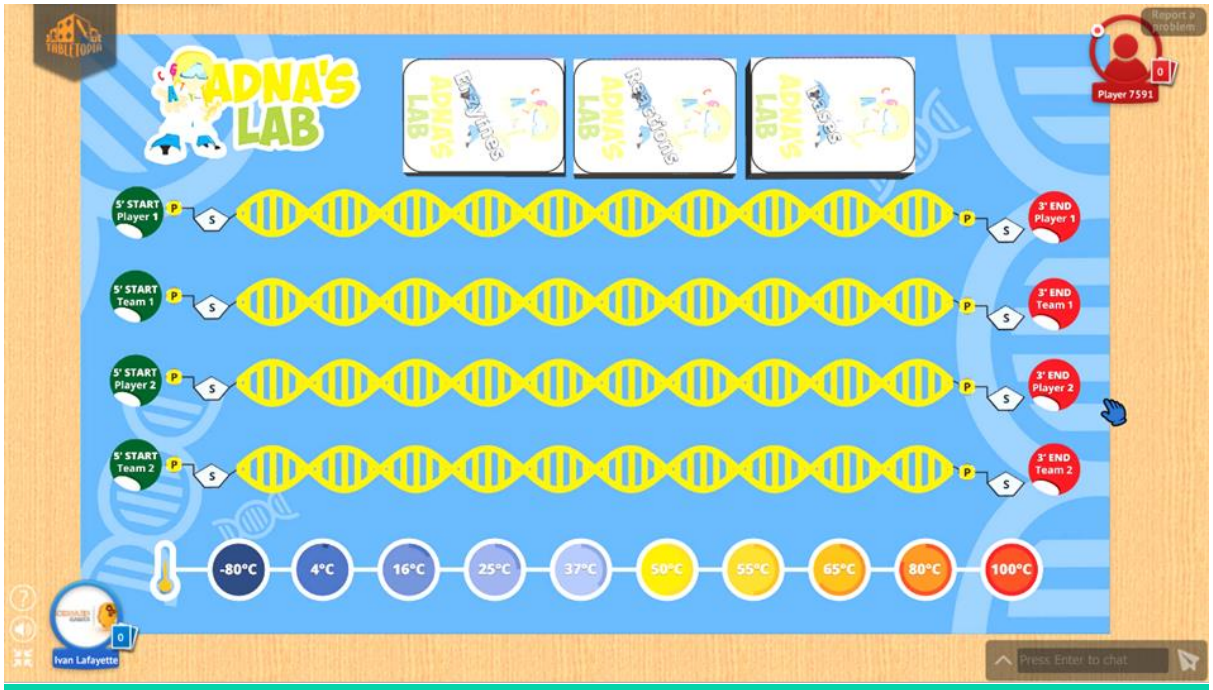
The Enzymes cards are **composed of 4 subgroups**, as mentioned earlier: Blue, Green, Red and Yellow.

The typical Enzymes card is divided in 4 areas: Name of the restriction enzyme, Requirements to be played (temperature, buffer and sometimes BSA), Trivia on genetics and Recognition sequence.




# How "Adna's Lab" is played

**1. Shuffle and distribute the three different decks to their corresponding spaces (Enzymes on the left, Reactions on the middle and Bases on the right)**

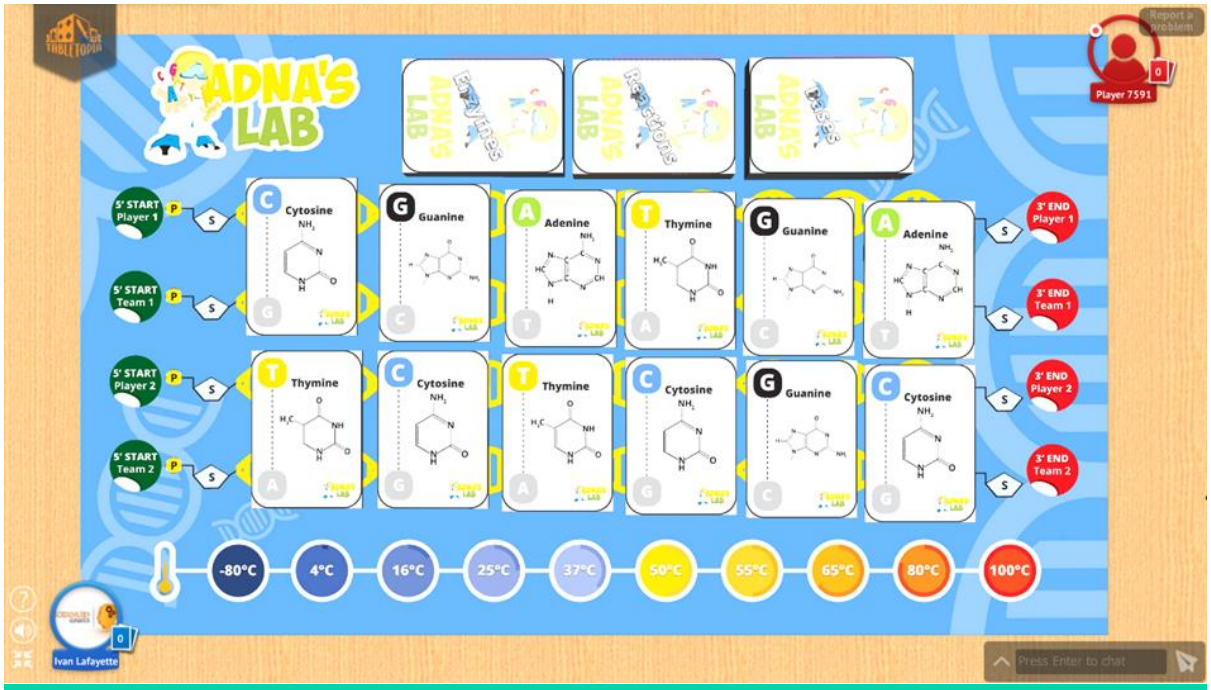



# How "Adna's Lab" is played

**2. Each player takes alternate bulks of 6 bases cards from the bases deck until one of them finds the A, T and G cards (corresponding to the start codon) - The player finding the start codon first (in any order of letters) will be the one to start the game.**

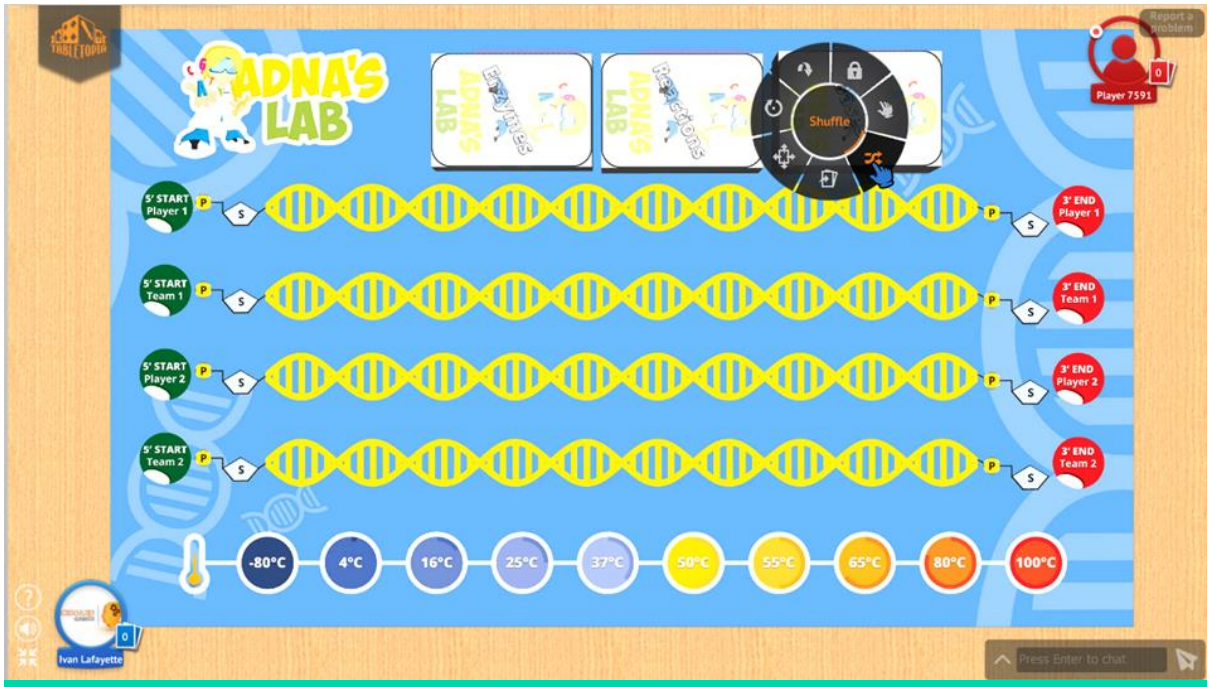
**If players haven't produced the ATG sequence with the first 6 cards, they take another 6 cards and try to produce the ATG sequence with the 12 cards they have in hands, not only with the new 6.**

Note: If uracil is drawn in the first 6 Bases cards a player takes, since it is compulsory to play them all in the initial round, the player will be obliged to contaminate his own chain.



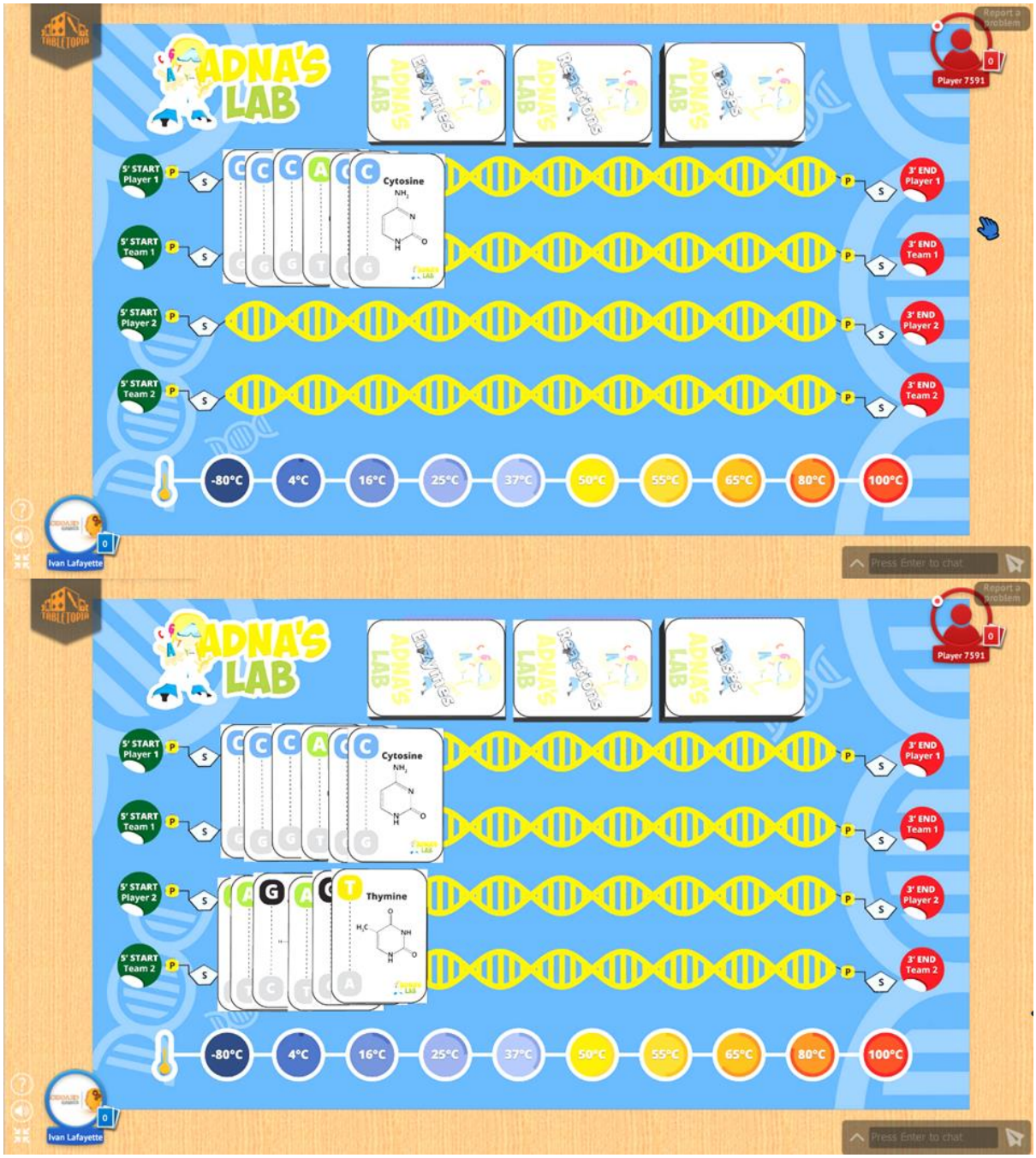

# How "Adna's Lab" is played

**3. Immediately after finding the A, T and G cards, the bases initially drawn by the players are put back in the Bases pile and the deck is reshuffled.**




# How “Adna’s Lab” is played

**4. Initial round** Starting with the player who revealed the ATG sequence first. Player starts his round by picking and laying **6 bases on his own chain.** Immediately after, the opponent does the same on his own chain. This is the only round where only bases can be picked and played, **neither Reactions nor Enzymes cards are picked or played at this round**, and bases can only be played in the players’ own chains.


ADNA'S LAB
Player 7591
5' START Player 1
5' START Team 1
5' START Player 2
5' START Team 2
3' END Player 1
3' END Team 1
3' END Player 2
3' END Team 2
Cytosine
Thymine
-80°C
4°C
16°C
25°C
37°C
50°C
55°C
65°C
80°C
100°C
Ivan Lafayette
Press Enter to chat

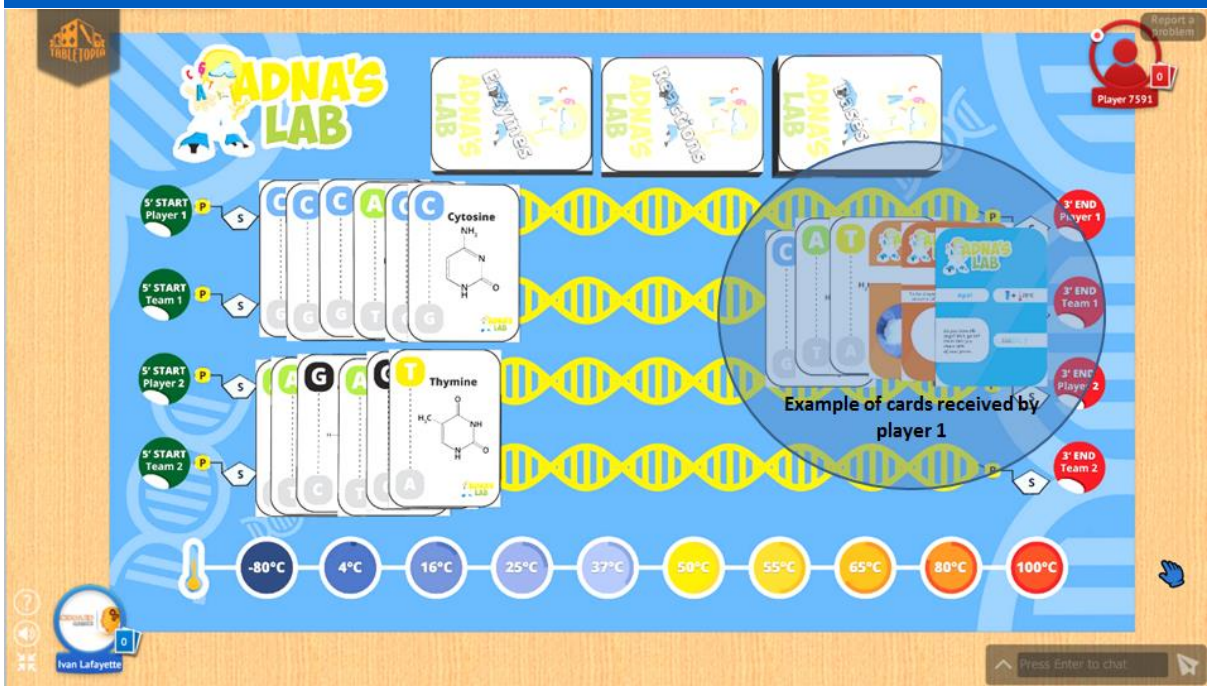
# How “Adna’s Lab” is played

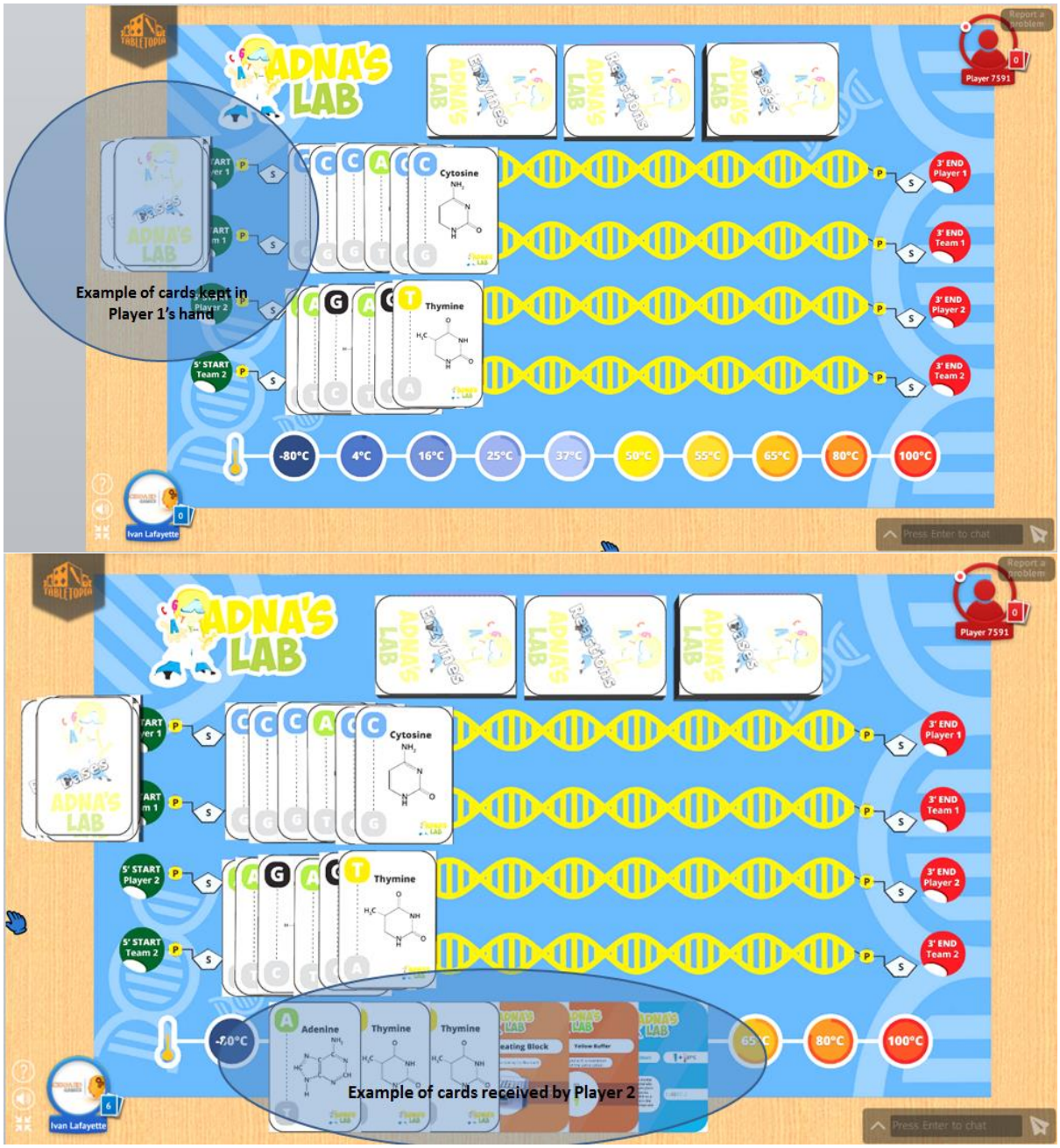
**Following rounds** The game then proceeds by alternate rounds where both players always take 3 Bases cards, 2 Reactions cards and 1 Enzymes card. Only then round starts.

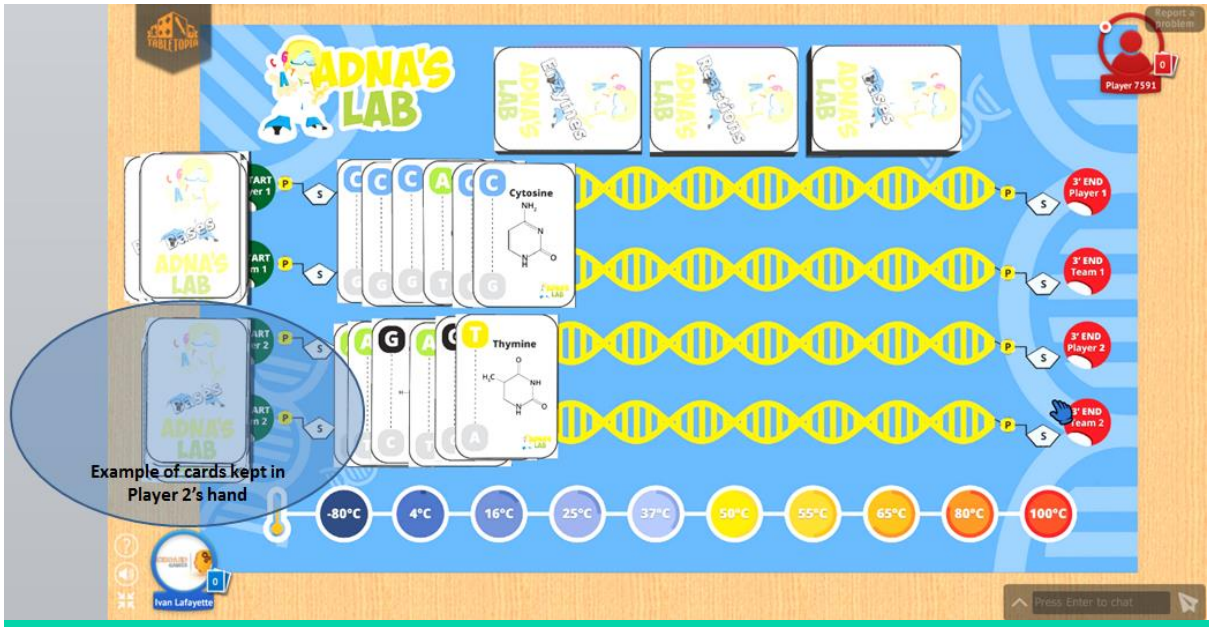
The player enjoying his round can then:

- **Play Bases on any of the chains** (bearing in mind that it is actually dangerous to enhance the opponent’s chain if there is no strategy to reduce it at some stage).
- **Attack with Reactions cards or Enzymes cards** (these attacks can be defended by the opponent with a valid defence card). This attacking/defending process can go on until player decides not to defend/attack any more or simply has no means to do it.

Hint As soon as possible take a look at your Enzymes cards and set the easiest recognition sequence on your opponent’s chain. Later on you’ll be able to destroy his chain by using that enzyme and gaining a vantage point.




ADNA'S LAB
Player 7591
Example of cards kept in Player 1's hand
Cytosine
Thymine
5' START Team 2
3' END Player 1
3' END Team 1
3' END Player 2
3' END Team 2
-80°C
4°C
16°C
25°C
37°C
50°C
55°C
65°C
80°C
100°C
Ivan Lafayette
Press Enter to chat
Adenine
Thymine
Thymine
Example of cards received by Player 2




# How "Adna's Lab" is played

**Before your round ends** You can discard up to a maximum of 3 cards. The moment you discard any type of cards you want, up to a maximum of three, these are to be placed on the bottom of their respective deck and the opponent has not got the right to see which particular cards you decided to discard, but only to what deck they belong.

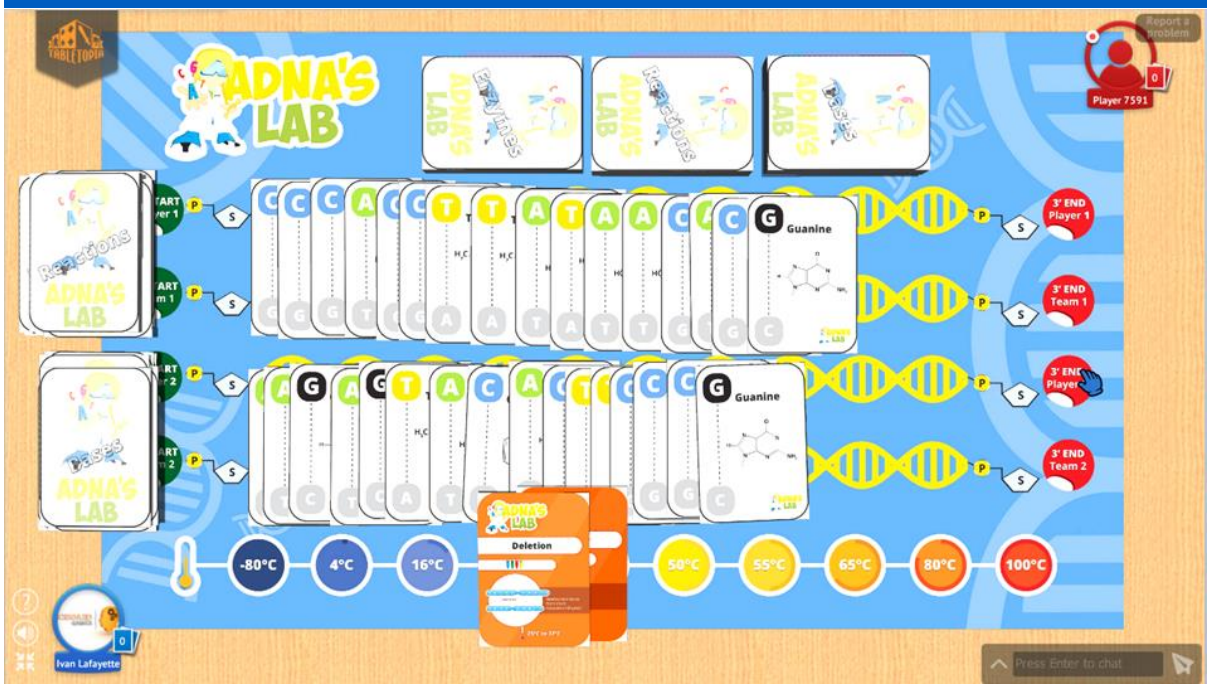
# How “Adna’s Lab” is played

## Attacking and Defending

1) When a player attacks the opponent he can only play one attacking card at a time (along with other required cards) and then wait to see if the opponent has cards to defend such attack.

2) If the defending player blocks the attack, the attack is considered ineffective and the attacker can then play another attacking card (and subsequent required cards).

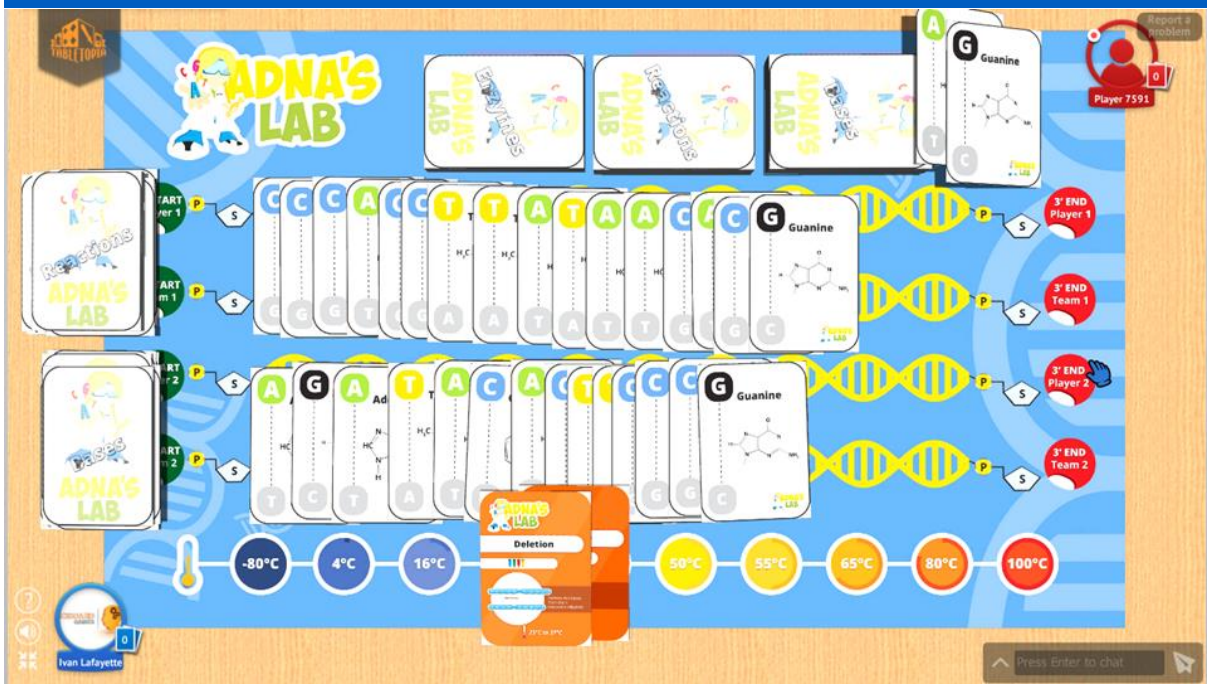
Always have in mind that at the time of attack the reaction temperature required must be the one seen in the reaction thermometer!!!



# How “Adna’s Lab” is played

**Reaction temperature** The reaction thermometer states the current temperature in the reaction vase. If a player plays a reaction that occurs, for example, at 37°C and the thermometer is at 25°C, the reaction will not take place. The player must firstly increase the temperature of the reaction thermometer to 37°C to be able to see the card having an effect. However, if the reaction thermometer is at 37°C and the reaction card requires that same temperature, the card is only effective if the opponent does not present a card that defends that same action or changes the temperature in the reaction thermometer.

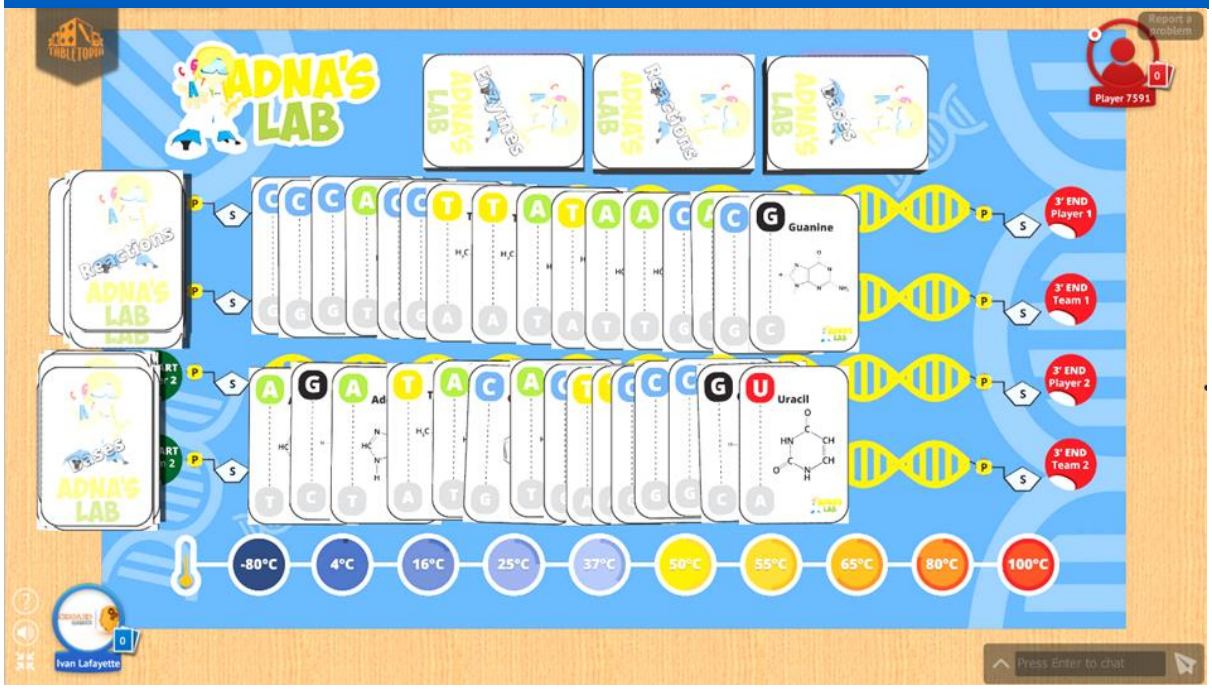
**The valid reaction temperature is always the last shown on the reaction thermometer!!!**



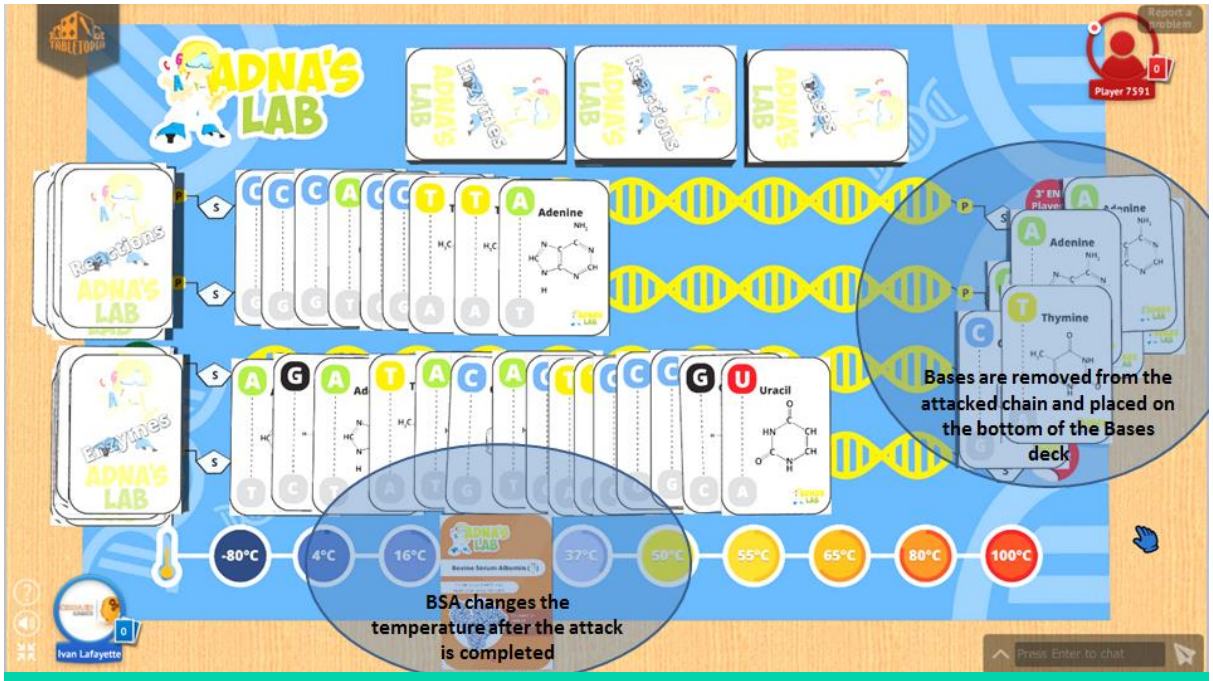
# How “Adna’s Lab” is played

## Attacking and Defending

**Uracil** This card represents a RNA base and therefore is seen as **contamination**. When uracil is played on a chain, the player with a contaminated chain cannot proceed adding bases to his chain until uracil is removed. Uracil can never be placed inside a chain, and can be removed by deletion, RNAse or playing a restriction enzyme on the chain that will delete the hanging where uracil sits.




ADNA'S LAB
Player 7591
Guanine
Uracil
3' END Player 1
3' END Team 1
3' END Player 2
3' END Team 2
-80°C
4°C
16°C
25°C
50°C
55°C
65°C
80°C
100°C
Thermal cycler
Preparing an attack by changing the temperature from 25C to 37C
Ivan Lafayette
Example of an attack by Enzymes card along with required cards (buffer and BSA)




# Special Features

**Restriction Enzymes are all the enzymes in the Enzymes deck. The way they cut is always from the 3'-End to the 5'-Start, starting from the last base on the right going left to the base immediately after the cut arrow. All bases to the right side of the arrow will then be removed from the chain and put back in the bottom of the Bases deck.**

Note: If a chain contains two or more exact sequences recognised by a played restriction enzyme, the chain will be cut to the sequence placed closer to the 5'start.

**Natural mutation Whenever the temperature in the reaction thermometer is above 60°C a natural mutation process occurs. In this sense, every time such condition is verified and a player is starting his round, the opponent will have the opportunity to swap places of two existing bases in the opponent's chain. This effect happens prior to any cards being played.**

**Single Letter Codes in the Enzymes deck**

N corresponds to any nucleotide, i.e., A or C or G or T.

R = A or G, Y = C or T, W = A or T

# Game contents

"Adna's Lab" is composed of:

A board game **platform**

**3 card decks** (Bases, Reactions and Enzymes)

**240 playing cards** in total

**102 Bases cards** (25 x Adenine, 25 x Thymine, 25 x Cytosine, 25 x Guanine, 2 x Uracil)

**50 Enzymes cards** divided by 4 subgroups (10 x blue, 13 x green, 14 x red, 13 x yellow).

**88 Reactions cards**

# Game contents

**List of Reactions cards**

- 2 x Agarose gel card
- 2 x Alkaline phosphatase card
- 2 x Amplification (PCR) card
- 4 x BSA card
- 3 x Deletion card
- 2 x Dephosphorylation card
- 2 x Detergent card
- 2 x DMSO card
- 2 x DNA loading dye
- 2 x DNA polymerase card

# Game contents

**List of Reactions cards**

- 2 x DNAse I
- 2 x dNTPs card
- 2 x Dry Ice
- 2 x Electrophoresis card
- 2 x Ethidium bromide card
- 2 x Goggles card
- 6 x Heating block card
- 2 x Ice box card
- 2 x Klenow fragment

**List of Reactions cards**

- 2 x Ligase card
- 2 x Ligation card
- 2 x Linker card
- 2 x Magnesium chloride card
- 2 x Non-toxic DNA gel card
- 2 x Nuclei acid denaturation card
- 2 x Polylinker
- 2 x RNAse A card
- 2 x Spectrophotometer for nucleic acid quantification
- 2 x Thermal cycler
- 6 x Ultraviolet light card
- 2 x Water bath card
- 4 x Red Buffer card
- 4 x Green Buffer card
- 4 x Yellow Buffer card
- 4 x Blue Buffer card
- 1 x DNA Ladder card

## List of Reactions cards

| Card Title | Card Type | Playing requirements | Effect | Blocked by |
|---|---|---|---|---|
| Agarose gel | Attack | 25°C | Pick 2 Bases from the Bases deck | Detergent |
| Alkaline Phosphatase | Attack | 25°C to 37°C<br>Any buffer<br>Dephosphorylation | Remove the last 2 bases of a chain | Detergent<br>Klenow Fragment |
| Amplification (PCR) | Attack | Over 50°C<br>Any buffer<br>dNTPs<br>DNA Polymerase<br>Magnesium Chloride | Add 3 bases to 3'-End | Detergent |
| Bovine serum albumin (BSA) | Support for Attack | Restriction enzyme | Increase or decrease temperature one level after attack is finished | Detergent |
| Deletion | Attack | 25°C to 37°C<br>Any Buffer | Remove two bases from chain (sequence religates) | Detergent |
| Dephosphorylation | Defence | 37°C<br>Any Buffer<br>Alkaline Phosphatase | Blocks ligation card | Detergent |

## List of Reactions cards

| Card Title | Card Type | Playing requirements | Effect | Blocked by |
|---|---|---|---|---|
| Detergent | Defence | - | Blocks any Reactions card | Detergent |
| Distilled water | Temperature | - | Decrease temperature one level | Detergent |
| DMSO | Support for Attack | Over 50°C | Pick 3 bases from the Bases deck | Detergent |
| Dnasel | Attack | - | Cut any chain smaller than 12 bases leaving only the 4 initial bases | Detergent |
| DNA ladder | Attack | Active only when attacker's chain is shorter than opponent's chain | Delete 3 bases in the opponent's chain, from 3' to 5', until chain length matches | Detergent |
| DNA loading dye | Attack | 25°C | Reveal opponent's hand | Detergent |
| DNA Polymerase | Support for Attack | Over 50°C | Swap up to 3 bases | Detergent |
| dNTPs | Support for Attack | Over 50°C | Add 3 bases to 3-End | Detergent |

## List of Reactions cards

| Card Title | Card Type | Playing requirements | Effect | Blocked by |
|---|---|---|---|---|
| Dry Ice | Temperature | - | Reduces temperature to -80°C | Detergent |
| Electrophoresis tank | Attack | 25°C | Take all bases from opponent's hand | Detergent |
| Ethidium Bromide | Attack | 25°C | Reveal and obtain two cards from opponent's hand | Detergent<br>Non-toxic DNA gel stain |
| Goggles | Defence | - | Blocks Ultra-violet light | Detergent |
| Heating Block | Temperature | - | Increase temperature 2 levels | Detergent<br>Ice Box |
| Ice Box | Defence | - | Decreases temperature to 4°C | Detergent |
| Klenow Fragment | Defence | 25°C | Blocks Alkaline Phosphatase | Detergent |
| Ligase | Support for Attack | 4°C to 16°C | - | Detergent |

## List of Reactions cards

| Card Title | Card Type | Playing requirements | Effect | Blocked by |
|---|---|---|---|---|
| Ligation | Attack | 4°C to 16°C<br>Any Buffer<br>Ligase | Religates a broken chain (e.g. after restriction enzyme effect) | Detergent |
| Linker | Defence | 25°C to 37°C | Add 3 bases to the middle of a cut chain (e.g. after restriction enzyme effect). Chain can religate after addition. | Detergent |
| Magnesium Chloride | Support for Attack | Over 50°C | - | Detergent |
| Nucleic acid denaturation | Defence | 100°C | Blocks Thermal Cycler | Detergent |
| Non-toxic DNA gel | Defence | 25°C | Blocks Ethidium Bromide | Detergent |
| Polylinker | Defence | 25°C to 37°C | Add five bases to the middle of a cut chain (e.g. after restriction enzyme effect). Chain can religate after addition. | Detergent |

## List of Reactions cards

| Card Title | Card Type | Playing requirements | Effect | Blocked by |
|---|---|---|---|---|
| RNAse A | Defence | 37°C | Remove uracil from chain | Detergent |
| Spectrophotometer for Nucleic Acid Quantification | Attack | 25°C | Add 2 bases to the 3'-End | Detergent |
| Thermal cycler | Attack | - | Changes temperature to any level wanted | Detergent<br>Nucleic acid denaturation (only at 100°C) |
| Ultra-Violet Light | Attack | 25°C | Swap up to 4 bases | Detergent<br>Goggles |
| Water Bath | Temperature | - | Increases temperature to 55°C | Detergent |
| Blue Buffer<br>Green Buffer<br>Red Buffer<br>Yellow Buffer | Support for Attack | To be played with a restriction enzyme of the same colour | - | Detergent |

# Frequently asked questions

**We consider "Adna's Lab" very straightforward and easy to play. However, if you have any doubts we are here to clarify them for you. Just email us any game mode questions you might have to sciboardgames@gmail.com and we will reply asap.**

## Can I use the deletion card to remove uracil from my chain?

**Yes, the deletion card allows you to remove two bases from anywhere in the chain you played it against. Once you've picked a target chain you can only apply the effect to the selected chain though.**

## When I use the deletion card against my opponent what bases do I remove?

**You remove two bases from anywhere in the chain. It doesn't matter where you take it from regarding that you remove only two and from the chain you played it against.**

## When does the natural mutation effect occur?

Whenever the temperature in the reaction thermometer is above 60°C, a natural mutation process occurs. In this sense, every time such condition is verified and a player is starting his turn, the opponent will have the opportunity to swap places of two existing bases in the opponent's chain. This effect happens prior to any cards being played.

## Do I have to start my chain with the ATG sequence?

No! The ATG sequence of cards is just to determine which player starts the game. After that is determined each player can start his/her chain with whatever bases he/she has in hand.

## When I draw my cards do I have to show them to my opponent?

**No! The only cards you show your opponent are the cards you play. Eventually, your opponent might play cards that force you to reveal your hand.**

## Can I block a detergent card with another detergent card?

No! The use of a detergent in the game is to give an idea of how a reaction got messy and the biological sample destroyed. You wouldn't reinforce that messiness with additional detergent, would you?

## Can I do multiple attacks at a time?

No, a player can play only one attack at a time and wait for the opponent to defend that attack. If defended, the attack card is considered ineffective and placed on the bottom of the Reactions deck. Only when the first attack is resolved can the attacking player decide if he/she wants to attack again or not.

## Can I add bases to the middle of a chain?

**Unless the card clearly states that you are allowed to do it, you can only add bases to the 3'-end of the chain.**

## What does it mean those four colour tubes?

**They are buffers, meaning that you can play any of those buffers,**
**NOT all of them.**

## How does temperature works when an enzyme requires BSA?

If an enzyme requires BSA you have to play the enzyme card along with the BSA card. Then, when the enzyme effect is over you will have to change the temperature in the reaction thermometer one level up or down.


## Can I discard cards at the end of my round/turn?

Yes, you can discard up to a maximum of three cards just before your round/turn ends. Than, you will have to place the discarded cards in the bottom of their respective decks and the opponent is only allowed to know what deck these cards belong to, and not what specific card has been discarded.