Student's Learning Activities (Eijkman and Beri-Beri)

Activity 1

You will watch a video with narration or listen to a story from your teacher for Christian Eijkman and his researches about the disease beri-beri. Please write the most important points of the story according to your view and discuss them in your group. (Indicative important points: the description of Eijkman's experiments, Eijkman's initial view about the disease beri-beri and the reason which had affected him for this explanation, …..)

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Education and Culture DG
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Activity 2

At the following link you can find the description of Eijkman's experiment with the chicken during his research for the cause of the beri beri disease.

(http://www.nobelprize.org/educational/medicine/vitamin_b1/eijkman.html).
The description of the experiment is as follows:

During the first years of Eijkman's work at the institute in Java, two of his colleagues managed to extract micro-organisms from people who had died from beriberi. When they returned to Europe they left Eijkman behind as the institute's director.

Eijkman tried to infect rabbits and monkeys with the micro-organisms. However, the animals didn't get sick. Eijkman concluded that beriberi must be a disease which took a long time to develop. To wait a very long time, until the rabbits or monkeys showed signs of beriberi, wouldn't work. He needed animals which developed the disease more quickly. It would also be good if they were cheap and easy to maintain.

Eijkman bought chickens and housed them in large cages in the shadow under the institute's extended roof. He injected some of the chicken with the micro-organisms. After less than a month, all chickens got sick.
Eijkman thought that the chickens which he had injected with micro-organisms had infected the ones without injections.

Question 1. Based on the narration you have followed, what did push Eijkman to this conclusion?

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He bought new chickens and kept them, one by one, in smaller cages. But these chickens also got sick. Eijkman realized that the whole institute must be infected and decided to keep new chickens at another location.

Question 2. What did lead Eijkman to this hypothesis?

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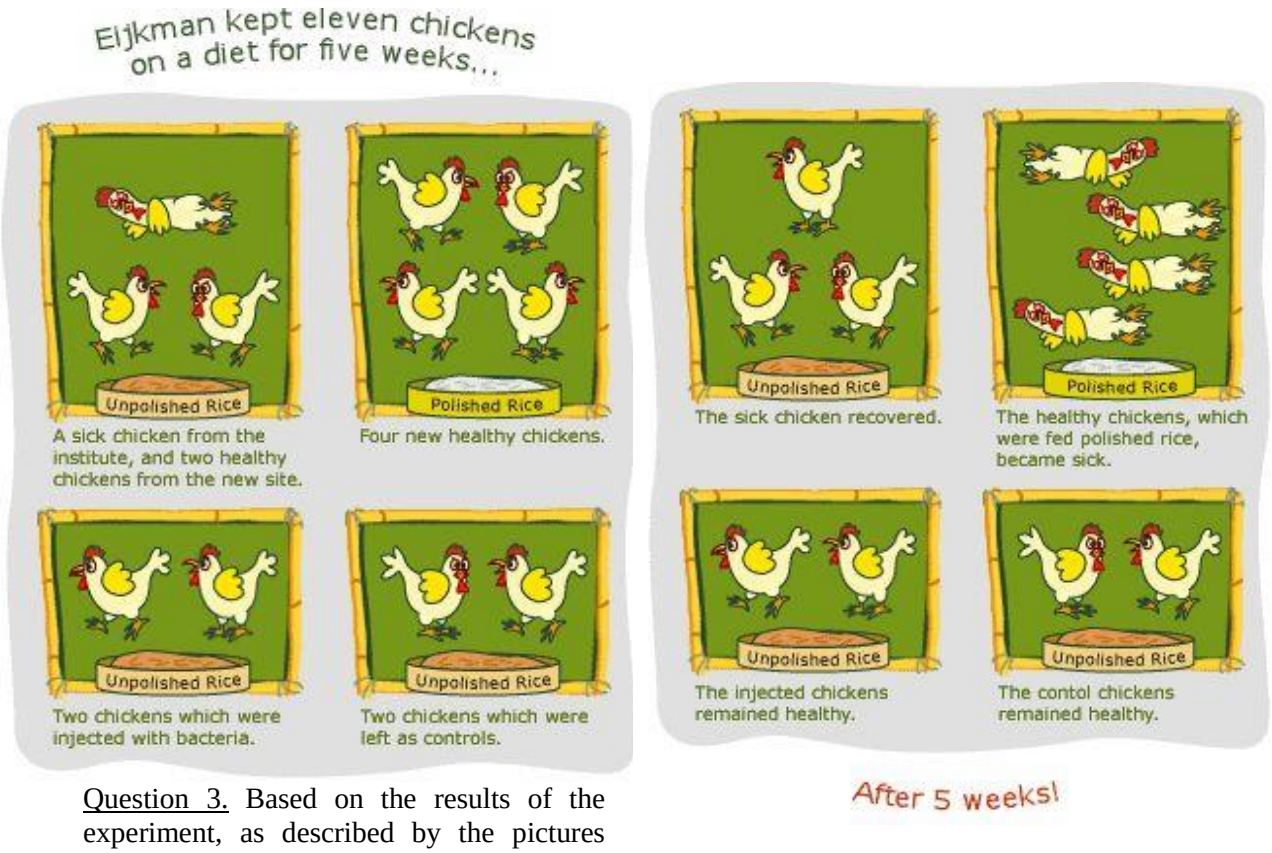
But when he did this, all the chickens got well. Eijkman couldn't understand what was happening. He hadn't done anything to cure them!
The man who fed the chickens told Eijkman that he had given them cooked white rice during the period they got sick. It was leftover rice from the next-door hospital. Later, a new cook there didn't want to give him left over rice and he had gone back to feeding them with unpolished uncooked rice. It was after this that the chickens had recovered.
When Eijkman understood that the disease had something to do with the diet, he decided to make trials. He did something like this...

Picture 1: Beggining of the experiment

Picture 21: 5 weeks after



Question 3. Based on the results of the experiment, as described by the pictures above, what are the conclusions you can draw?

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Question 4. Discuss about your conclusions with the other members of your group. Write down the common points and present them in class.

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Question 5. Eijkman has been awarded with a Nobel Prize for his research on the beri - beri disease. Discuss about the Nobel Prize. Please refer to other scientists you know that have been awarded with the Nobel Prize and write down two of them.

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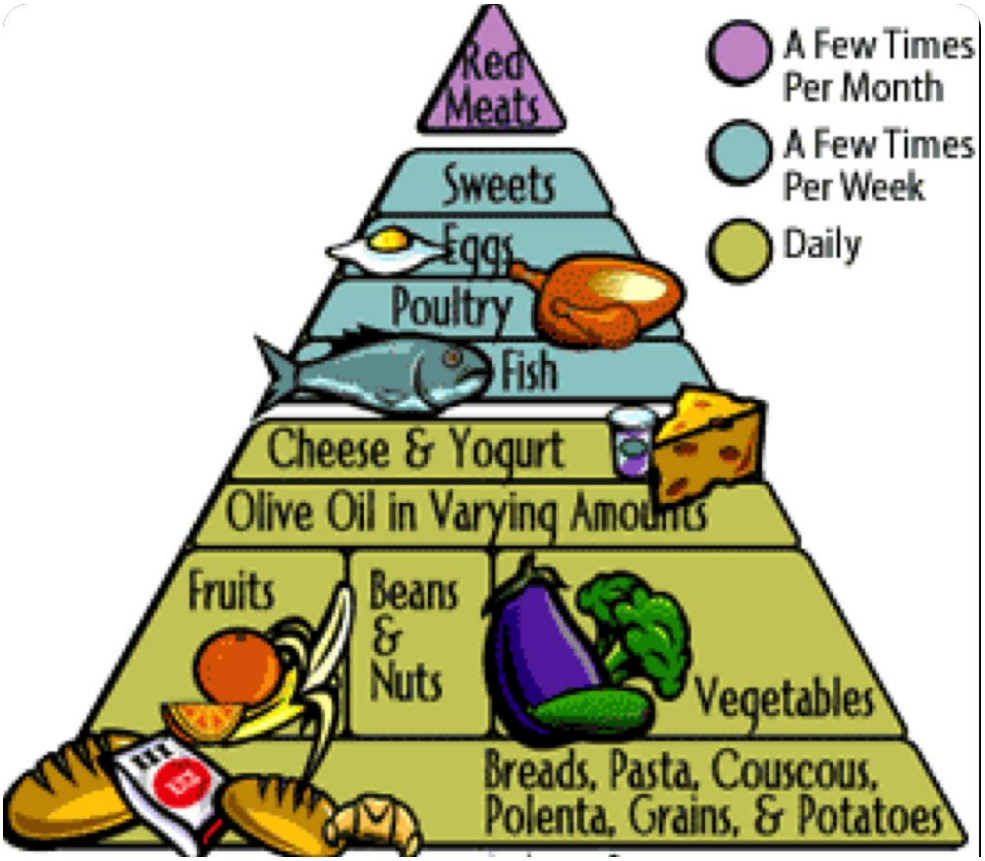
Activity 3

At the figure bellow you can find the Mediterranean diet pyramid and then a table for vitamins.



Picture 2: Mediterranean diet pyramid
(Source: Oldways Preservation & Exchange Trust and The Harvard School.)

Table 1: Information about vitamins

Vitamin	Function	Deficiency symptoms	Natural sources
A	Plays a role in the functions of the skin, night vision.	Impaired night vision, skin problems.	Liver, eggs, dairy products, carrots
D	Plays a role in the well-being of bones, teeth and joints, and calcium and phosphate metabolism.	In children, rickets; in adults, osteomalacia.	The sun, oily fish, dairy products, margarines and spreads, eggs.
E	Prevents the oxidation of fatty acids; protects cells.	neuromuscular problems, peripheral nerve damage, muscular weakness, retinopathy, dementia, anaemia.	Vegetable oil, nuts, almonds, fatty fish, whole grains, egg yolk.
B1 or thiamine	Helps to convert food into energy; an important part of metabolism and nerve and muscle function.	Fatigue, nerve pain, walking problems, loss of appetite, constipation, muscle weakness, memory loss, disorientation, depression. Long-term deficiency can lead to the beriberi disease or heart failure.	Meat, offal, whole grains, vegetables, eggs yolk, pulses.
C or ascorbic acid	Prevents oxidation in the metabolism of connective tissue, regulates immunity, skin function and collagen synthesis and improves iron absorption.	Decreased immunity, problems in mucous membrane function, scurvy.	Citrus fruit, berries, vegetables, potato.
K	Necessary for blood	bleeding disorders, osteoporosis and	Green vegetables,

	coagulation and for the prevention of vascular calcification and bone health	vascular calcification.	such as broccoli, spinach, cabbage, cucumber, kidney, eggs, liver, cheese.

Question 1. Based on the data above, do you consider that the Mediterranean diet is sufficient to prevent vitamin deficiency or the emergence of diseases such as beri-beri?

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According to what is known from History:
"During the period that followed the discovery of the continent of America and Australia sailors would travel for months without having the possibility to consume fresh fruits or vegetables. This resulted in the appearance of scurvy, which would decline and disappear as soon as the sailors arrived on land and put back to their diet fruits and fresh vegetables.
Moreover beri-beri disease appeared in Ejkman's experimental animals after a period of time during which they had been fed with milled rice and the disease resolved when they reverted to their diet with paddy rice."

In addition modern research has shown that:

Vitamins are compounds found in food which are necessary for the normal metabolic functions of the body. The body is either unable to compose them, or does not compose them at the necessary quantities. Vitamins are divided into the fat-soluble (A, D, E, K) which are stored in the body, and the water-soluble (B, C) which are used by the body but their remnants are excreted. All vitamins are fairly well absorbed, while toxicity risk occurs mainly by excessive intake of the fat-soluble vitamins.
Water soluble: the ones that dissolve in water, e.g. present in fruit juices
Fat soluble: the ones which are dissolved in non-aqueous solvents and the animal organisms store them mainly in their adipose tissue.

Based on the texts above, give a full and well documented response to the following question:

Question 2. Why do these two vitamin deficiencies (scurvy and beri-beri) occur and not others that would be due to lack of vitamins A, D, E and K;

Discuss it in your group, write down and present a full and well documented response.

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Activity 4

Using the list of ideas that describe the characteristics of science and the ways it develops, try to locate and write these ideas in the story you heard and the activities of this lesson. These ideas that scientists call Nature of Science (Nature Of Science-NOS-) are:
Characteristics of Nature of Science (NOS)

1. Science demands and relies on empirical evidence.
2. Knowledge production in science includes many common features and shared habits of mind.
3. Scientific knowledge is tentative but durable.
4. Laws and theories are related but distinct kinds of scientific knowledge.
5. Science is a highly creative endeavor.
6. Science has a subjective element.
7. There are historical, cultural, and social influences on science.
8. Science and technology impact each other, but they are not the same.
9. Science and its methods cannot answer all questions.

Scientists argue that in order to learn science one must first understand what exactly science is. Because it is difficult to define science, scientists give a list of its characteristics.

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