

Lesson Plan

NEUROHEADWAY

Neuroscience Into Education

Concepts: therapy, general practitioner, medical doctor, medication, pharmacist

Background

Neurons are basic constituents of the central nervous system (CNS is consisting of the brain and spinal cord) and form large networks. Neurons are cells that are able to receive signals from other neurons, our inner organs, environment, etc. via chemical molecules, physical pressure, etc. These signals are important for our everyday life, since every reaction we make is a result of the activation of neurons through these signals within our central nervous system (while it is also possible to receive signals from within the CNS, it will not be discussed extensively in the class). After receiving such signals, neurons usually forward them to other cells which can be neurons, muscle cells, other cells, etc. and unleash typical behaviors within these target cells, which is in essence the response for a given stimulus. While neurons are the most basic elements of the brain, the brain also has a lot of regions. Usually these regions contain a subset of neurons and according to classic neuroscience, regions can be associated more or less with given functions. There are regions primarily responsible for hearing, seeing, memory formation, etc. However, reality often is that these functions are realized through the delicate cooperation of different regions. The latter will be partially mentioned in the animation video. Hereby, don't forget to note during the discussion of the video, that overactivation could also happen, for example: if too many children would be in a class.

Neurons are essential for us, since as stated above it is impossible to react to the changes in our environment without them. Sometimes, however, they do not function properly. There are basically two forms of damage to them, which can result in diseases. One is a loss of functional neurons or connections within the brain. If this occurs, some functions cannot be initiated or maintained, like we cannot remember things in Alzheimer's disease, cannot move or feel our hands and legs or other body parts after stroke. However, reality is often that these neurons interact with each other and impairments to some of them results in an overactivation to others (the consequences of such imbalance won't be extensively discussed during the class). For example in depression neurons responsible for emotional control are damaged, while neurons in those brain regions where negative emotionality resides are overactivated. Overactivation is the main abnormality in epilepsy, which results in convulsions. Of course, besides having neurons lost or overactive, connections between them can also be strengthened or weakened, with basically similar consequences. It is also important that

usually neuronal networks may compensate over- or underactivation of a certain number of neurons. This is because of the so called synaptic plasticity. Particular networks and neurons may participate in signal transmission which was not their task originally. There are also additional capacities in networks, thereby, losses can be also compensated. In such stadium of disease sensitive diagnostic methods aimed to test particular functions could detect abnormalities. It would be important to discover diseases in this stadium, because therapies would be usually more effective. However, above a certain threshold functional impairments become obvious and a manifest disease will be diagnosed.

The above concept can be translated into the therapy. Drugs are major participants in most current therapeutic approaches. Drugs should be applied only in a way prescribed. Oral drug preparations cannot be applied in any other form or in any other dose. Despite information in the leaflets, most patients do not apply medicines correctly. In fact, approximately 60% of patients do not take their medications as prescribed, or do not take them at all. It is important that patients have the right to choose their therapy, therefore, it is unnecessary to fool doctors with therapy compliance, they would only be fooling themselves. Therapy failures and side effects are often related to such deviances. This is because there is a therapeutic blood concentration range for every medication. Within this usually delicate range efficacy already occurs, with minimal chances for side effects. Below this range inefficacy, above this range side effects can take place. Every dose left out or every dose applied to early may result in such effects. There is also a chance for unintended failure, however. There are medications which may interact with certain types of food or other medications.

Currently, lifestyle interventions are gaining ground as possible means to prevent and treat diseases in addition to drugs. Medications are easier to use, because they do not require such commitment, but they are usually not free of complications. A common slogan among pharmacologists remains: "A medication that works has side effects." In contrast, lifestyle interventions are usually free of these or they occur only limitedly. A healthy lifestyle includes a healthy diet, composed of complex carbohydrates, proteins from healthy sources and a low amount fat. While several extreme diets exist in the literature, none of these extremes showed evidences for better health outcomes. As an overall rule: a balanced diet containing various foods in normal quantities are the best way. Among these foods fruits, vegetables, whole grains and legumes should definitely be included. Active physical exercise is another important aspect. It has been shown to enhance cognitive functions and reduced the chance of diabetes, cancer, cardiovascular diseases, stroke, depression, high blood pressure, overweight, osteoporosis, among others. For children at least 60 minutes moderate or vigorous physical activity per day is recommended with additional gains for additional time above the 60 minutes. For

adults (including above 65 years) 150 minutes moderate or 75 minutes of vigorous training are minimum per week, however, the double that amount is recommended. Patients with diseases are no exception only if diseases manifest in mobility problems (thus, age, diabetes or high blood pressure are absolutely no contraindications). Recently, stress reduction or even psychotherapy became also important. These can be considered for the mind and soul, what physical exercise represents for the body, an activity for the balance of our personal life. Therefore, there shouldn't be stigmas attached to such, especially psychotherapy. There are more time-consuming and less time-consuming approaches. For example progressive muscle relaxation is a less time-consuming approach for stress reduction and can be played with children on another occasion. Several youtube videos help with the latter.

During the class the following concepts are to be understood by the pupils:

Therapy: treatment intended to relieve or heal a disorder. It can contain both medications and lifestyle changes. There are multiple forms of therapy. Usually, we may think about medicines as a form of therapy, however, very often therapy contains lifestyle changes or consist entirely of them. Some diseases that can be treated with lifestyle changes as therapy in earlier stages: type 2 diabetes, mild depression, mild anxiety, or high blood pressure.

GP: general practitioner, a doctor who treats patients with illnesses. Illnesses can be of different severity. More serious illnesses usually have more serious symptoms, while mild illness has mild symptoms. Teacher may ask children to mention mild and serious diseases. Usually, if somebody's overall vital attention is upheld, it is a mild disease. If somebody's overall vital attention is not upheld, there is a chance for a serious disease. Vital attention is the attention exerted towards everyday tasks and happenings, symptoms that may indicate a lack of such attention are: doesn't care about things going around her/him, cannot listen to others, don't know basic information about the environment, what date it is, etc.

Medication: drug or other form of medicine that is used to treat a disease. In this regard any substance (incl. placebo) could be considered as a medication/medicine if it is able to alleviate symptoms of disease or heal disease itself.

Pharmacist: a person who prepares medicines and helps to use them correctly. Pharmacists are more than simple "cookers" of medicines, they are also highly qualified members of healthcare staff, besides medical doctors, they may also be asked to help in case of medical need.

Lifestyle: the way in which a person lives. Examples: eating, sport, sleep, stress, etc., find detailed description above.

The first sentence at the following words is always the definition, please, try to explain every unknown word in these definitions to the pupils. Additional information is given to provide an overview about focuses to be emphasized. Always try to use words and expressions understandable for the pupils.

Postman game description:

1. Show slide 1.
2. Ask each pupil to form groups of 8 and stand up in a circle, make clear: they are very-very small cells from their brain, the neurons, whose task is to transmit messages to each other from the environment (teacher) to our body parts (last neuron).
3. Indicate who will be the first neuron and who will be the last.
4. Let pupils choose whom they want to transmit the message from the group, except the last neuron (they cannot transmit backwards), make clear, they can only give the message to the chosen pupil, nobody else.
5. Then whisper to one of the pupil in each group a word or expression from the definitions of this part (e.g. therapy, general practitioner, etc.)
6. Ask the pupils to whisper the received word along the line (the pupils are not allowed to whisper backward), make clear, they can repeat the word only once
7. Ask the last pupil receiver to write down the word (probably it won't match the original)
8. Repeat the game once more with another expression.
9. Now exclude a pupil from the circle, make clear, she/he became sick and cannot participate, but also make clear, no changes to the order of transmission can be made
10. Whisper the next definition. (The message cannot reach the last one)
11. Ask the last pupil receiver to write down the word (probably it won't match the original)
12. Now ask the excluded child to step back, because she/he recovered.
13. Now ask the children to yell random words except those currently whispering the chosen word transmitted from the teacher.
14. Ask the last pupil receiver to write down the word (probably it won't match the original)
15. Discuss what did happen in the last two rounds, when somebody was missing or the others were yelling.

16. Emphasize the connection between messages within the brain and the pupils. Emphasize that if such messages do not reach intact the last pupil in the group (or the last neuron), then it is similar to what happens in our brain when we have a CNS disorder. Make clear, that therapy tries to make these connections function again

Game 1.

1. Create 5 groups from the children.
2. Present the definitions on the slides one-by-one.
3. Use the definition on the slides. First explain them, what they see and bring examples to make it more personal. (1 minute)
4. Play with each definition a game from the following (2 minutes), make clear, pupils should remember it, because they will be needed later:
 - a. Pupils can write down only 3 words from the definition, which help them to remember
 - b. Pupils can draw something that helps them to remember the definitions (they cannot use letters on the drawings)
 - c. Pupils in a group separate the definition by words and everybody has to remember only her/his part
5. For points 3 and 4 together give 3 minutes at each definition.
6. After all the definitions were shown, Draw on the board the slide that is divided into 5 parts (slide 8., in the middle is therapy)
7. Assign each group to a given part. Let them write down what they know about it (definition and also examples). It can be made at the table or if too small, use crayons on the floor.
8. Ask the groups to shortly present what they wrote down to their parts and what examples, other knowledge about the given part could they find.

Game 2.

1. Let groups from the previous game (observational game) reflect to the learnt parts.
2. Ask them to create a drawing about neurons, disease and therapy of the disease.
3. If the pupils are too young use slide 9. as direction, but apart of that let them draw freely. However, try to help the drawings in the groups to ensure they understood each part correctly.