

Science education workshops on DNA

The workshops are divided in four different activities:

- Can you tell me where I can find DNA?
- Making DNA tangible: DNA extraction from kiwi
- Measuring DNA size
- The DNA compaction challenge

This document describes the activities and the materials you need to prepare. Because some of our images are not free of rights, we cannot show them on the wiki.

Can you tell me where I can find DNA?

DNA is present in the cells of all living things. Everything, really? Can you identify where it's hiding? Will you be able to extract it (and leave with it!)?

- ➔ **Activity:** Among the different pictures representing animals, cars, vegetables, bacteria, stones, plants, find which ones contain DNA.
- ➔ **Materials to prepare:**
 - Quiz sheet with 8 photos each labelled from A to G
 - Answer sheet with the same photos and the highlighted right answers
- ➔ **How to interact with the public?** The exercise is usually simple enough for people and is a great way to start the interaction leading to the next workshops

Making DNA tangible : DNA extraction from kiwi

DNA is present in kiwis too. Will you be able to extract it (and leave with it!)?

- ➔ **Activity:** hand-on activity, guide the people in the protocol for DNA extraction
- ➔ **Materials to prepare:**
 - Kiwi (if possible overripe)
 - Zip lock freeze bags
 - Dishwashing liquid (without coloring agent !!!)
 - Table salt
 - Spoons
 - Glasses
 - Surgical gauze (cheesecloth works too)
 - Funnel
 - Test tubes
 - Cold ethanol 100 %
 - Skewer pic
 - Extraction solution: mix 45 mL of water with 1 teaspoon dishwashing liquid and 1 g of salt; mix without making bubbles
 - Two laminated print-outs of the protocol preferably in size A3 and some free

Making DNA tangible (continued)

- Step-by-step protocol (include illustrations to make it easier to comprehend):
1. Peel $\frac{1}{2}$ kiwi and remove the white heart
 2. Place the $\frac{1}{2}$ kiwi in a zip lock freeze bag and crush it completely
 3. Prepare the extraction solution (-> solubilizes cell and nuclear membranes)
 4. Add 2 teaspoons of this extraction solution (aka Magical liquid for children) in the zip bag
 5. Close the bag, mix/knead the crushed kiwi fruit.
 6. Filter the green liquid through a gauze and transfer the purified liquid in a test tube
 7. Gently add a layer of cold ethanol (another magical liquid) in this tube. Do not mix and let the solution stand. (EtOH has a lower density than kiwi mixture and like DNA is very low, DNA will be in EtOH)
 8. From the very first minutes, watch for the appearance of a white precipitate, this is DNA*.
 9. Using a wooden skewer, recover the precipitate and put it in a tube containing cold alcohol

*Advice : if there is a big crowd at the workshop, to avoid a long wait prepare in advance one tube with the DNA precipitate in alcohol,

DNA SIZE MEASUREMENT WORKSHOP

How is DNA measured?

DNA is very long and its length is different for each organism. In your opinion, who has the longest DNA?

- The bacterium *Lactococcus lactis*, which is used to make yoghurt? **0.001 meter**
- Wheat? **10 meters!!**
- The kiwi fruit? **0.25 meter**
- The fruit fly *Drosophila melanogaster*? **0.01 meter**
- Humans? **2 meters!**

- Activity: Match the different organisms shown on a picture, with the length of their DNA.
- Materials to prepare:
- Quiz sheet with, on one side, 5 photos or silhouettes each labelled from A to E with bacteria, wheat, kiwi, *Drosophila*, a human and, on the other side, the suggested sizes labelled 1 to 5
 - Answer sheet with the same photos and the highlighted right answers
- On this workshop, you ask this question about the length of DNA in different organisms. Then, public can understand the DNA compaction challenge.

DNA COMPACTION CHALLENGE

The two strands of DNA can be separated to read the genetic information or condensed to the most compact organization as a chromosome.

Come and discover the different representations and compactions of DNA, from the atom to the chromosome, and find out how to make a DNA molecule fit into a cell.

- ➔ **Activity:** Use a yarn ball and unwind it to image DNA compaction. Challenge the public to find the best way to compact it so it could fit into a tennis ball. Remind people that the DNA should be able to easily unwind in certain places “so the genetic code can become accessible”, all the while preventing knots... Depending on the public you can show wool threads that twist and name the plectonemes that are formed
- ➔ **Materials to prepare:**
 - Wool yarn ball
 - 2 tennis balls
 - Images/poster of DNA structure and the different stages of compaction with histones, nucleosomes and chromosomes. DNA supercoils