Cortex Quest

BIOLOGY

HEAR WE GO!

THE SOUND OF SYNAPSES

Supporting documentation

CONTEXT

Welcome to **CORTEX QUEST : HEAR WE GO!**

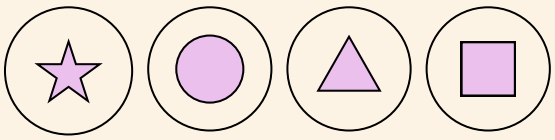
A scientific mishap has **miniaturized** your team of biologists... You've been projected inside the human body, right into the heart of the auditory system, for a mission of the utmost importance: to **understand** the auditory pathway and how the **sensory system** works!

Equipped with your VR tools, you will :

- Explore the **cochlea** and uncover its secrets;
- Activate the **hair cells**;
- Play with sound **frequencies** to understand how low and high tones are perceived;
- Trigger **action potentials** and follow their path through the neurons;
- Reach the **auditory cortex**.

Shapes

Throughout the game, you'll come across **shapes** that appear on your bracelet.

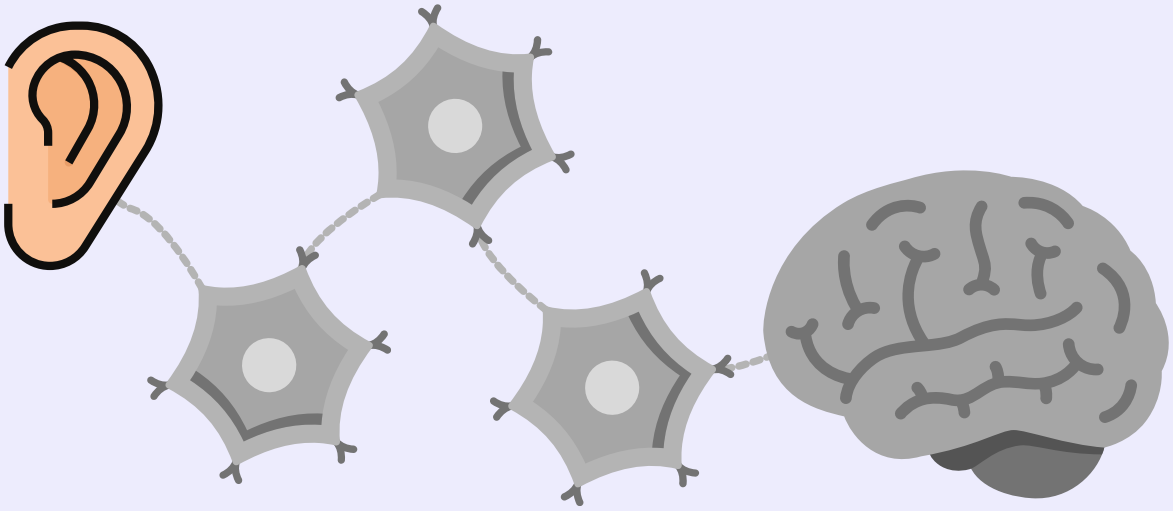


Each represents a different **action** to be taken depending on the context.
When you see it, it’s time to communicate with your teammate!

HUB

SITUATION

The Hub serves as the **central** point of the game. It provides an overview of the **sensory system pathway** and helps you understand each stage within its larger context.



You will return here at **key moments** to understand how the actions you perform on a **microscopic** scale influence the entire system on a **macroscopic** level.

PLAYER'S GOALS

1 - Getting to the ear

Move to get in front of the ear.

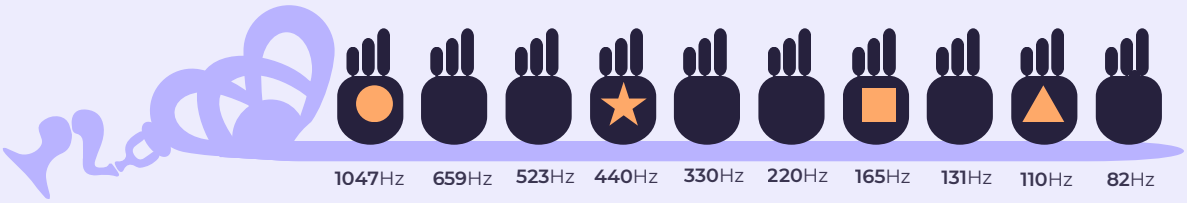
2 - Interact with the ear

Bring your hand closer to the Introduction button and press on it. Once you completed the level, start level 1 to enter the cochlea.

Stimulating the cochlea LEVEL 1

SITUATION

You're looking at the **unfolded cochlea**, which contains **hair cells**. Each of these cells reacts to a specific range of sound **frequencies**.



The **bracelet** allows you to change the frequency of the **sound** .

PLAYER'S GOALS

1 - Activate all the hair cells

Activate all the hair cells at least once by playing with the corresponding sound frequency. Note what happens to the hair cell activated.

2 - Activate a specific hair cell

Use the visible shapes on your bracelet to identify and stimulate four **specific** hair cells.

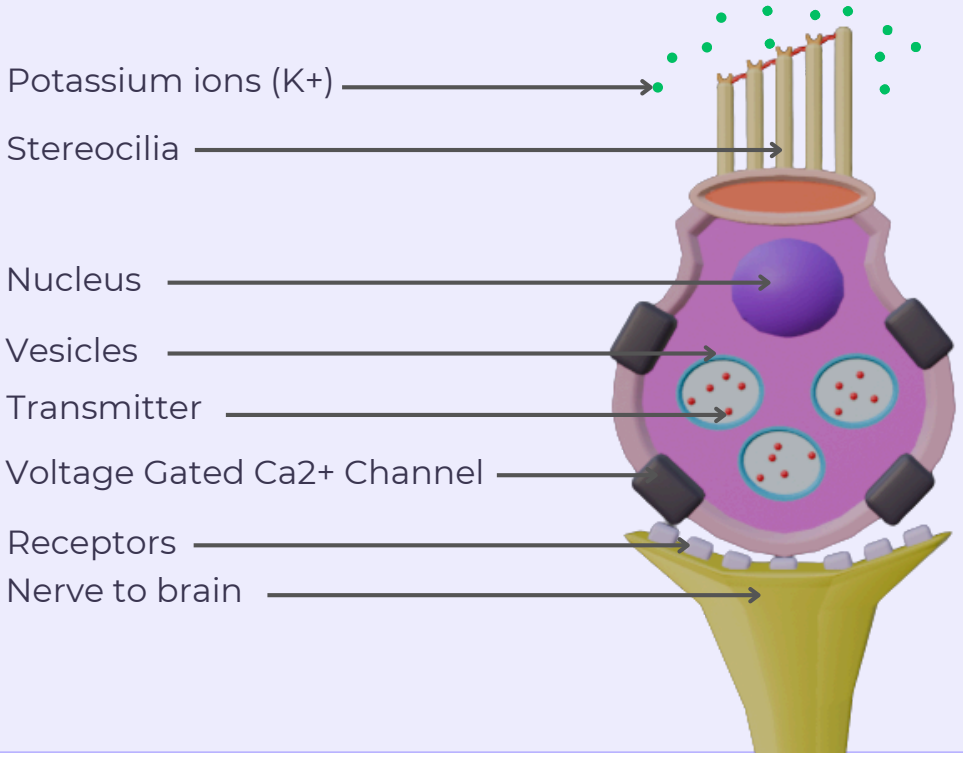
- **1047** Hz
- **440** Hz
- **165** Hz
- **110** Hz

Depolarize the cell

LEVEL 2

SITUATION

Here you are, up close to a **hair cell**, where you can observe its structure in greater details.



PLAYER'S GOALS

1 - Manipulate a stereocilia

With one hand, **tilt** the stereocilia to the right to open the ion channel.

2 - Feed the ion channels

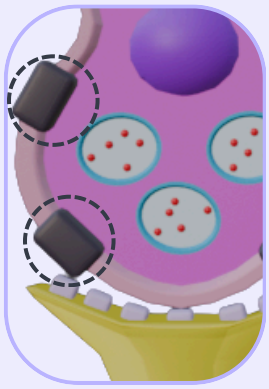
With the other hand, **grab** a potassium ion (K+) from those floating in the air and feed it into the ion channel.

Feed enough ions to **activate** the cell by **depolarizing** it.

Generate an action potential LEVEL 3

SITUATION

In the previous level, you managed to **depolarize** the hair cell, which unlocked the calcium channels.
They are now eligible to receive **Ca++ ions**. The Ca++ ions trigger the exocytosis of the neurotransmitters in the **synapse**.



PLAYER'S GOALS

1 - Load

All around you, you will find calcium ion (Ca++) **ammunitions**. Grab them and **reload** your Ca++ blaster !

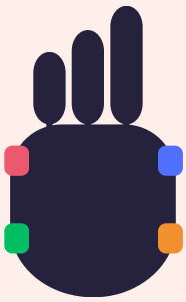
2 - Aim & Shoot

Your goal is to **hit** the **calcium channels**. Once you are aiming for one, pull the **trigger** to fire!

To know which channel to shoot among the four, carefully observe the shape in your braclelet.

Circle
Top left

Square
Top right



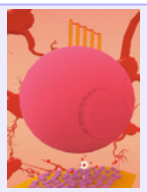
Star
Bottom left

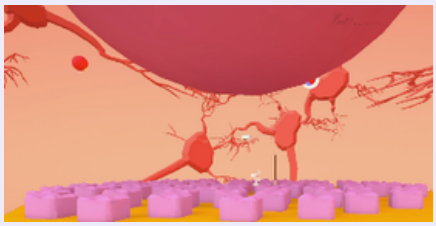
Triangle
Bottom right

Break down the neurotransmitter

LEVEL 4

SITUATION





You successfully released neurotransmitters in the synapse. They bind to the receptors of the post synaptic neuron in the auditory nerve and trigger action potentials . To avoid **overstimulation**, help with the **removal** of the neurotransmitters from the synapse.

PLAYER'S GOALS

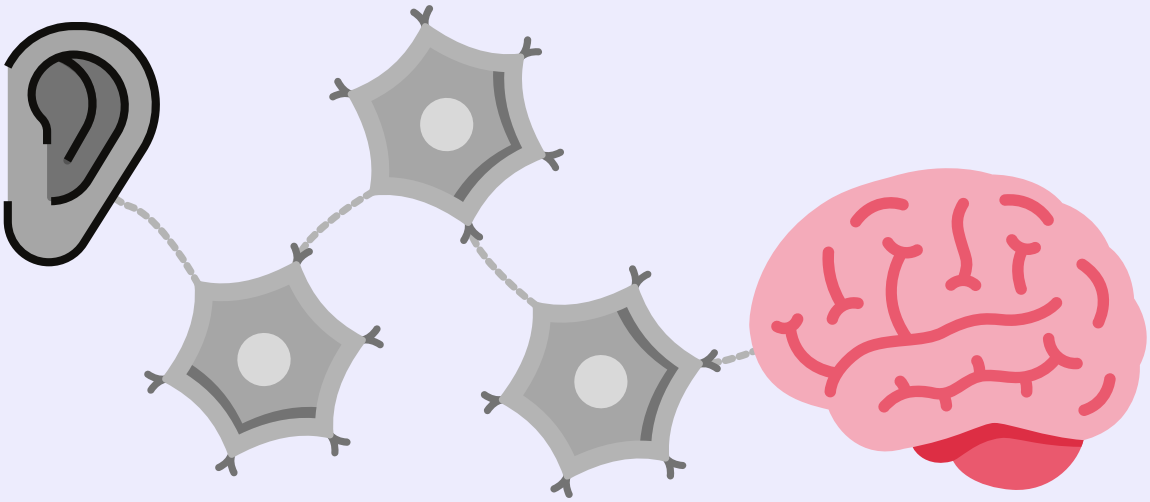
All around you, you will find **glutamates**. that needs to be removed from the synapse. Each of them is associated with a shape, which requires the following actions. You will hear a sound if you missed; you need a 'wining streak' to win this level.

Mystery symbol?	Star	Triangle
	☆	△
Reuptake	**Enzymatic degradation**	**Diffusion**
Reuptake is happening withouth your intervention. Which symbol is representing glutamates that are being reuptaken?	The star symbols must be sliced with a katana.	Triangle symbols must be dragged and dropped into a space where the they are carried far away.

HUB

SITUATION

Here you are in the hub for the **second** time. You can now witness from a distant view the **consequences** of the actions you carried out in the **previous** levels.
The neurotransmitters from the hair cells triggered **action potentials** in the auditory nerve.
Congratulations, you unlocked the last level, **the brain : auditory cortex**.



PLAYER'S GOALS

1 - Getting to the brain

Move to get right in front of the brain.

2 - Interact with the brain

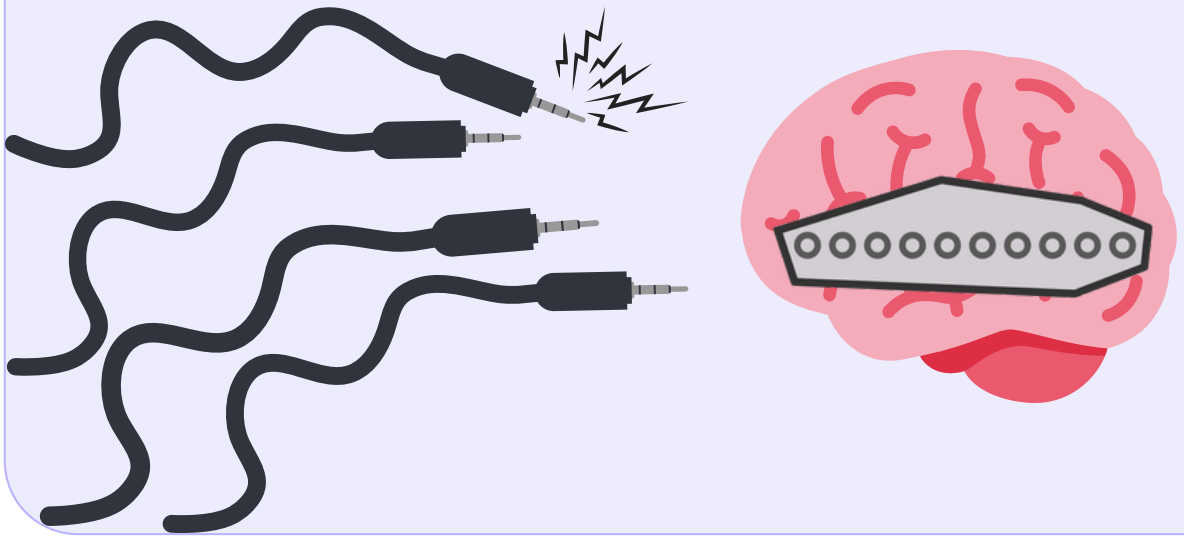
Grab the ear to start the last level.

Connect cortex

LEVEL 5

SITUATION

You are now looking at the brain, specifically the region of the auditory cortex. Beside you are axon terminals from neurons in the auditory nerve. Once these terminals connect to the appropriate area, they enable the perception of sound signals. The specific region they synapse with allows the brain to interpret sounds of particular frequencies.

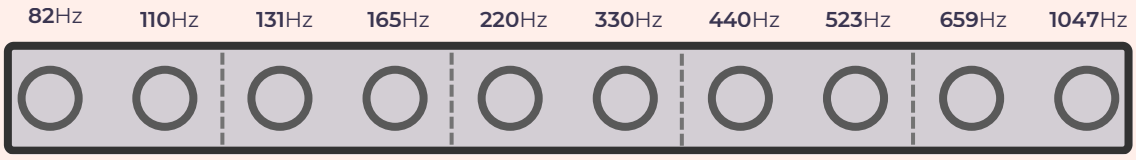


PLAYER'S GOALS

1 - Identification

Identify which neuron corresponds to which frequency by changing it using the **bracelet**.

The higher the pitch, the higher the frequency.



The neuron corresponding to the frequency selected on the bracelet **shines**.

2 - Link

Plug the active cable in the appropriate **area**.