

Learn.Genetics: DNA Extraction (Genetic Science Learning Center, <https://learn.gendev.azurewebsites.net/content/labs/extraction/>)

With shrinking classroom budgets and stricter regulations about what science teachers can and cannot do in their classrooms, there is a strong need for more virtual opportunities for students. Virtual or online laboratory activities are not only usually free, but they offer students experiences they might not be able to have in the real world. There are many places on the Internet where students can go to learn biology and practice their laboratory skills. One such site, called “Learn.Genetics” (<https://learn.gendev.azurewebsites.net/>), has a large collection of these activities that are user-friendly and suitable for students of all ages.

Among the virtual labs on the Learn.Genetics site is one in which students can participate in a DNA extraction (<https://learn.gendev.azurewebsites.net/content/labs/extraction/>). Removing DNA from human cheek cells may be prohibited in public school classrooms due to safety concerns, but here students can do it virtually. Students work their way around a lab, moving through each step of the extraction. They virtually use chemicals, pipettes, and centrifuges to pull the DNA from the cheek cells and then isolate the material in a test tube. The only computer

requirements for performing the simulation are an Internet connection and a web browser with the Flash extension.

When first launching the simulation, the user is presented with a question as to why it would be beneficial to extract DNA from an organism. The simulation provides some uses of extracted DNA and then describes the materials needed for the actual extraction. It then explains what DNA is, where it is found within a cell, and how it forms chromosomes. The simulation goes on to describe the procedure the user will follow. These steps include collecting cheek cells, bursting the cells to release their DNA, separating the DNA from proteins and other debris, and isolating the concentrated DNA.

Students start by clicking on a buccal swab and moving into the subject’s mouth. The animation automatically scrapes the cheek cells and moves the swab into a microtube for centrifugation. The pipette is then used to add lysis solution to the tube before the tube is placed in a water bath. The simulation provides a close-up view of the cells bursting open and releasing their genetic material. From here, students use the pipette to add salt to the DNA solution in order to cause proteins to clump together. The tube is then placed in a centrifuge to separate the clumped proteins from the DNA

(the proteins sink to the bottom). Alcohol is used to force the DNA out of solution and to make it visible.

There is no replacement for real-life, hands-on learning. Research has shown that when students actually *do* science instead of just reading or hearing about it, they tend to retain a lot more of the information. However, when supplies are limited or safety concerns arise, doing a virtual simulation is the next best thing. The DNA extraction simulation on the Learn.Genetics site is an excellent activity that is appropriate for students in middle school and up. The entire virtual extraction is animated with high-quality graphics and is highly interactive. There is only limited text for students to read, so English-language learners will have no trouble being fully engaged in the activity. Teachers may want to use this DNA extraction as a pre-lab activity to prepare students for actually pulling DNA out of a real organism. There is also a link with detailed instructions on how to extract DNA from just about anything; teachers may wish to follow these if they decide to perform the extraction in their classrooms.

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