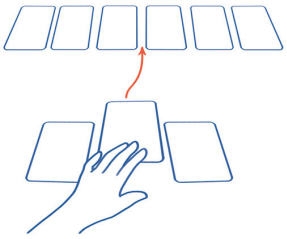
BRAIN STORIES

Game rules



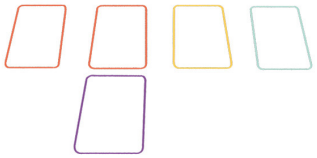
To place his card the player can :

1. Insert the card into a timeline (general or disciplinary).

When the player has chosen and announced out loud where he/she wants to place the card, the player turns it face down to reveal the date of the event.

2. Open a disciplinary timeline.

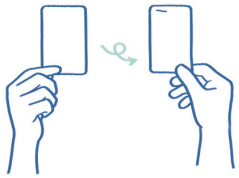
The player can place his/her card alongside a card in the main timeline to start a new timeline.



The new card must be correctly placed alongside a card from the same century. If the player gets the wrong century, the card is discarded and replaced, and it is the next player's turn.

• If the player opens a disciplinary timeline with a card belonging to two fields, it is still possible to place cards belonging to either (or both) of these fields in this timeline.

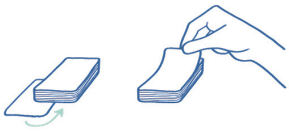
Joker cards can be placed in any disciplinary timeline. If a Joker card opens a new disciplinary timeline, the field of that timeline will be determined by the next card correctly placed in that timeline.



• If the card is correctly placed in relation to the other cards already in the timeline, it remains there. The round ends there.

• If the card is incorrectly placed in the timeline, the player discards it : the card goes back under the deck. The player draws a new card and his/her turn ends there.

The turn passes to the next player in a clockwise direction.



Aim of the game

Be the first player to place all the cards in your hand in the right place on the timeline(s)!

Set up

Shuffle the 80 cards. Deal 5 cards to each player. Players place their cards face up on the table (without the date).
The rest of the cards form the deck (face up). Place the first card of the deck in the centre of the table face down (with the date). This card is the starting event for the main timeline of the game.
The player who has most recently learned something about the brain begins.

How the game is played

On his/her turn, the player chooses a card from those placed in front of him/her. He/she must place this card in chronological order in relation to the one(s) already present in the centre of the table. The chronological order is represented by the alignment of the cards from the left (oldest events) to the right (most recent events).

Knowledge about the brain has been mixed up. Will you manage to put it back in order before everything is lost forever?

(Re)Discover Brain Stories!

Contents

80 cards corresponding to events that have marked the history of knowledge about the brain, divided according to their respective fields :

• 31 cards in **Medicine and Anatomy**
• 23 cards in **Physiology**
• 23 cards in **Psychology and Philosophy**
• 10 cards in **Artificial Intelligence**
• 7 **Joker** cards

Beware : 14 cards belong to two fields at the same time.

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Partner organizations :

• NeuroSchool
• Aix-Marseille Université
• CNRS
• LNC (Laboratoire de Neurosciences Cognitives) - UMR 7291

Game created by Estelle Nakul (PhD in Neuroscience)
Illustrations by Océane Gardet-Pizzo
Supported by the SATT Sud-Est

We warmly thank Anne Kavounoudias (Professor in Neuroscience, LNC - UMR 7291, AMU, CNRS), Zoé Dary (PhD Student in Neuroscience, LNC - UMR 7291, AMU, CNRS, and Fanny Trifilieff (Communications officer and translator) for their help and comments in the making of this game.

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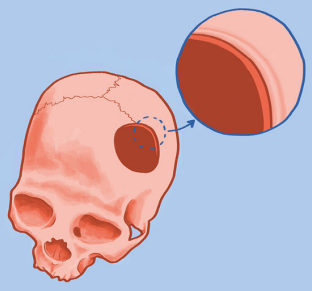
As soon as a card belonging to only one field is placed in the timeline, that card determines the field of that timeline.

You can only create one disciplinary timeline per field of study, i.e. a maximum of four disciplinary timelines, in parallel with the general timeline. A disciplinary timeline can only contain cards belonging to the same field.
Some cards belong to two fields : they can be placed in either of the disciplinary timelines.

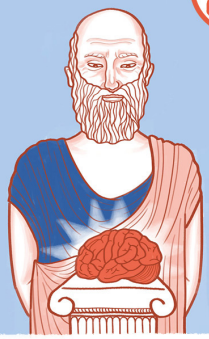


Early trepanned skulls sometimes show scarring which indicates that the subjects survived. Trepanning consists of making a circular hole in the skull, either to reduce the pressure on it or for spiritual reasons.

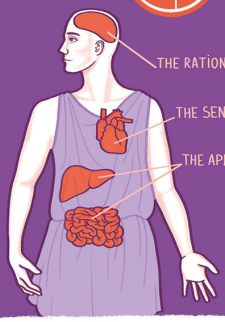
(Transcription of the word "brain" into hieroglyphs)

Edwin Smith's papyrus, the first known medical treatise, includes the word «brain» (or « medulla »). The author describes that damage to the brain induces disorders in the rest of the injured person's body on the side opposite the brain injury.

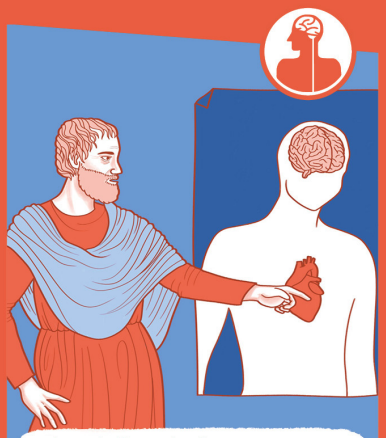
The first mention of automata appears in the *Iliad*. These autonomous artificial beings are capable of complex behaviors that can resemble those of humans. Greek mythology thus already evokes mechanisms common to technology and living beings.



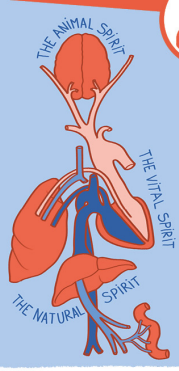
Hippocrates was born on the island of Cos. Father of Western medicine, he considered the brain to be the organ of thought and initiated the humoral theory: the functioning and health of the body is based on the circulation and balance of four fluids.



Plato founds the Academy. He teaches the theory of the three souls, each associated with a part of the body: the rational soul (intellect) in the skull, the sensible soul (feelings) in the heart and the appetitive soul (desires) in the liver and intestine.



Aristotle founds the Lyceum. He considers the heart as the seat of the intellect because it is at the center of the organism and it is warm, whereas the brain is cold. The brain only serves to temper the heat and restlessness of the heart.



Galen locates the mind in the brain. He distinguishes the encephalon, responsible for sensations, from the cerebellum, which controls the muscles by sending them spirits through the nerves, conceived as tubes. He based his work on numerous animal dissections.

Nemesius develops the ventricular theory in his treatise *On the Nature of Man*. He divides the major mental faculties into three different cells, associated with the cavities of the brain, the ventricles.

Avicenna writes, in the *Canon* of Medicine, that the soul is in contact with the real world through sensation (the senses) and perception. According to him, perception internalizes the sensation thanks to internal faculties that he locates in the ventricles.

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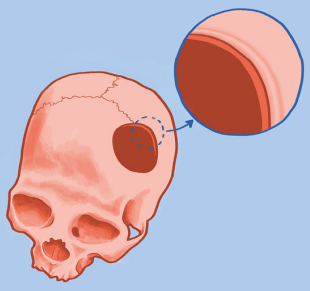

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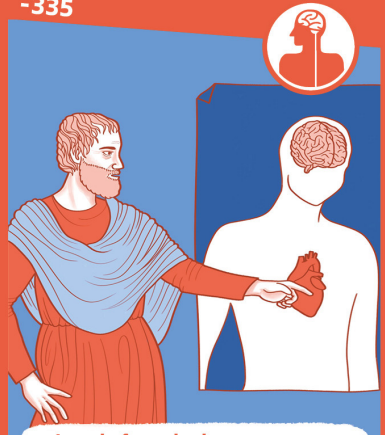

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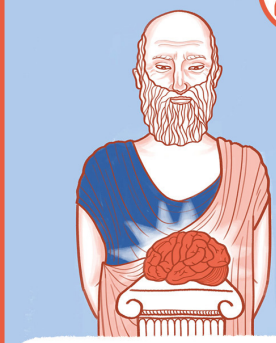

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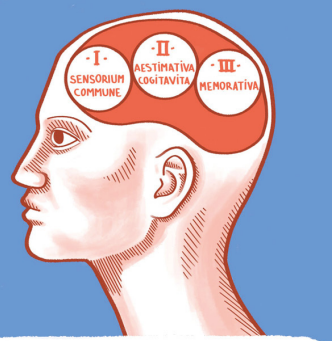

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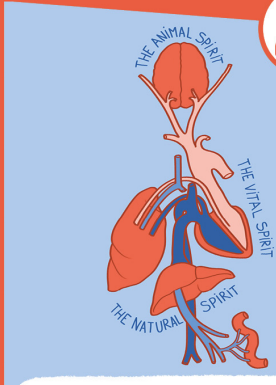

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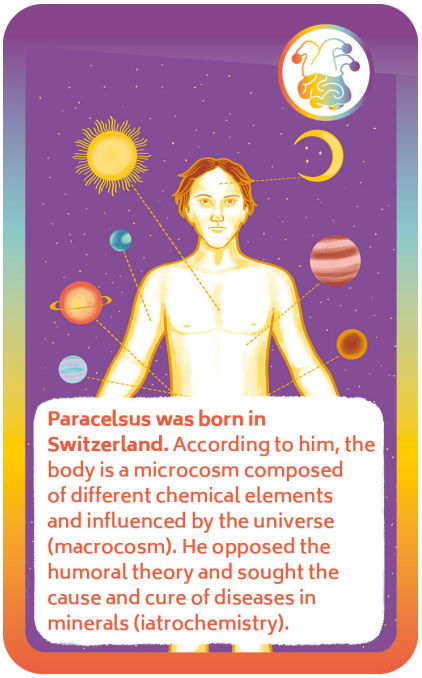

Paracelsus was born in Switzerland. According to him, the body is a microcosm composed of different chemical elements and influenced by the universe (macrocosm). He opposed the humoral theory and sought the cause and cure of diseases in minerals (iatrochemistry).

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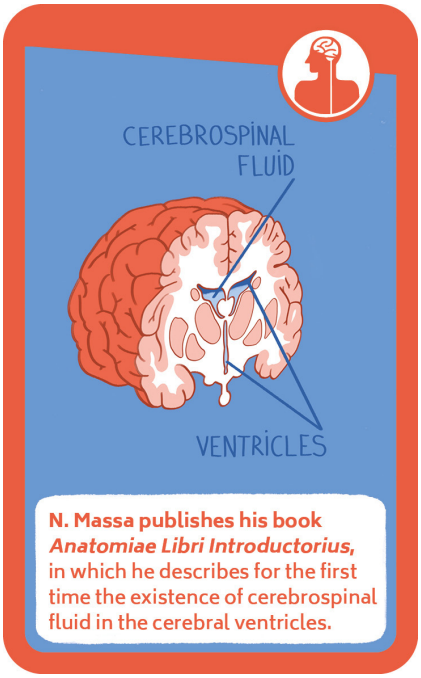

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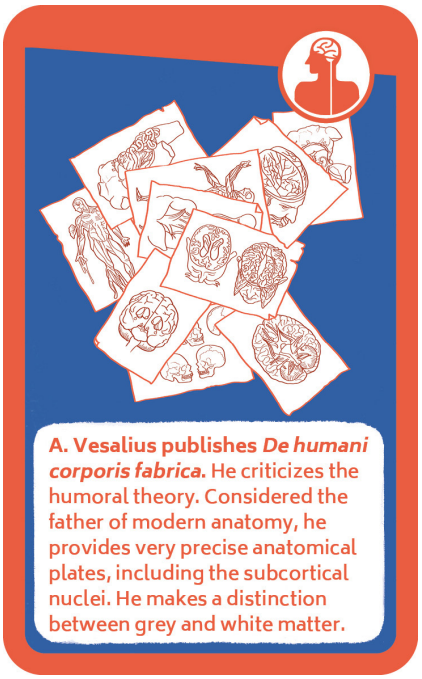

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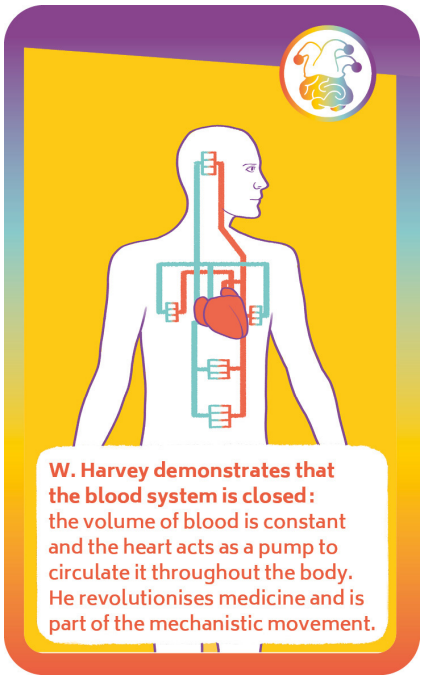
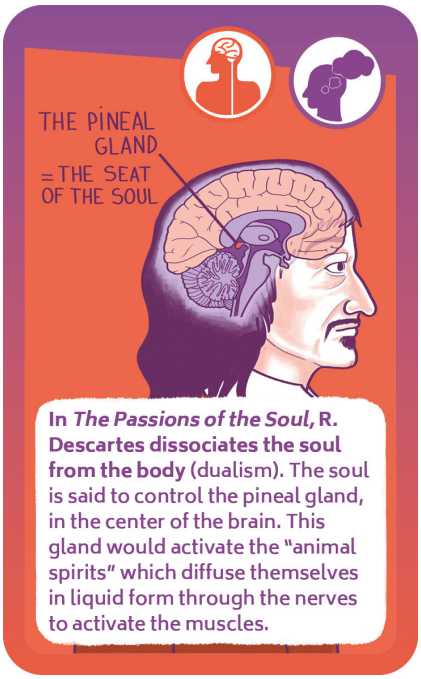
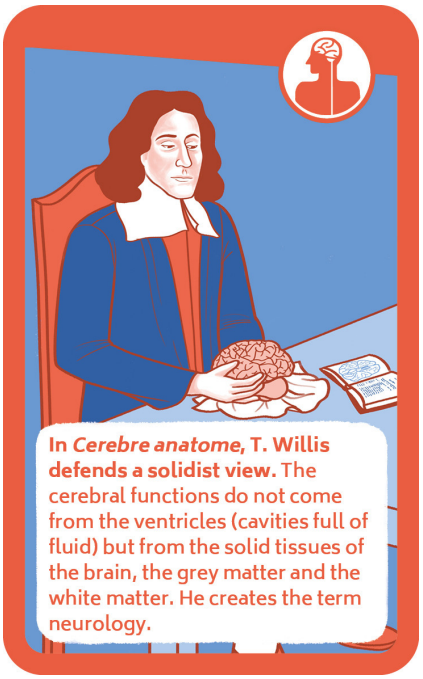


W. Harvey demonstrates that the blood system is closed: the volume of blood is constant and the heart acts as a pump to circulate it throughout the body. He revolutionises medicine and is part of the mechanistic movement.



In *The Passions of the Soul*, R. Descartes dissociates the soul from the body (dualism). The soul is said to control the pineal gland, in the center of the brain. This gland would activate the "animal spirits" which diffuse themselves in liquid form through the nerves to activate the muscles.



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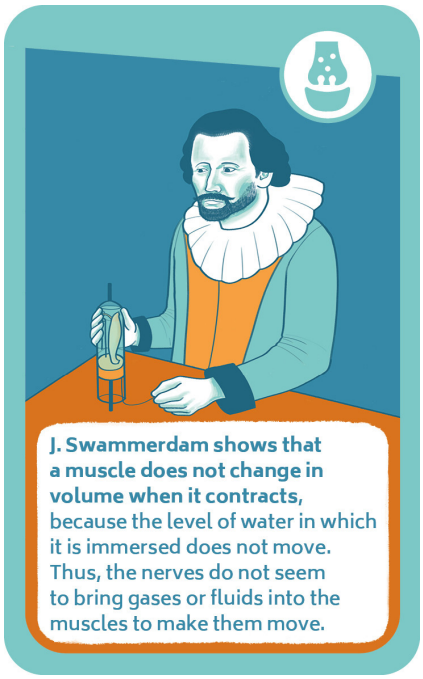

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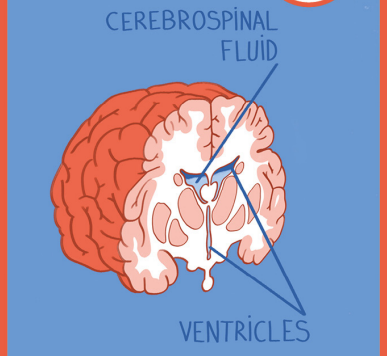

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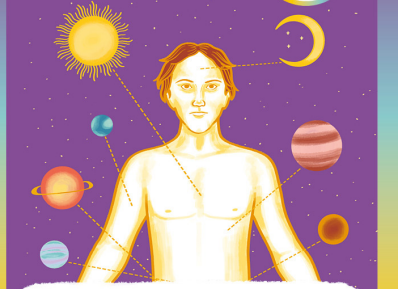

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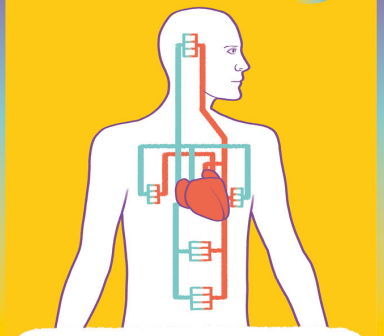

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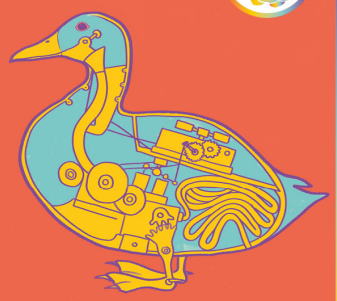
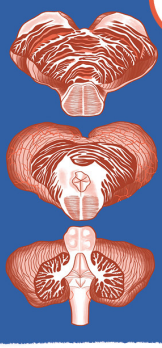


J. de Vaucanson invents an automaton duck, which behaves like a living duck and simulates digestion and defecation. Vaucanson's duck and other humanoid automata suggest that living things also rely on cause-and-effect mechanisms.

A. Morandi Manzolini becomes professor of anatomy at the University of Bologna. Thanks to numerous dissections, her wax sculptures are very precise and show elements as small as capillaries and nerves for the first time.

J. Walsh demonstrates that the torpedo produces electricity (to defend itself or to hunt). As the discharge from the fish causes a spark, it provides experimental proof that animal electricity exists.



F. Vicq d'Azyr publishes his *Treatise on anatomy and physiology*, in which he provides anatomical illustrations so precise that they are still relevant today. He describes the cerebral convolutions, names the gyri, and uses coronal sections.

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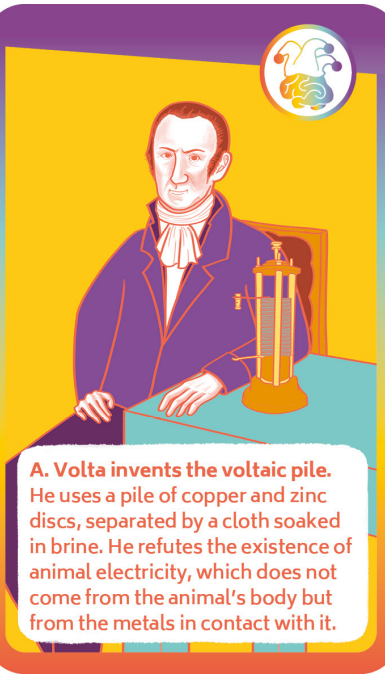
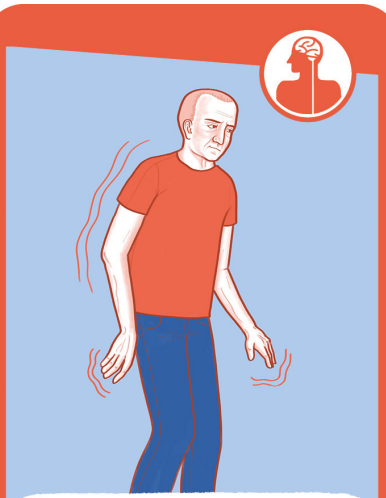
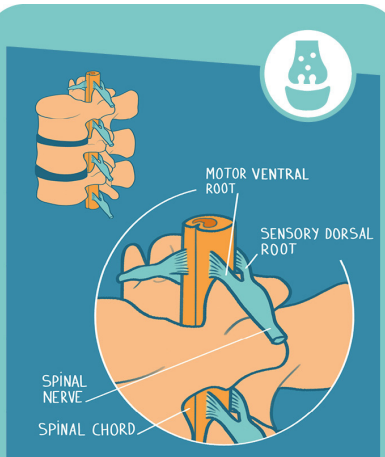


A. Volta invents the voltaic pile. He uses a pile of copper and zinc discs, separated by a cloth soaked in brine. He refutes the existence of animal electricity, which does not come from the animal's body but from the metals in contact with it.

J. Spurzheim calls the theory of his professor F. Gall phrenology. They locate different brain functions in different places in the brain. According to them, the shape of the skull follows the shape of the brain and reveals the characteristics of the person.



J. Parkinson describes the symptoms of what he calls shaky palsy, which is characterized by slowed movements, tremors and rigidity of the body.



F. Magendie shows the distinction between motor ventral roots and sensory dorsal roots of the spinal nerves, by clarifying C. Bell's discoveries. He founds physiology as an experimental science.

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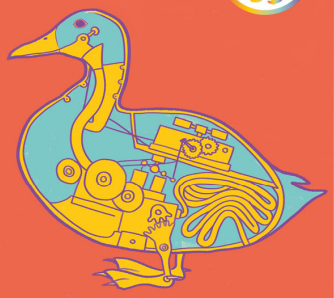

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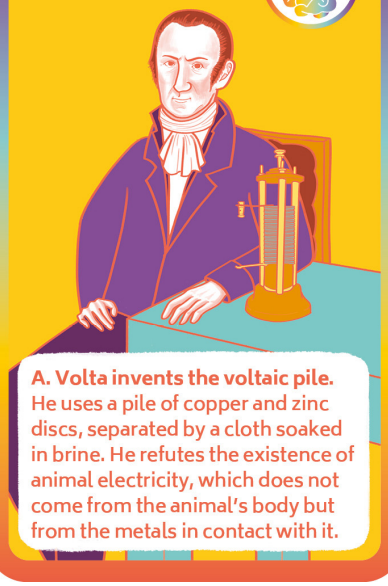

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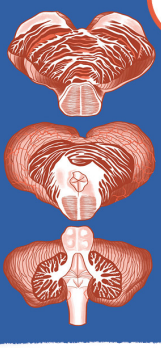

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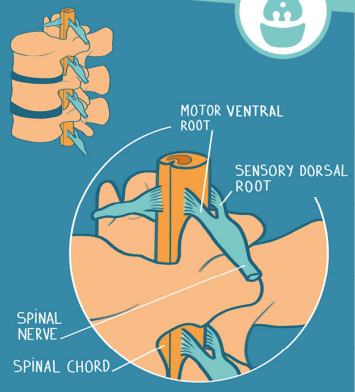

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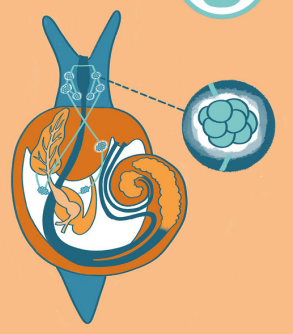

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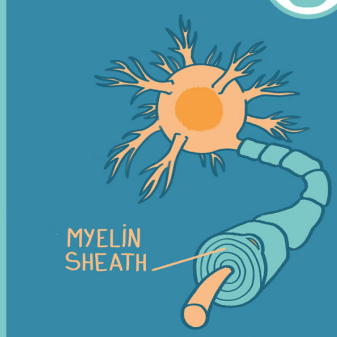

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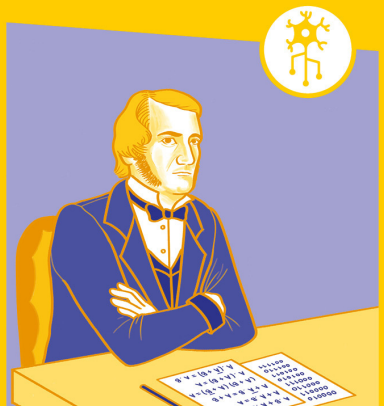

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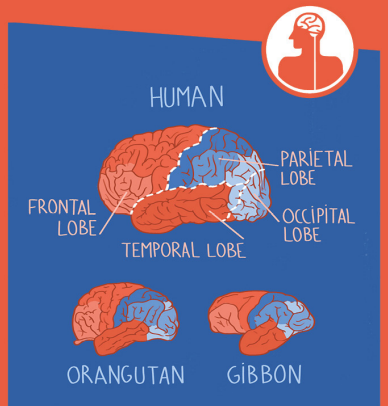

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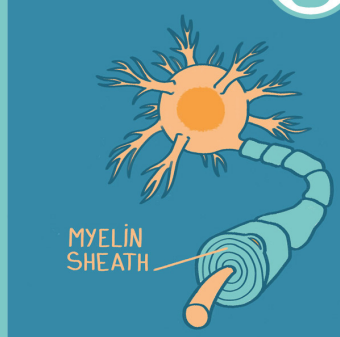

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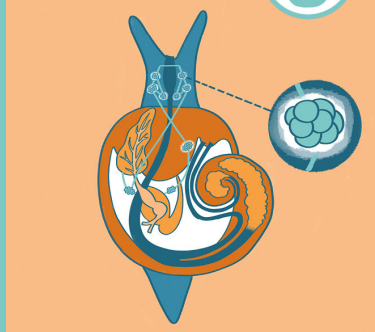

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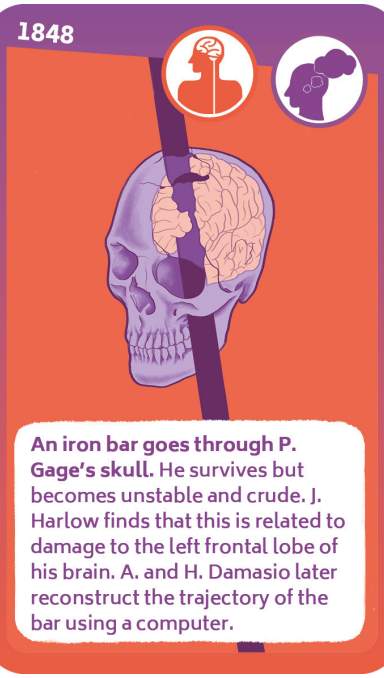

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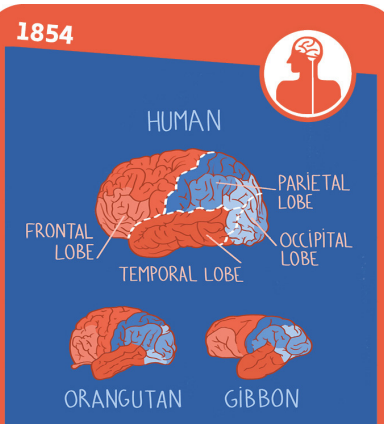

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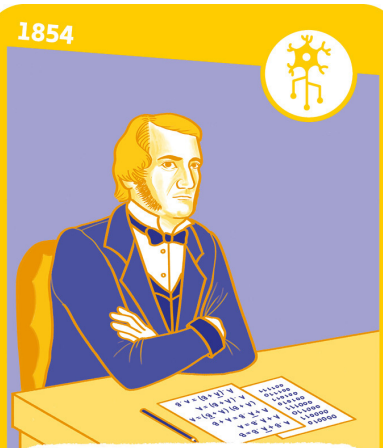

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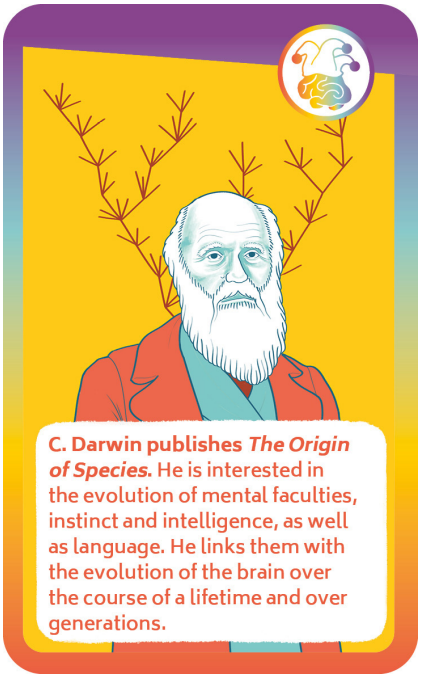

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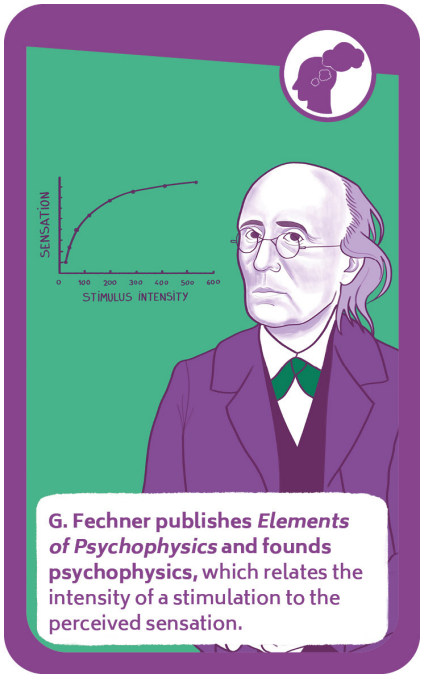

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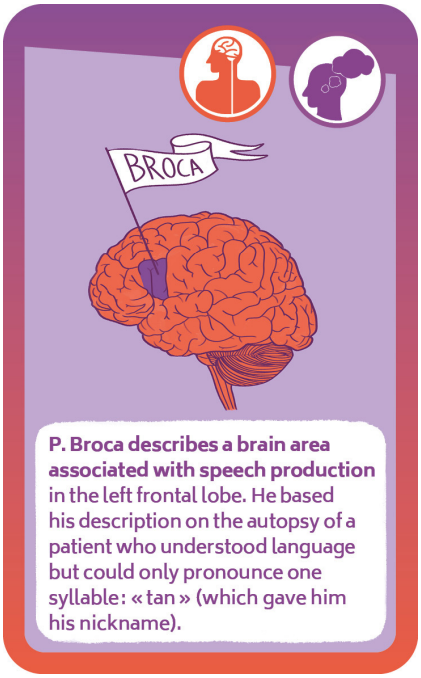

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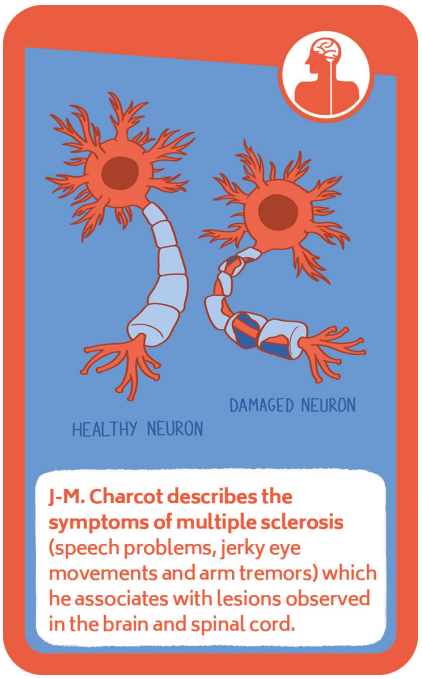

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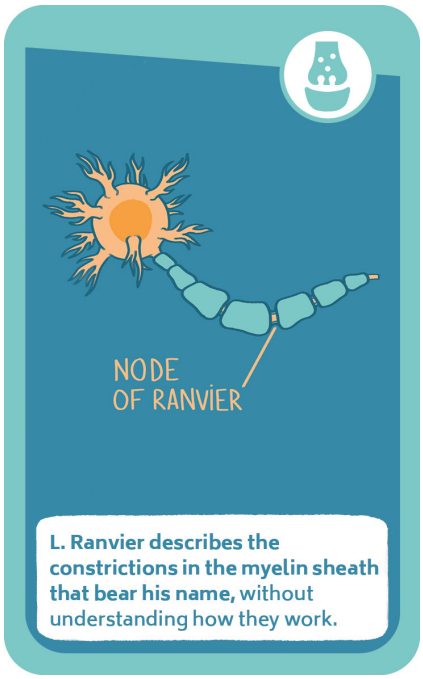

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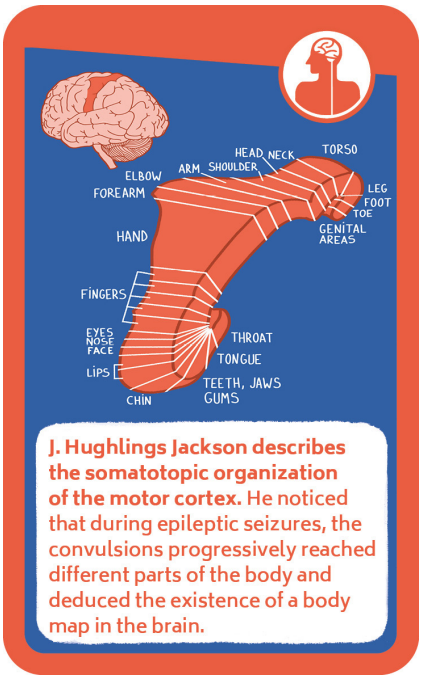

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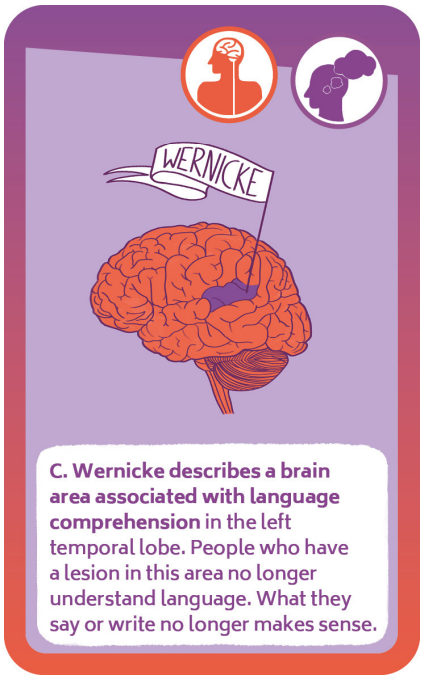

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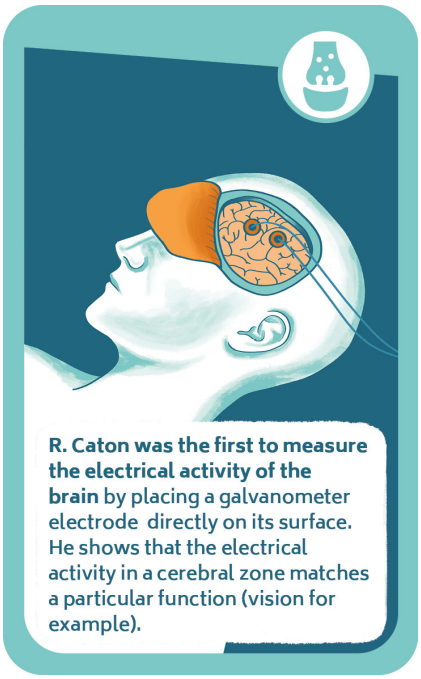

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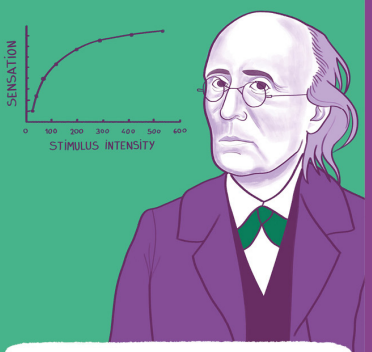

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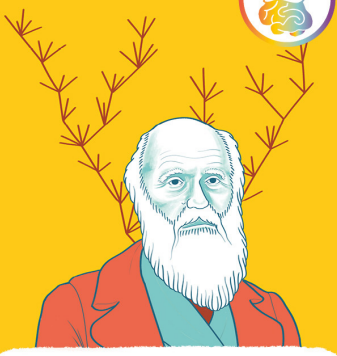

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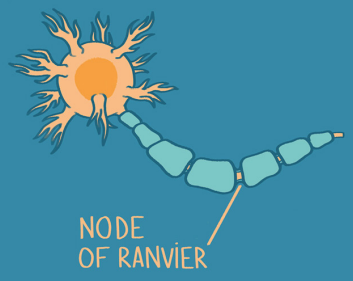

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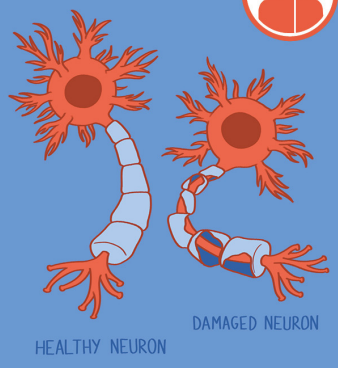

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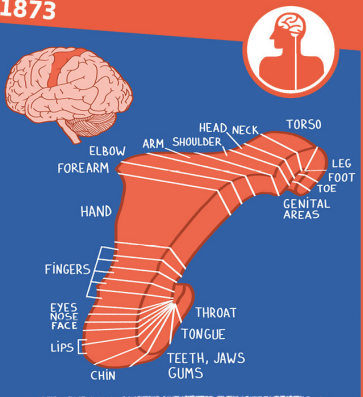

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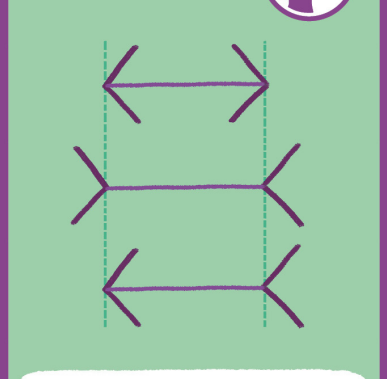

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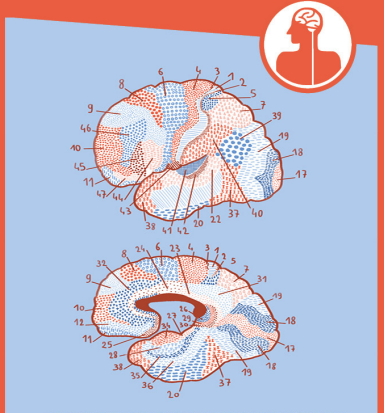

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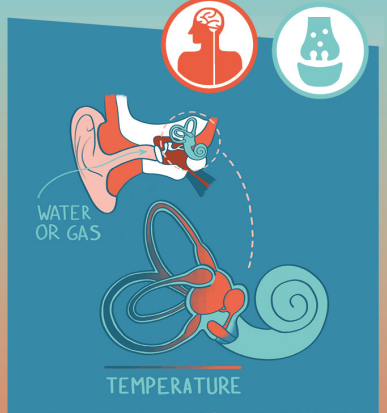

R. Bárány is awarded the Nobel Prize for his work on the physiology and pathology of the vestibular system, the organ of balance in the inner ear. He develops caloric vestibular stimulation to activate this organ artificially.

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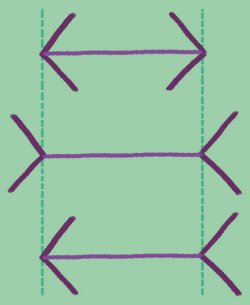

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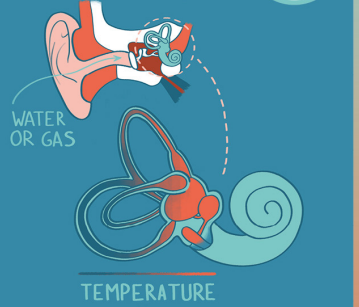

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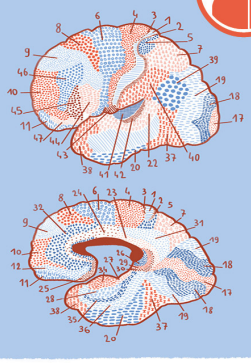

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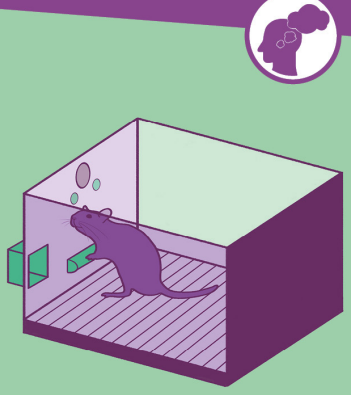

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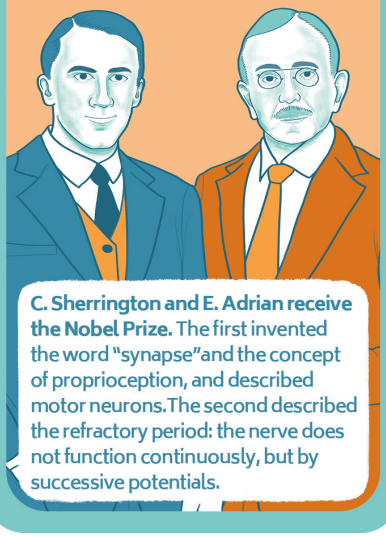

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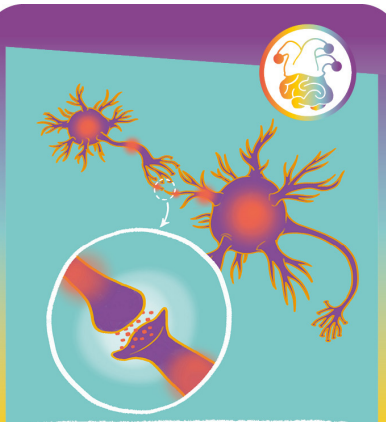

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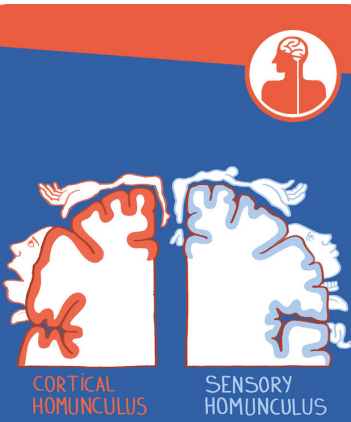

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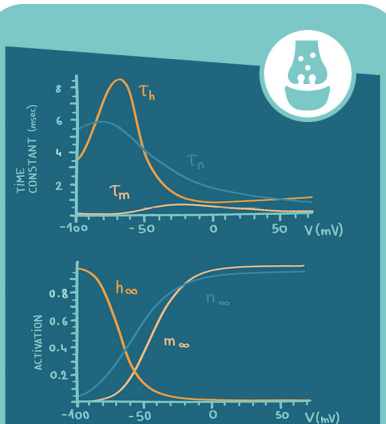

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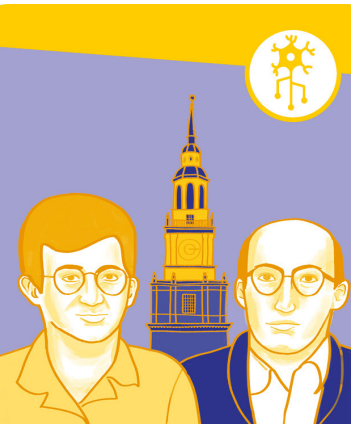

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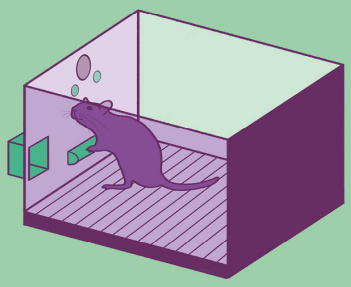

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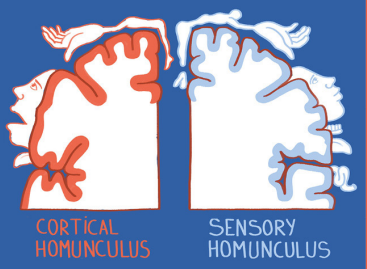

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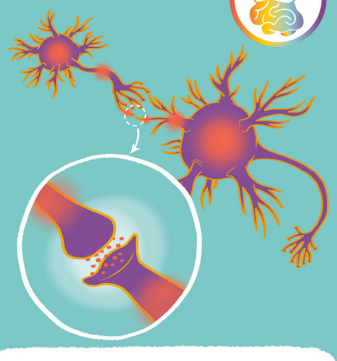

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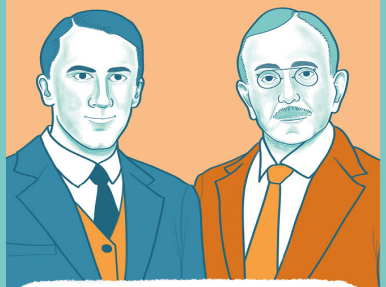

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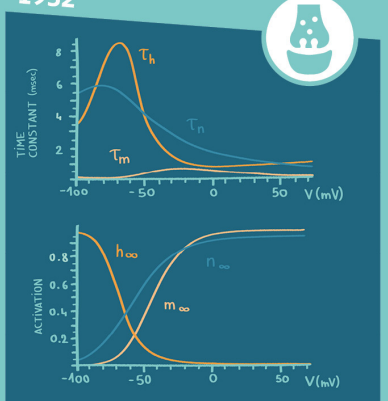
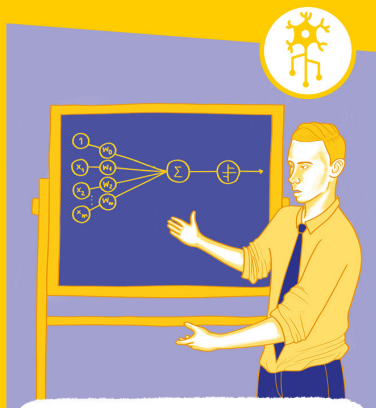


A. Hodgkin and A. Huxley develop equations that describe the creation and propagation of the action potential, through the dynamics of ion channels, in a giant squid axon. They were awarded the Nobel Prize for this model.

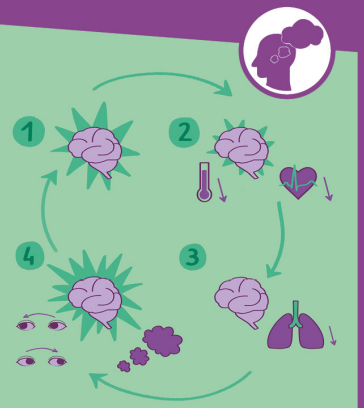
1950

A. Turing proposes a test of artificial intelligence: a machine could be considered intelligent if it manages to imitate human conversation, so as to make people believe that they are exchanging messages with another human being.

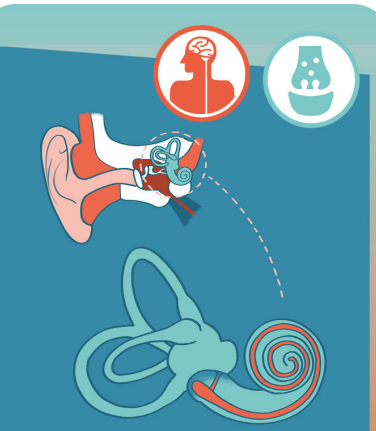
B. Milner publishes the first article on the H.M. patient with W. Scoville. Pioneering in cognitive neuropsychology, her studies reveal several memory systems. She shows the role of the medial temporal lobe (including the hippocampus) in long-term memory.



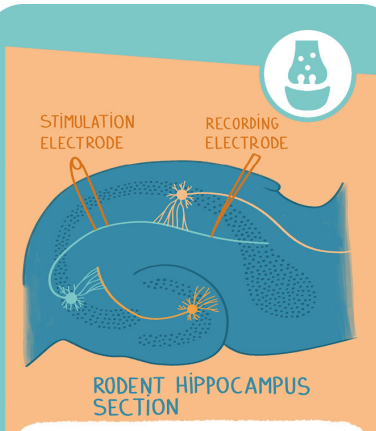
F. Rosenblatt invents the Perceptron, an algorithm considered to be the simplest artificial neural network, which learns to recognize the letters of the alphabet. This type of algorithm is the basis of the basis of machine learning.



M. Jouvet describes a new phase of sleep, REM sleep. During the phase, cortical brain activity resembles that of awakening and and numerous eye movements occur while the rest of the body is relaxed.



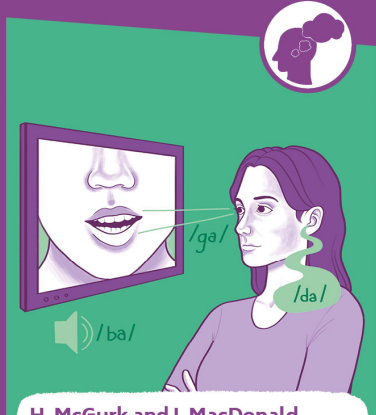
G. von Békésy wins the Nobel Prize for his work on the cochlea, the organ of hearing in the inner ear. He showed that the sound vibration propagates and that each wave has a given peak along the basilar membrane.



T. Lømo demonstrates the existence of long-term potentiation (LTP) by studying the hippocampus of rabbits in order to understand how short-term memory works. LTP is the strengthening of synapses between two neurons stimulated together.

T. Nagel proposes a thought experiment to highlight the problems of the objective and reductionist study of consciousness. According to him, a human being can imagine what it feels like to be a bat, but will never really know what it feels like.

The first AI winter is the first period of reduced funding and loss of interest in artificial intelligence. The field will undergo several such episodes, marked by criticism and distrust.



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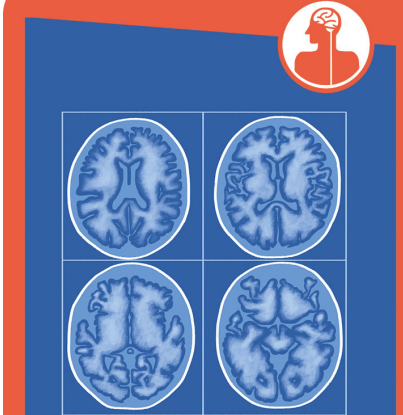
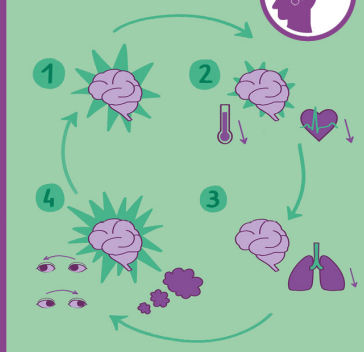


The first images of the human brain produced by magnetic resonance imaging (MRI) are obtained. This technique produces 2D and 3D images with a very good spatial resolution.

1959



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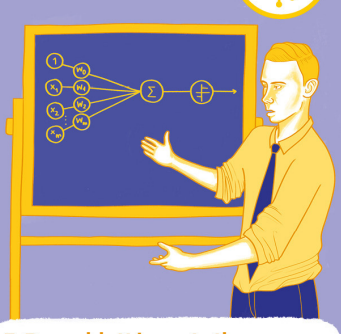

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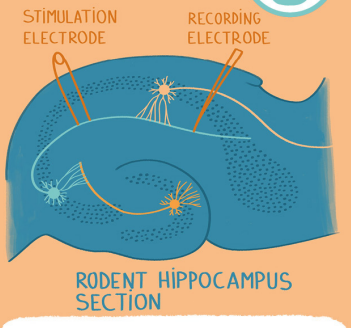

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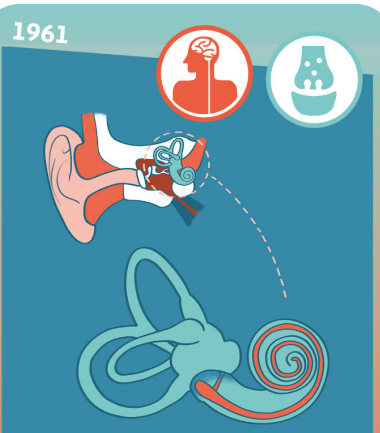

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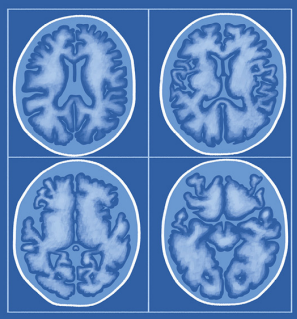

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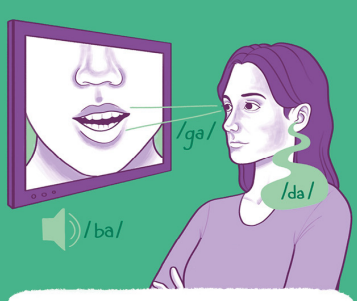

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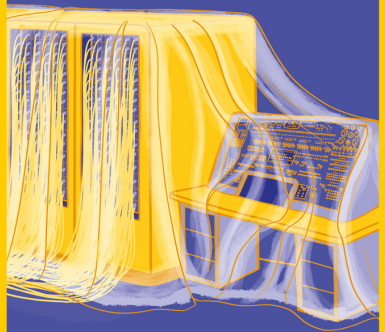

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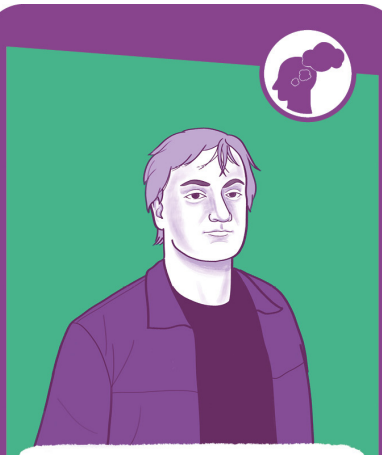

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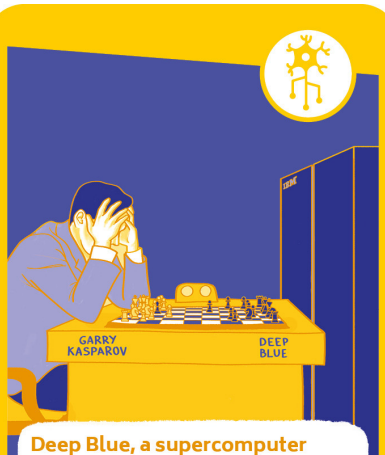

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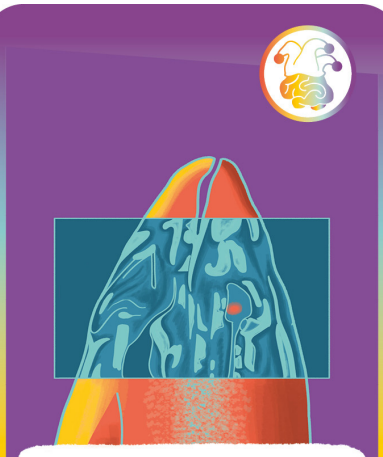

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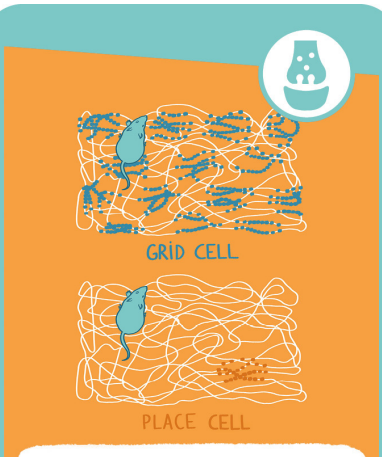

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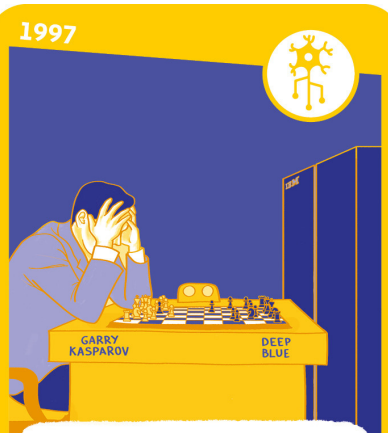

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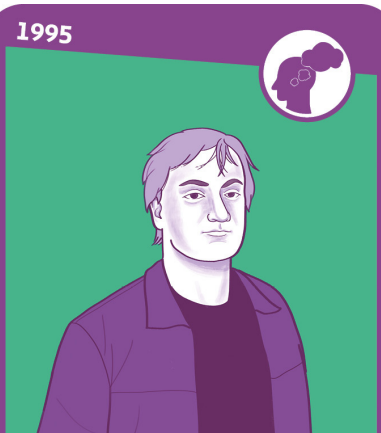

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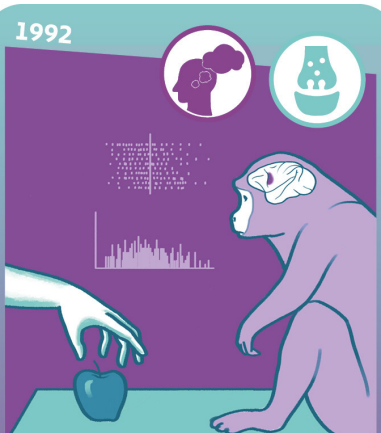

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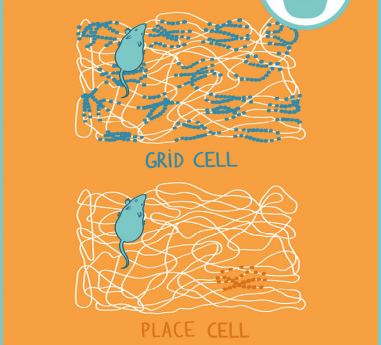
2014



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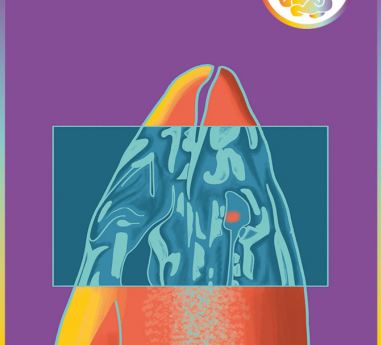

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