**Schule, Abteilung:** HBLA Sitzenberg, **Jahrgang:** III. Jg.

**Lehrer/in:** DI Nina Maurer

**Gegenstand:** Chemie Labor

**Thema:** DNA-Isolation

|  |  |
| --- | --- |
| **Activity type/s** | 1. Work sheet; the teacher reads the text and the students have to write down the verbs. 2. Fill in the verbs in the gap text 3. Put the working steps into the correct order. 4. Perform the DNA-isolation and make a video of this activity. |
| **Classroom**  **format** | 12 students  The students work in pairs |
| **Time** | 3 to 4 lessons of 50 minutes |
| **Procedure** | 1. The teacher reads out the text twice and the students listen and write down the verbs. 2. Now hand out the work sheets. 3. The students get into pairs and fill in the verbs in the gap text. 4. The teacher writes the verbs on the board. 5. The students read out the text to compare. 6. The students cut out the sentences and stick them to the matching picture. Now they have the work instructions. 7. They get in pairs. One student performs and shows/explains the DNA-Isolation and the other takes a video of this process with the mobile phone.   Then they switch.   1. The video has to be uploaded on Moodle. |
| **Resources** | <https://en.wikipedia.org/wiki/DNA> (23 March 2024)   * [DNA Isolation Step 1: Preparing the Sample](https://www.youtube.com/watch?v=xlrwef2Y3f0) * [DNA Isolation Step 2: Extracting the DNA](https://youtube.com/watch?v=iYaxOwZLIAk) * [DNA Isolation Step 3: Precipitating the DNA](https://youtube.com/watch?v=y7kny3Xy4k4) * [DNA Isolation Step 4: Cleaning & Eluting the DNA](https://www.youtube.com/watch?v=buzWMKIHbBI) |
| **Content-related**  **learning**  **outcome** | The students learn about the location of the DNA in cells. They revise the structure of the DNA. To destroy the cell compartments in different ways (mechanically and chemically) they can understand the chemical composition of the cell compounds. |
| **Language-related**  **learning**  **outcome** | The students are supported to listen to the English language. By listening to the verbs, they get a good working tool for the language. The students can describe a work procedure by themselves. |

**DNA-Isolation**

**Background Information**

The abbreviation **DNA** **comes** from the English name *deoxyriboncleic acid(*(/diˈɒksɪraɪboʊnjuːkliːɪk, -kleɪ-/ ) (in German *Desoxyribonukleinsäure*) and is more commonly **used** than the German equivalent **DNS**.   
The DNA, a nucleic acid, **is organized** in a double-helix of long chain molecules. The “building blocks” are nucleotides. Each nucleotide **consists** of a phosphate rest, the sugar Deoxyribose and one of four organic bases, Adenin (A), Thymin (T), Guanin (G) and Cytosin (C).

Animals, plants and fungi **are built up** of eukaryotic cells, where most of the DNA **is organized** in chromosomes within a nucleus (Zellkern). A small part **is found** in mitochondria (the “power station of the cell”). In addition, plants **have** DNA in Chloroplasts, which **are responsible** for photosynthesis. Procaryotes, such as bacteria, **do not have** a nucleus. Rather, their DNA **floats** in the cytoplasm. <https://en.wikipedia.org/wiki/DNA> (23 March 2024)

To **extract** the DNA, both, the membrane of the cell and nucleus, have to be **dissolved**. The mortar is supposed to mechanically **destroy** the cells. Next, a common detergent, like dish soap, **dissolves** the phospholipic double membrane. In addition, enzymes **are digested** through proteases. Salt **increases** this effect. High temperature is important to **accelerate** the process and **denaturate** DNAses (enzymes which decompose DNA). Subsequent cooling is necessary to **preserve** and **precipitate** the DNA.

**Instruction:**

*Chemicals:* Sample: Vegetables (onion, cucumber, zucchini, peppers, tomato,…). Fruits (kiwi, banana, strawberry,…)

dish soap

NaCl

Ethanol 96%

Ammoniummolybdad-solution

Aqua dest.

*Equipment:* water bath with thermometer

funnel

filter

beaker

mortar

*Working steps:*

* Fill 50ml of Ethanol into a bottle and put it into the freezer
* Prepare the detergent: mix 40ml dish soap, 12g NaCl and 360ml Aqua dest. (this solution is enough for all students)
* Crush, mix and grind the sample in a mortar sample: The cells must be destroyed before DNA may be isolated
* Put one teaspoon of sample into a test tube and add the same amount of detergent; keep the mixture in the 90°C water bath for 15 minutes (for further destruction of cells)
* Now it’s time to filter the sample: Collect the filtrate in a screw-top test tube (Schraubreagenzglas) – there should be about 5-10ml of filtrate
* Precipitate DNA: Put the test tube into the ice (freezer) and slowly pipette ice cold Ethanol into the sample letting the Ethanol run down the tube wall; you should see white threads/flakes
* To verify that your result is real DNA, do the phosphate-test with Ammoniumbolybdad (check instructions in your book

**Vocabulary:**

consist bestehen

extract extrahieren

dissolve auflösen, lösen

destroy zerstören

digested verdaut

increase erhöhen, steigend, zunehmen

accelerate beschleunigen

denaturate denaturieren

preserve erhalten, bewahren

precipitate ausfallen

organized organisiert, gegliedert

based beruhen auf, basieren auf

built up aufgebaut

responsible verantwortlich

float schweben, treiben, schwimmen

dissolve auflösen

**Additional Media:**

* [DNA Isolation Step 1: Preparing the Sample](https://www.youtube.com/watch?v=xlrwef2Y3f0)
* [DNA Isolation Step 2: Extracting the DNA](https://youtube.com/watch?v=iYaxOwZLIAk)
* [DNA Isolation Step 3: Precipitating the DNA](https://youtube.com/watch?v=y7kny3Xy4k4)
* [DNA Isolation Step 4: Cleaning & Eluting the DNA](https://www.youtube.com/watch?v=buzWMKIHbBI)