

Lesson Plan

NEUROHEADWAY

Neuroscience Into Education

Lesson Plan

- 1) Could you prepare a background picture for the first slide showing the main idea of the module; my suggestion would be a surface of the brain with glowing spots and lines between those spots that would represent activated neuronal webs, similar to the appearance of the Earth's surface from the space at night as shown below.
- 1) Artwork on slides 2, 3, and 4 was taken from the internet. Could you prepare our own illustrations having the same message?
- 2) Slide 4; A functioning of neural networks is illustrated with a postal system. This could also be presented in a form of an animated clip.
- 3) Slide 5; I would suggest we embed in the slide a link to an animation clip showing the experiment. Following the clip teachers will proceed with the explanation of the photomicrographs of the brain.

Description of the experiment: There are two cages with a mouse in it. First we show a cage in which a piece of cheese is added. In the first attempt a mouse carefully and slowly approaches the cheese and runs away into a shelter (a shelter is a box with a small entrance hole in it). In the second attempt the mouse slowly approaches the cheese and starts eating it.

Then we show a cage and a cat outside of the cage sitting. In the presence of the cat a mouse in the cage freezes for a while and then runs into a shelter. In the presence of the cat the mouse does not leave the shelter.

Lesson Plan: Behaviour Neuroscience

Methods: Finding Brain Regions for a Behaviour

Learning Objectives

Students will learn that:

- Brain functions, including behaviour, are regulated by specific neuronal webs that vary in total neuronal numbers,
- Neuroscientists are able to distinguish between neurons that are involved in a given brain function (e.g. behaviour) at a given time point and neurons that are not and properly tag active neurons, which is necessary to understand and characterize neuronal webs involved in a given brain function (e.g. behaviour).

Lesson

Introduction

Tell students they will learn about the functions of the brain, the way the brain operates to execute those functions, and the way neuroscientists do research to figure out places in the brain that execute a particular function.

Functions of the Brain/Slide 2/Teacher Modeling

- Tell students that the brain is one of the most complex organs in the human body responsible for practically everything we do and we are aware of.
- Proceed with the explanation of brain functions.
- For a brain function of receiving information from the environment ask students to use their senses, like touching things, etc., to demonstrate the idea of organism's interaction with an environment and receiving information from an environment.
- Ask students to recall a particular situation from the past to demonstrate a brain function of saving information or the memory.
- Ask students what would they do in a given situation to demonstrate a brain function of responding and reacting to received information.

Principles of Brain Functioning/Slides 3 — 5/Teacher Modeling

- Tell students that one of the most important tasks in neuroscience is to understand how the brain works — that is which neurons/parts of the brain operate in a given brain function and how the brain executes a given brain function.
- Tell students that the fundamental elements of the brain are called nerve cells or neurons, which have several shorter branch-like processes and one or few longer processes.
- Tell students that the structure of a neuron, that is its numerous processes, enable a neuron to connect with other neurons into neuronal webs.
- A neuronal web is a functional web-like structure consisted of numerous neurons that operate in a given brain function.
- Tell students that structure and function of neuronal webs could be illustrated with a postal system and service respectively. A neuron could be illustrated with the main

post office of a city, and a neuronal web with a postal system connecting different cities and countries.

- Tell students that individual brain functions are regulated by specific neuronal webs and not the entire brain. Illustrate this by the example that sending a letter to Norwich requires different postal routes than sending a letter to Paris.

- Tell students that the brain consists of many neurons and that neuroscientists do not know yet the functions of all neurons in the brain.

- Tell students that neurons that operate in a given brain function at a given time point are different from neurons that do not, and that neuroscientists know the differences and are able to colour such neurons so they can observe them under the microscope. Illustrate this by the example that when we hand in a shipment to a postal worker, the postal worker registers our shipment and take out a receipt so we are able to trace our shipment.

- Tell students that they will see a demonstration of a real experiment with laboratory mice in which neuroscientists wanted to find neurons in the mice brain that operate when mice seek a shelter and hide in the presence of a cat.

- Explain students the experiment.

- Proceed with the figure showing black dots (neurons) in the red circle in the mice brain.

- Tell students that only neurons that were operating at a given time point are shown as black dots.

- Tell students to pay attention on differences between the right and left figure of the mouse brain in the number of black dots that represent neurons that were operating in the presence or in the absence of a cat. The higher number of neurons in the red circle in the mouse brain in the presence of a cat than in the mouse brain in the absence of a cat indicates that those neurons were operating when a mouse was hiding in a shelter in the presence of a cat.

Activity/Maze Game/Slides 6 — 8/Guided Practice

- Explain students that they will solve a maze similar to what they saw in the experiment and what neuroscientists do when they study the function of neuronal webs in the brain.

- Explain students that by solving a maze they will find neurons that operate when a mouse finds cheese or a cat.

□ Instruct students to first solve both mazes and then guide students to answer the questions on the question sheet. All students should participate in answering the questions.

□ Pass out maze game worksheets. Explain students that each maze represents the mouse brain and the numbered circles in the maze represent neurons.

□ Explain students that a piece of cheese in the upper left corner of the game sheet indicates a situation in which a mouse finds cheese, and similarly, a cat head indicates a mouse in the presence of a cat.

□ Instruct students they have to solve a puzzle by finding neurons that lay on the way through the maze from the »START« to »FINISH« point. Instruct students that when solving a maze full lines should not be crossed.

□ Instruct students to paint the neurons that lay on the way through the maze.