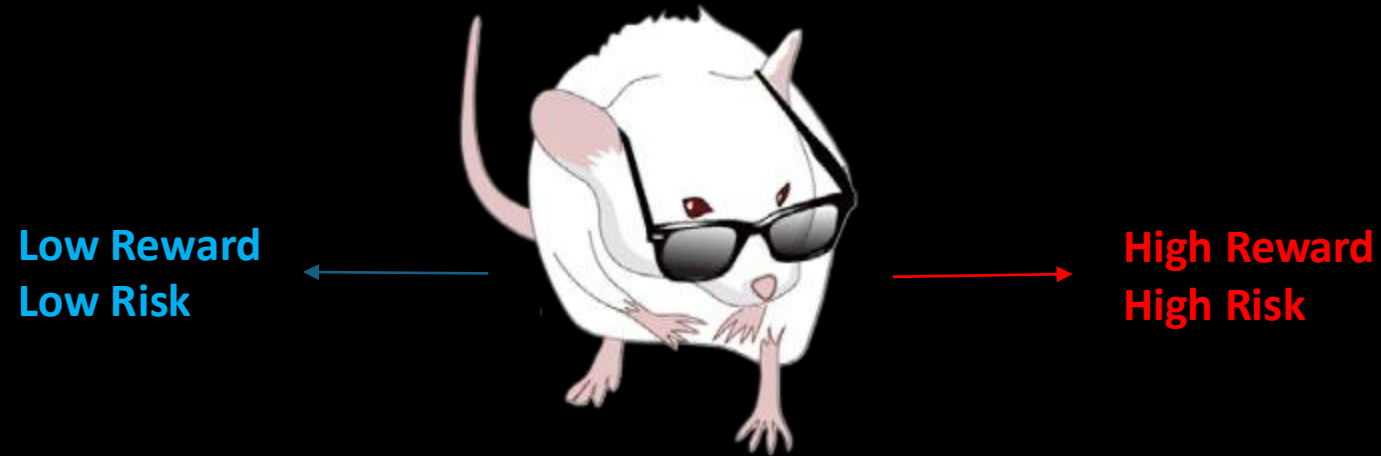


Decision-Making Under Stress



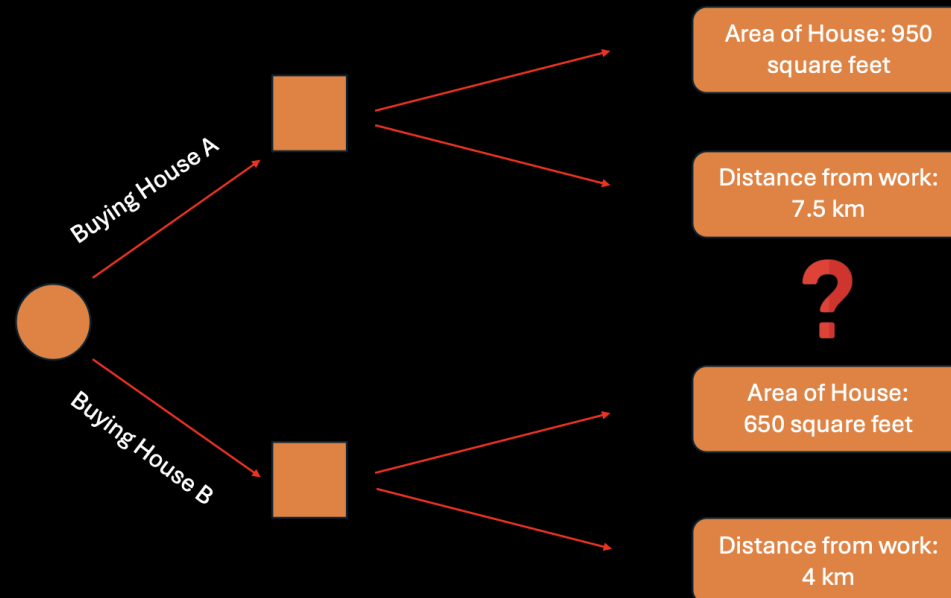
HOW TO CHOOSE
HOW TO CHOOSE



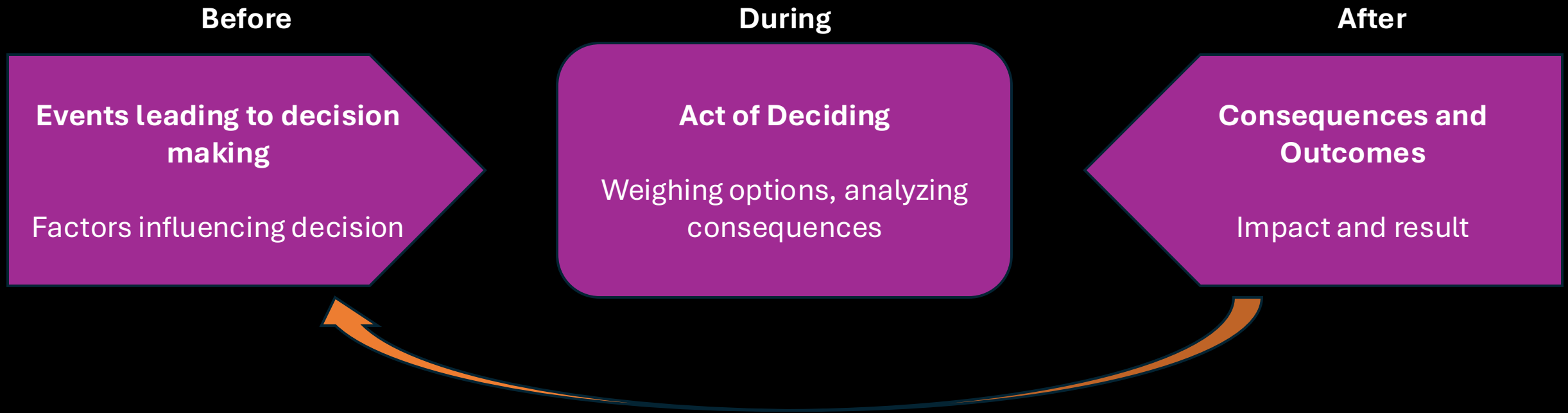
Decisions, Decisions...

- We are faced with various decisions, choices and judgements daily and throughout our lives: what to have for lunch, where to go on a holiday, what car to buy, and so on. Some of these decisions have little impact on our lives while others have long-lasting effects.
- Despite their diversity, these decisions all share a common structure. They involve choices between several options, they concern future states of the world that are uncertain or unknown, and they have varying degree of importance.
- Quite often, the decision-making process is specific to the decision being made. Some choices are straightforward, while others are complex and require a multi-step approach.

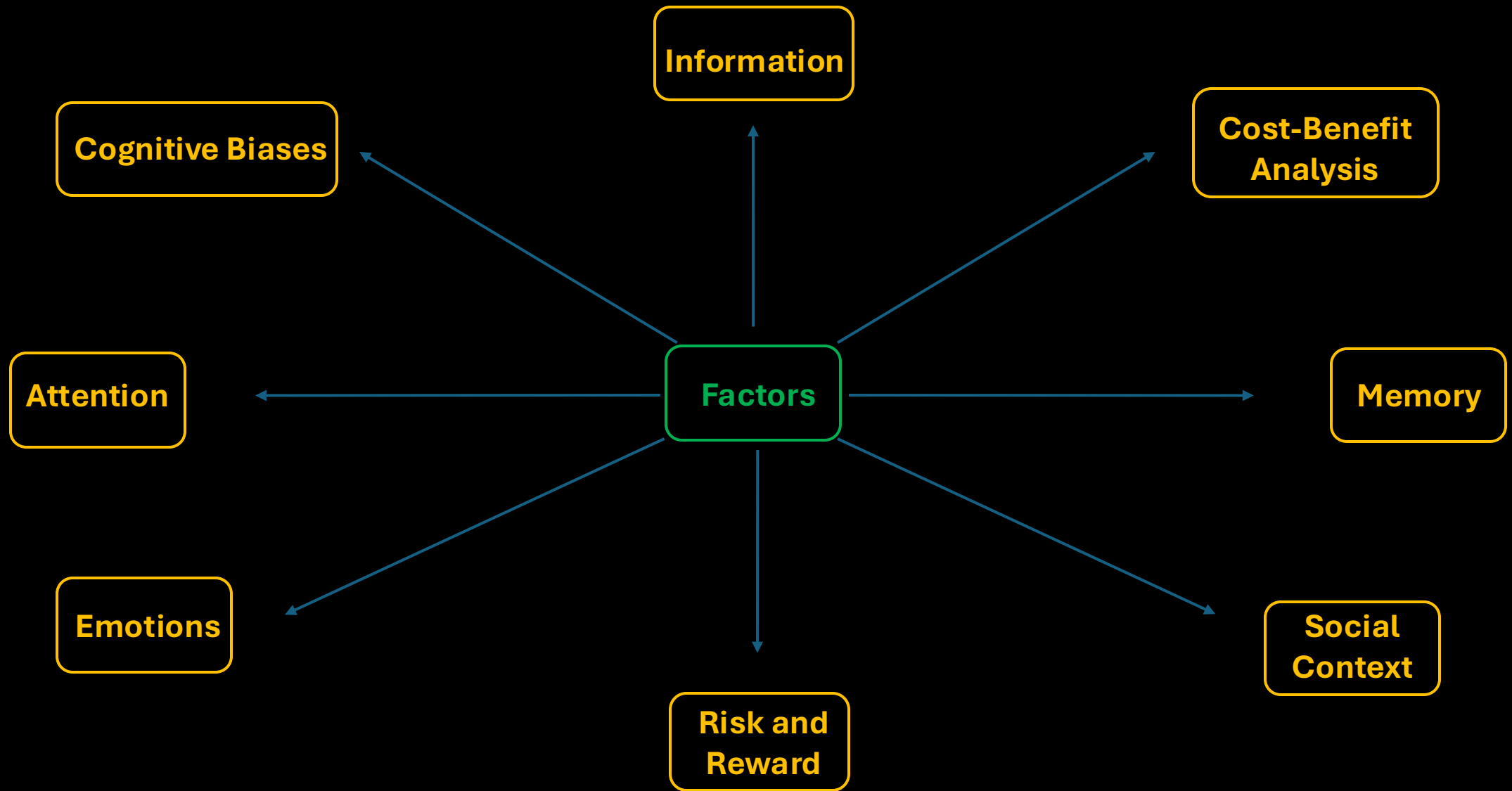
- A decision maker chooses from a set of alternatives to maximize an outcome that's related to the future state of the world. While doing so, the decision maker implements different kinds of decision-making 'frameworks', depending on the simplicity of the situation.
- For example, individuals use heuristics to make decisions as it helps in reducing the effort expended in making decision. Deciding what to have for lunch can be a decision made using heuristics.
- However, situations that have a higher stake often use rational, deliberate processes to decide between options. For example, deciding between two houses uses a Cost-Benefit Analysis to contrast and compare different factors, like the area of the house, distance from the workplace, and so on.



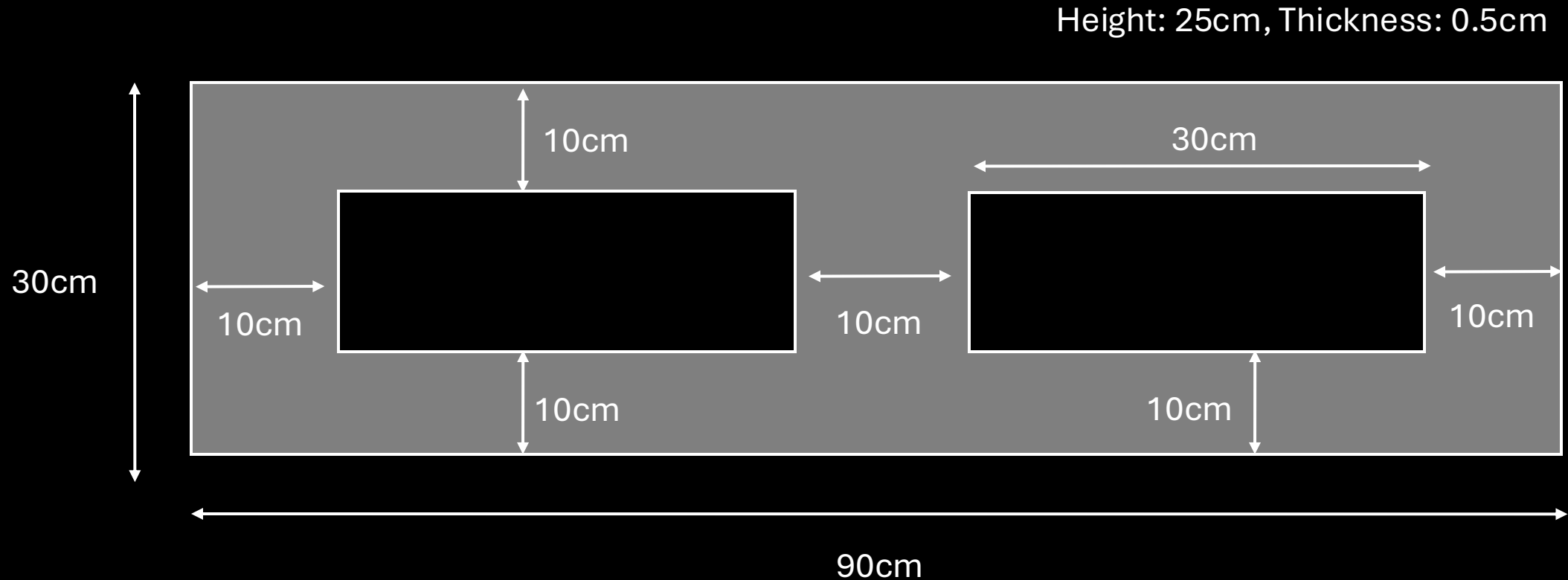
The Decision-Making Process



Given the opportunity to learn information about the decision made through feedback and repetition gives rise to accurate judgement and decision-making.



Experimental Assay



References:

1. Rakshasa & Tong (2020) - stem: 30 cm, arm length: 30 cm, width: 10 cm
2. Friedman (2017) - stem: 36 cm, arm length: 23 cm, height: 23 cm
3. Maze Engineers – stem: 35 cm, arm length: 27.5 cm, height: 20 cm

Components

1. **FLIR BlackFly-S (x1)** - High speed recording camera with IR lens to enable recording in dark using IR lights
2. **IR sensors (x5)** - Sensors to be used as region of interest that tracks progress of mice through assay
3. **IR Lights (x2)** - Infrared lights for recording in dark
4. **Servo Motor (x4)** - 360-degree rotational servo to open and shut door
5. **LED Panels (x4)** - 12 led lights to light up path
6. **Solenoid valve (x2)** - Liquid dispensing valve to dispense reward
7. **Arduino Mega (x1)** - Microcontroller to automate assay

Legend



ROI



LED Panel



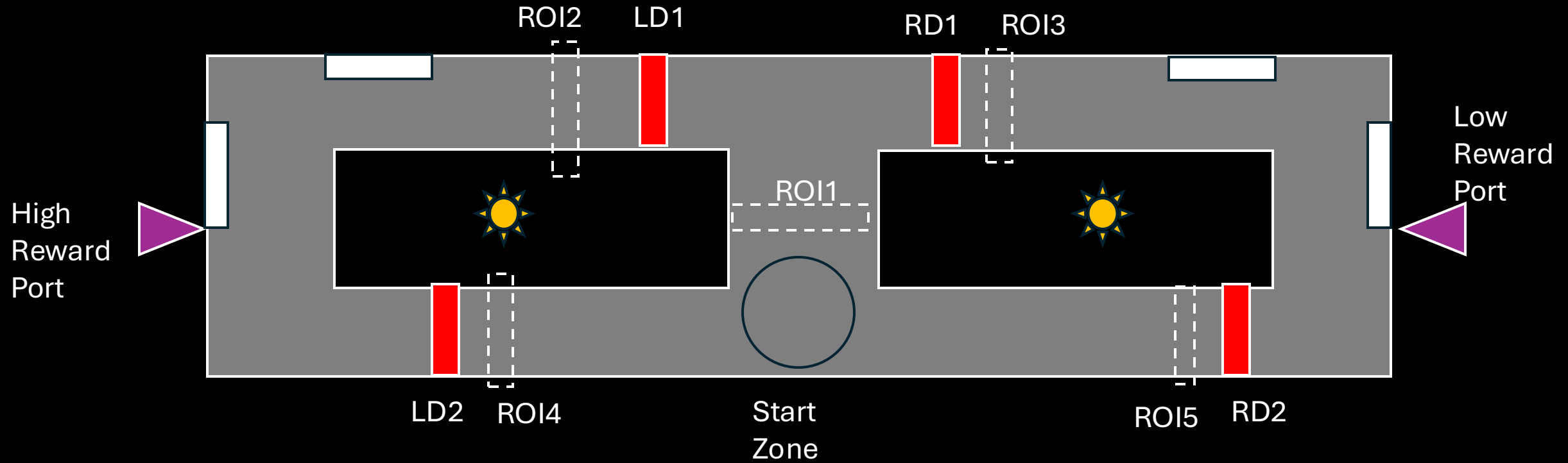
Door



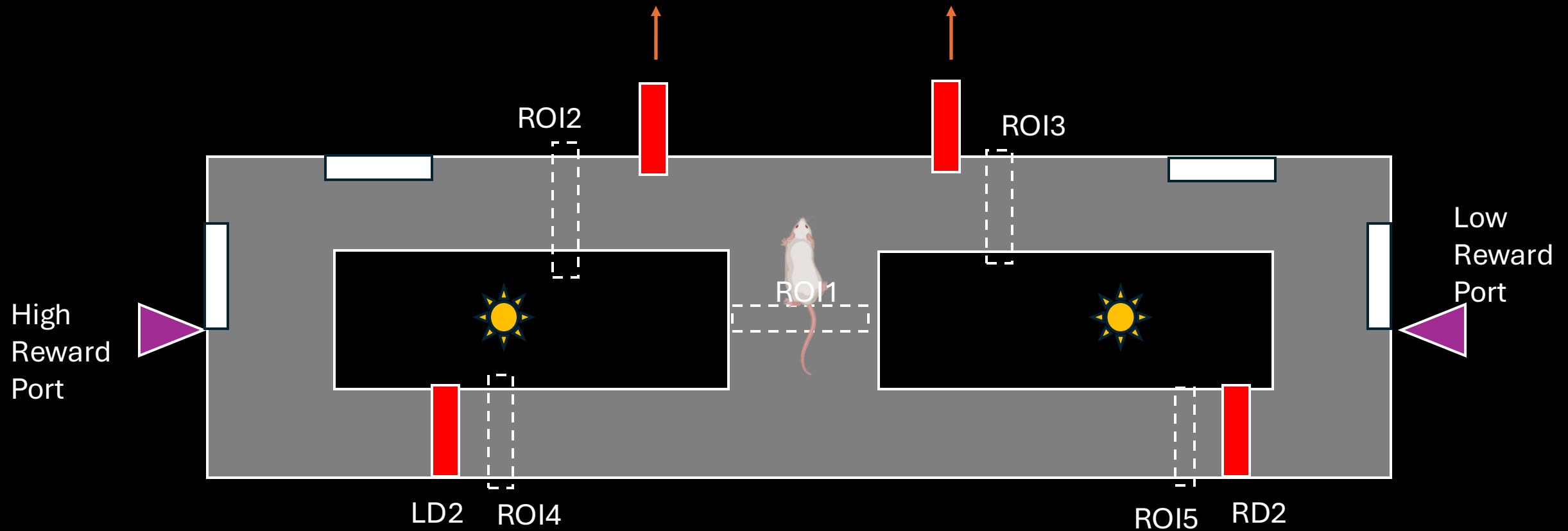
IR Lights



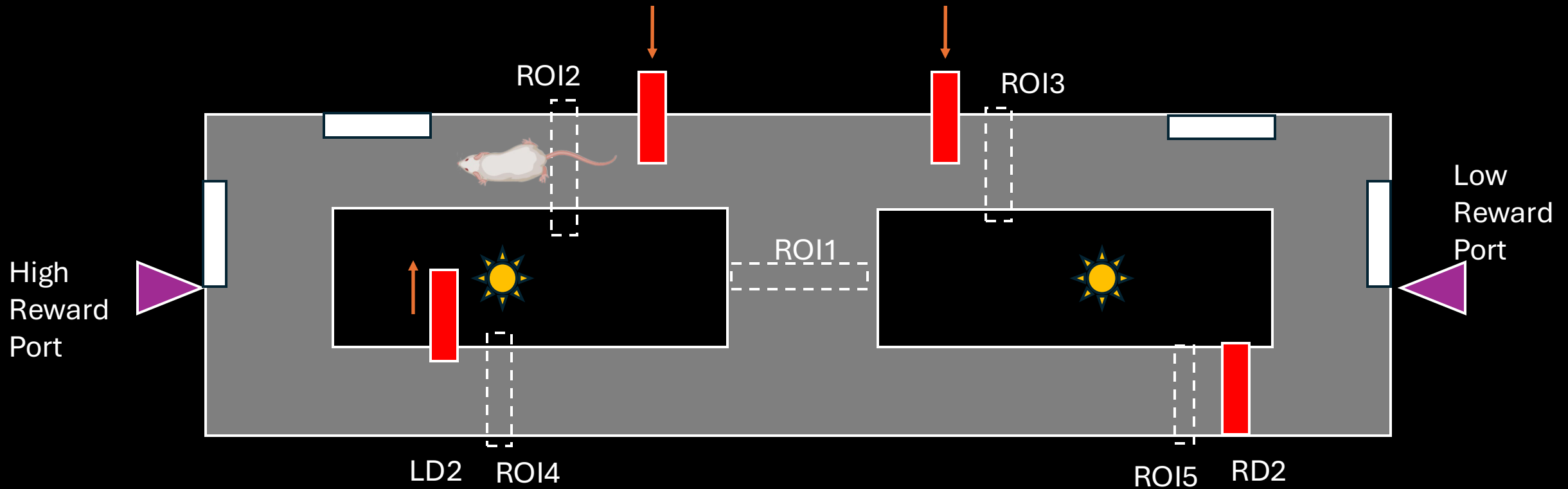
Port



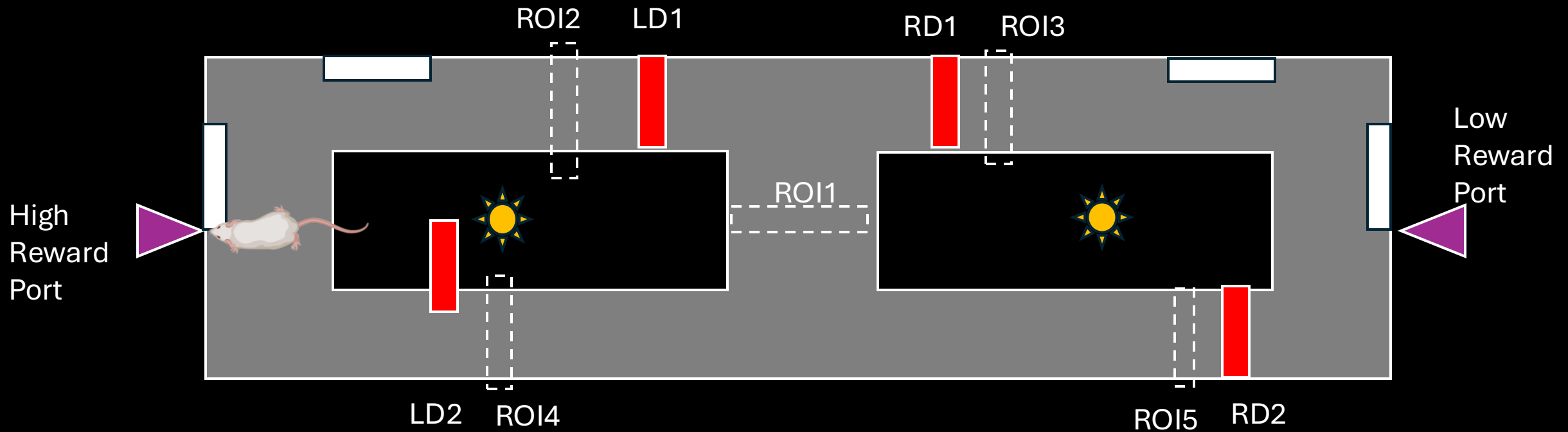
- As the mice crosses **ROI 1**, the IR sensor gets triggered, which causes **LD1** and **RD1** to open.
- The activation of **ROI 1** also causes the LED panels in both arms to turn on.



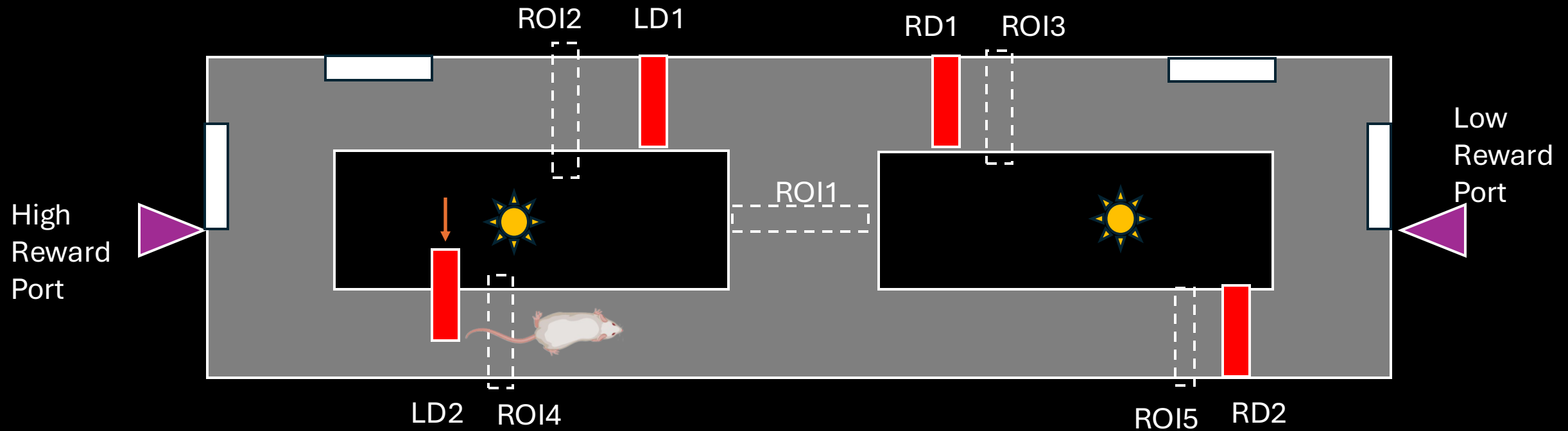
- The mice turns towards either the right arm or the left arm.
- Assuming the mice turn towards the left arm, **ROI2** is activated, which causes **LD1** to close. The door at the end of the arm, **LD2**, opens. The solenoid valve for the High Reward Port (**HRP**) is activated and dispenses the reward.
- **RD1** closes as **ROI2** gets activated.



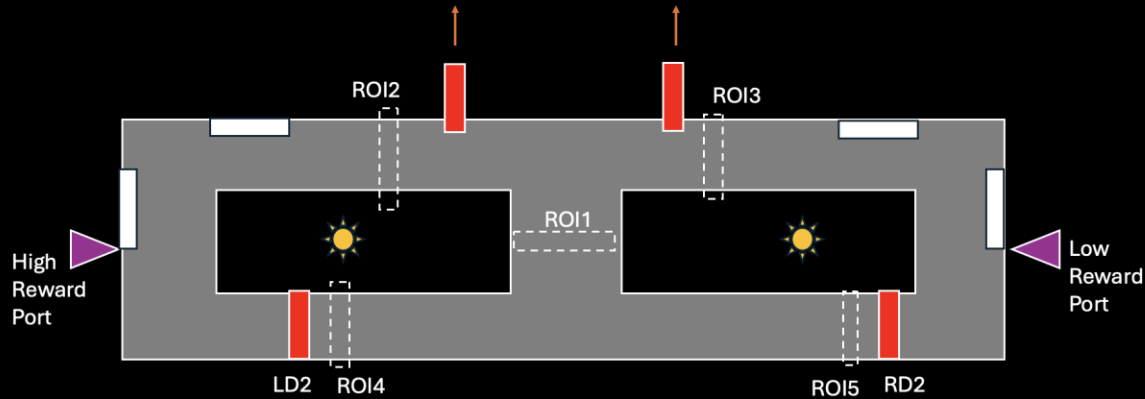
- The mice proceeds to consume the **reward** from the corresponding port of the arm.
- After **reward** consumption, the mice begin moving towards the start zone.



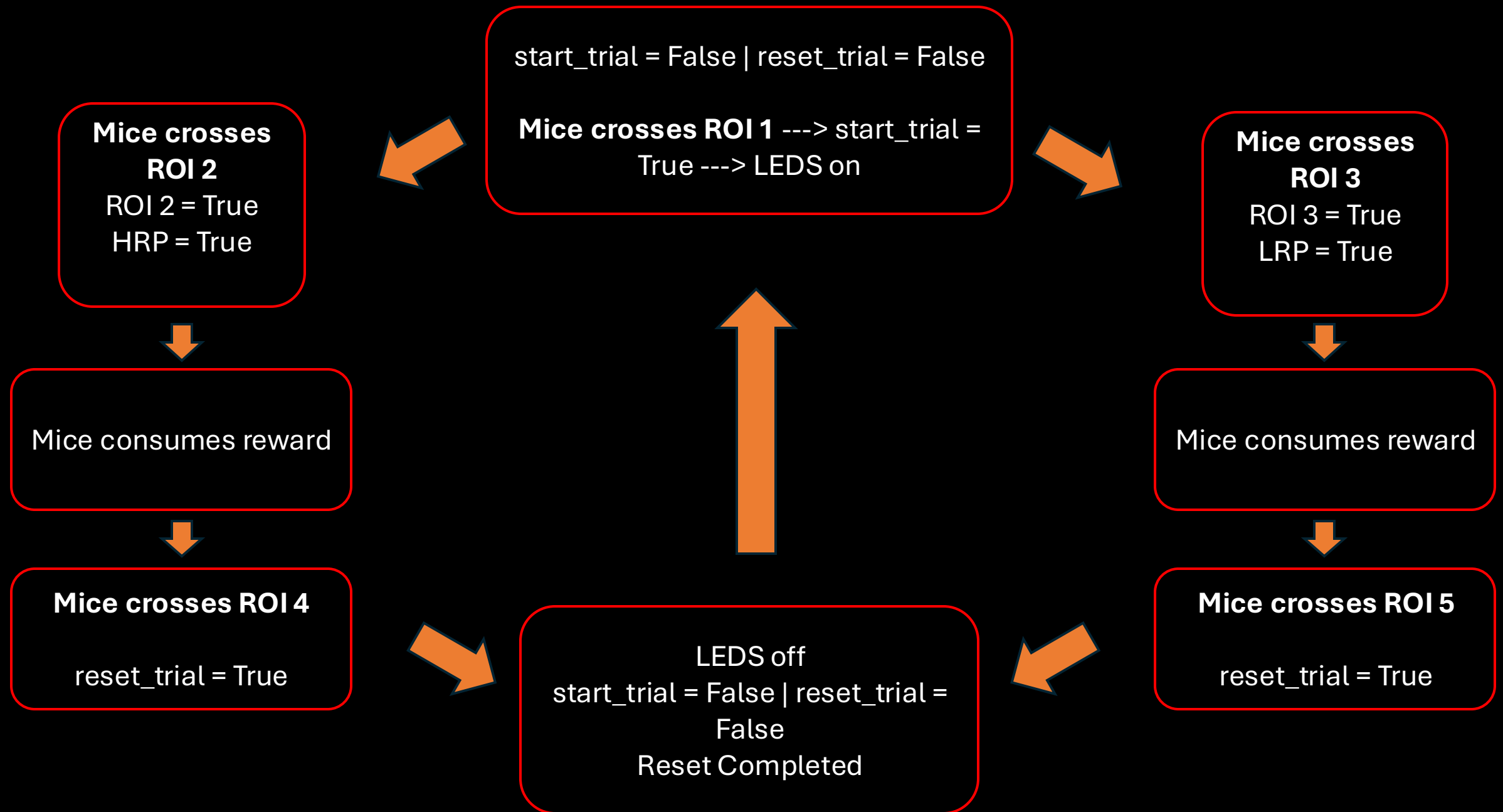
- As the mice crosses **ROI4**, **LD2** closes, preventing the mice from re-entering the arm.
- The activation of **ROI4** also resets the assay, causing the LED panels to turn off and get ready for the next trial as the mice reaches the start zone.



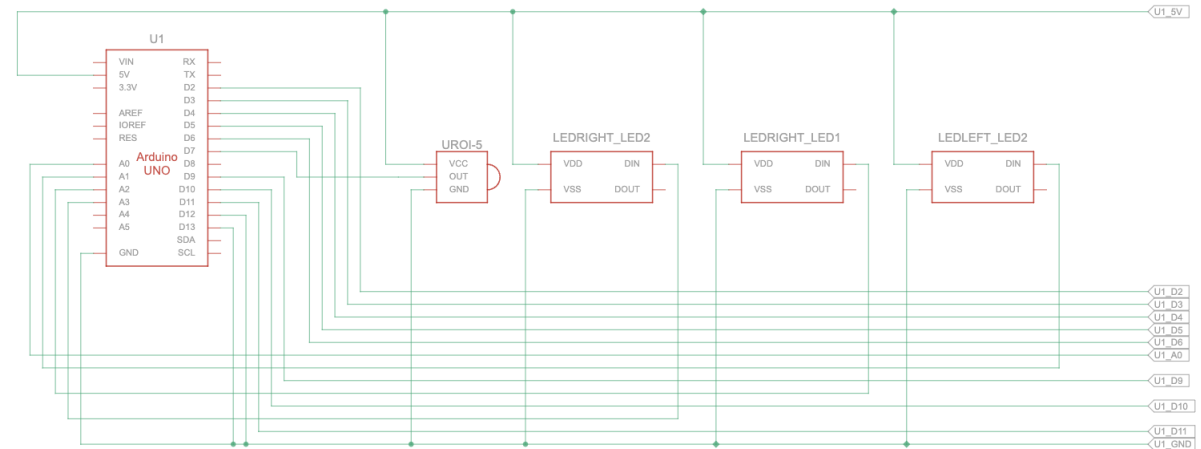
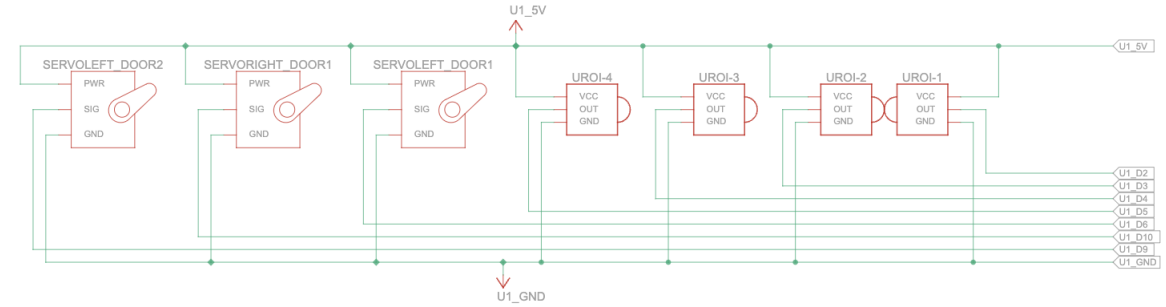
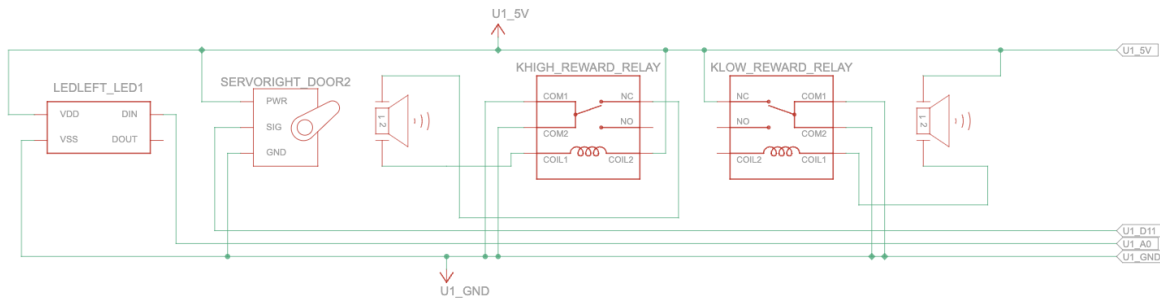
Logic Flowchart



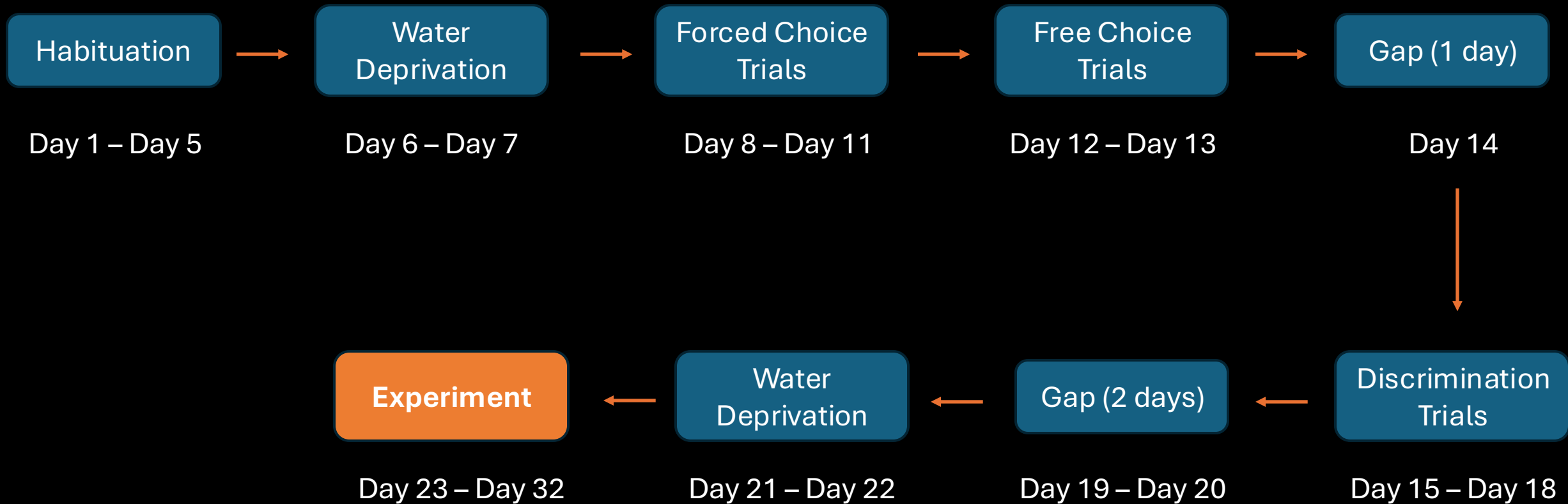
- Activation of **ROI 1** – Opens **LD1** and **RD1**, **LEDs** on
- Activation of **ROI 2** – Closes **LD1** and **RD1**, dispenses reward from **HRP**, Opens **LD2**
- Activation of **ROI 3** – Closes **LD1** and **RD1**, dispenses reward from **LRP**, Opens **RD2**
- Activation of **ROI 4** – Closes **LD2**, **LEDs** off, **trial resets**
- Activation of **ROI 5** – Closes **RD2**, **LEDs** off, **trial resets**



Circuit Diagram



Timeline



Protocol

- Mice will be divided into two groups based on the assignment of rewards to a particular arm:

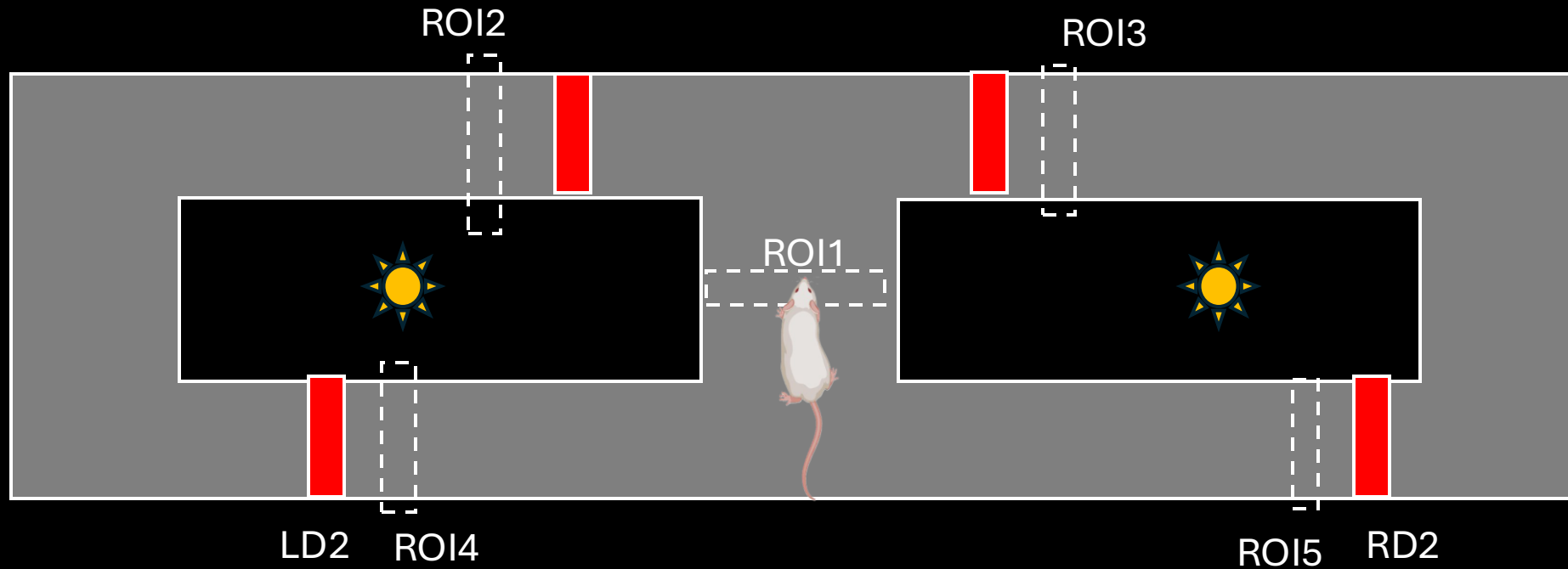
Group A – High Reward (Left) | Low Reward (Right)

Group B – Low Reward (Left) | High Reward (Right)

- This will be done to test whether mice have spatial bias towards one arm of the maze. The assignment of high-reward and low-reward arms will remain the same throughout the experiment.
- **Water Deprivation**

A. Habituation (5 days)

Mice can freely explore the assay for 10 minutes for 5 days. No reward or cost is present in the assay. This is meant to help them get familiar with the working of doors.



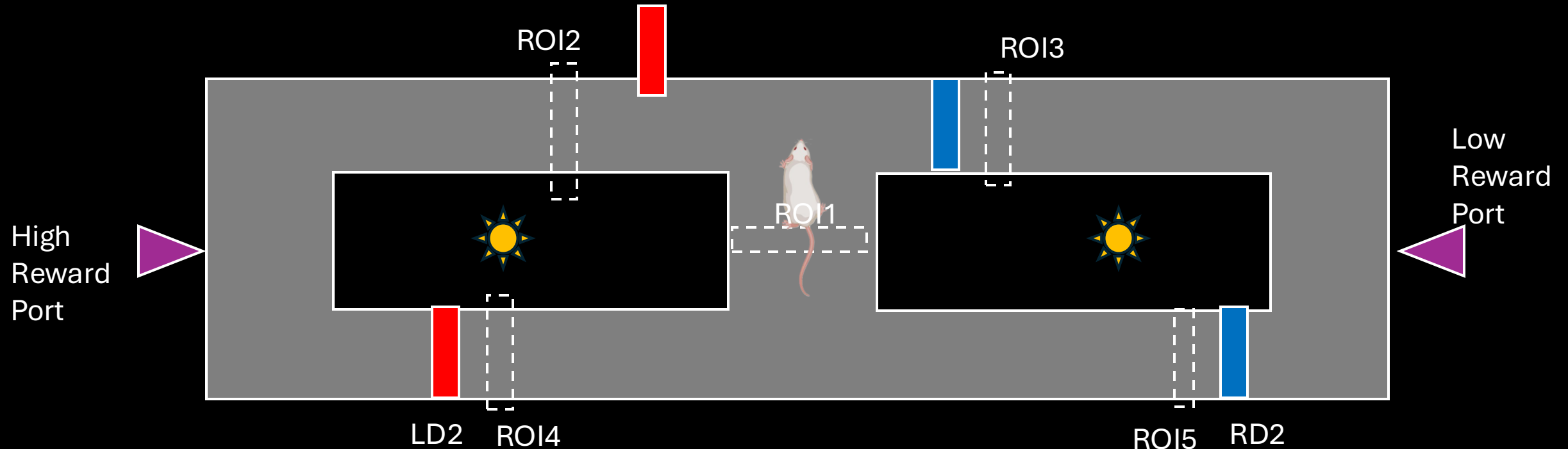
B. Forced Choice Trials (4 days)

One arm of the assay will be shut, forcing the mice into the other arm. For example, the arm with low reward will be blocked to force the mice toward the high reward arm. No cost will be present in the arms.

Day 1 & Day 3: High Reward Arm blocked

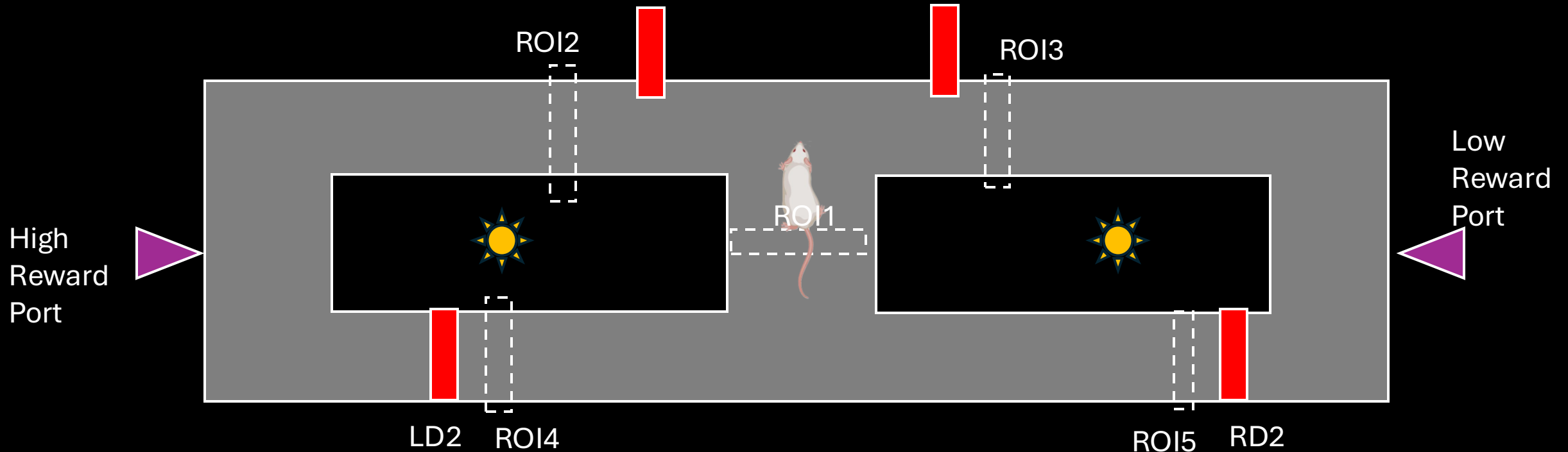
Day 2 & Day 4: Low Reward Arm blocked

This is done to ensure the mice learn that both a high-reward and a low-reward option are present in the assay.



C. Free Choice Trials (2 days)

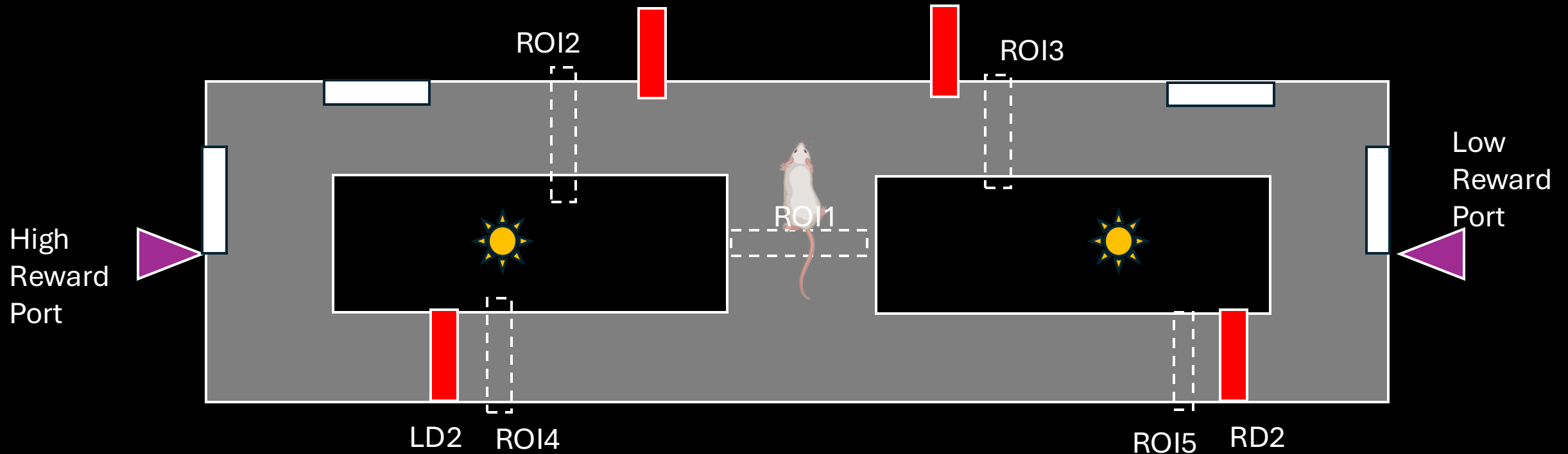
After the forced choice trials, the mice will undergo a free choice trial where both arms will be open without the presence of any cost. **Data will be collected to establish whether the mice have a preference for the high-reward arm by measuring if they choose it at least for 75% of the trials.**



D. Discrimination Trials (4 days)

Both arms will be open, and costs will be present along with rewards. The high cost (bright light) will always be paired with high reward (sucrose), and the low cost (dim light) will always be paired with low reward (water).

This is done to establish whether the mice are averse to bright light associated with the high reward. **Data will be collected to determine if there is a drop in preference for the high-reward arm due to the presence of bright light.**



Experimentation

Day	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
Reward	High Reward (L) - Low Reward (R)	Low Reward (L) - High Reward (R)	High Reward (L) - Low Reward (R)	Low Reward (L) - High Reward (R)	High Reward (L) - Low Reward (R)	Low Reward (L) - High Reward (R)	High Reward (L) - Low Reward (R)	Low Reward (L) - High Reward (R)	High Reward (L) - Low Reward (R)	Low Reward (L) - High Reward (R)
Injection	DCZ	Saline	Saline	DCZ	---	---	DCZ	Saline	Saline	DCZ
Stressor	---	---	---	---	Acute Stress	Acute Stress	Acute Stress	Acute Stress	Acute Stress	Acute Stress

Acute Stress: 4 hours of immobilisation before experiment