



INTRODUCTION TO THE KIT

The DNA Extraction Kit is designed to help you teach a classic protocol by using household chemicals to extract nucleic acids from onion cells. The SEP protocol, kit reagents, and equipment included are for the SEP lab, The Stuff that Genes are Made Of. The kit notebook contains several protocols for other DNA extractions in the Other Protocols section; however, this kit does NOT contain all of the reagents or equipment needed for these options. If you would like to do an animal cell DNA extraction, we do have a stock of frozen thymus (sweetbreads) that we can provide you upon request.

PREPARATION & SET-UP

This procedure assumes you have the SEP DNA Extraction Kit.

You will need to provide the following materials, which are **not** included in the kit:

- onion (the lab is written for onion, but it has also been used with other fruits and vegetables)
- sharp knife (the kit contains only a small sandwich knife)
- ethanol, 95% or 100% (keep at -20°C or on ice)
- ice (enough to make an ice bath for a 1000 ml beaker)
- distilled water, at least 200 ml
- balance
- racks or beakers to hold tubes for DNA spooling

NOTES ABOUT REAGENTS AND PROCESSES

Detergent: Palmolive and Dawn work well. People doing this lab have also had success with light-colored shampoos.

Salt: Some write-ups specify non-iodized; others have not found this to make any difference in success.

EDTA: Not all write-ups for DNA extraction labs include EDTA.

Meat Tenderizer: Use a brand such as Adolph's, which contains papain, a protease from papaya.

Avoid tenderizers that contain bromelain (from pineapple).

Hot water bath: More is not better here. Longer heating may denature or degrade the DNA.

Ethanol: Cold ethanol is better. Leave ethanol in freezer or on ice until just before use.

Blending: Some users recommend not doing this step. At SEP workshop 1996, we found that blending gave better results than not blending. Briefer blending for soft materials (such as lettuce or banana) might be appropriate. You can also try using a mortar and pestle.

CLASSROOM MANAGEMENT

In this lab, students work in four different groups; each group prepares one step of the extraction procedure. You might need to plan for downtime activities once each group completes their step in the procedure. This Kit is designed to produce one filtrate volume per class. Once the filtrate is obtained, you can design how many students will actually spool DNA. (There should be enough for approximately 40 students.)

Stopping points: The procedure can be stopped once the onion filtrate is obtained. (If you do this, then the Meat Tenderizer solution (Step 1, team 3) should not be made until the day you

actually spool the DNA. The enzyme in the meat tenderizer is not stable in solution.) The filtrate can be refrigerated overnight and spooled the next day. Some users choose to refrigerate after the filtrate has been aliquoted into tubes for spooling.

Spooling: If DNA doesn't spool or precipitate, it may have been fragmented (degraded) during earlier steps. Try letting tubes containing ethanol and filtrate sit undisturbed in the refrigerator overnight—sometimes more DNA will precipitate out, forming a larger and more compact mass that can be teased out of tube with a stirrer.

For spooling, the ratio of DNA filtrate to ethanol is 1:2.

Adapted from a protocol designed by Melinda Mueller

ACTIVITIES AND EXTENSIONS

The notebook includes several activities, models, and references to aid in teaching about DNA size and scale.

- ❑ A plastic model of DNA is included, which can be displayed to introduce the actual structure of the molecule.
- ❑ Gelatin capsules and thread are provided along with an activity in the notebook, "The Size of the Genome", which is in the DNA Size section of the notebook. These supplies are for an activity where students make their own bacterial genome in a capsule.
- ❑ Cassette tapes are provided to show, by analogy, an example of how copious amounts of information can be stored and used. This teaching by analogy activity is also in the DNA Size section of the notebook.
- ❑ A yarn model of condensed DNA (chromatin) during prophase and uncondensed chromatin during normal cell activity is provided as a visual.
- ❑ DNA radiograms are also included in the kit, should you choose to show your students how to read a DNA sequence. The instructions for how to read these radiograms are in the DNA Sequencing part of the notebook.

WORLD WIDE WEB RESOURCES ON DNA

The Tech Museum of Innovation in San Jose, California has an informative website which includes several bits of information on DNA size and scale. You can visit this site at: <http://www.thetech.org/genetics/>

Cold Spring Harbor Laboratory in New York hosts a site known as the Dolan DNA Learning Center. There are several resources for teachers including animations and laboratory protocols that may be useful in your genetics curriculum planning. This site also includes ethics units, informative historical information on DNA research, and current events in molecular biology research. You can visit this site at: <http://www.dnalc.org/home.html>

The Genetics Science Learning Center at the University of Utah has an updated site, which includes several virtual labs, actual lab protocols, informative animations, and science references for use in the classroom. This site also has updated information on contemporary issues in biomedical research, which includes several vignettes about ethics in science. You can visit this site at: <http://learn.genetics.utah.edu/>