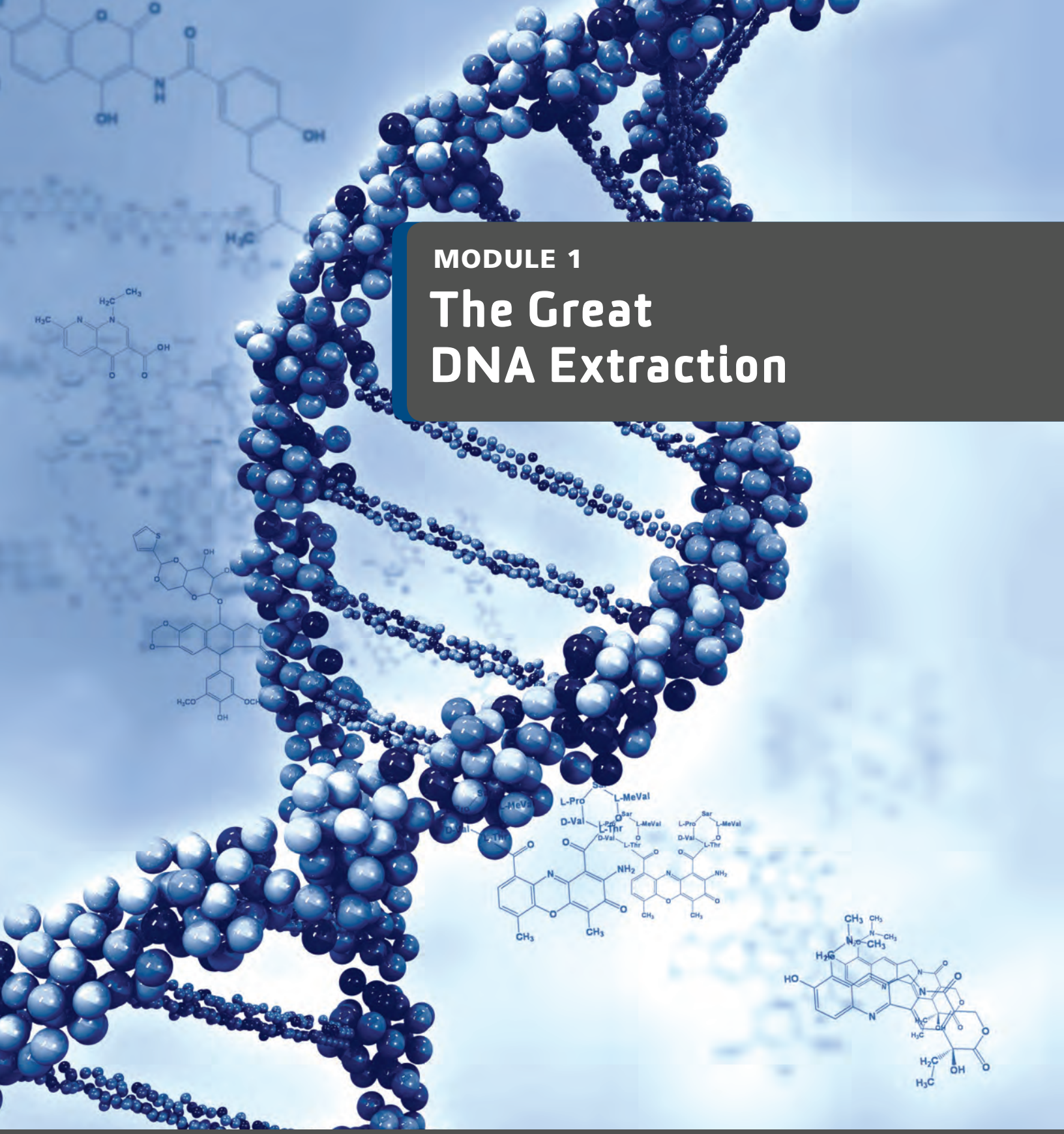


MODULE 1

The Great DNA Extraction

FACILITATOR'S GUIDE

GENETICS FOR KIDS

Acknowledgements

Curriculum Writers

Deirdre Bonnell
Rochester City School District

Kim LaCelle
Wheatland-Chili Central School District

Advisory Panel

Miriam Blitzer, Ph.D.
University of Maryland School of Medicine

Ann Cavallo, Ph.D.
University of Texas, Arlington

W. Augustine Dunn
Department of Molecular Biology and Biochemistry
University of California, Irvine

Paula Gregory, Ph.D.
Department of Genetics
Louisiana State University Health Sciences Center

Neil Lamb, Ph.D.
Director of Educational Outreach
HudsonAlpha Institute for Biotechnology

Multimedia, Graphics, and Editing

Meaghan D. Barnett
Down to the Letter

Matt Herter
Spektrum Digital Solutions

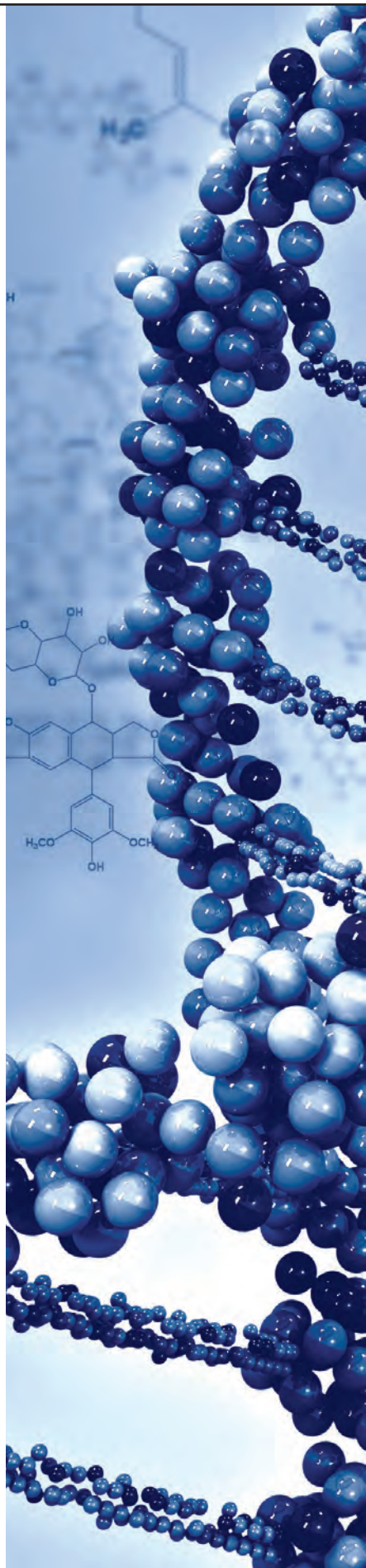
Jeff Owczarzak
Graphic Design

KDH RESEARCH & COMMUNICATION

Genetics for Kids: A Multimedia Curriculum for Middle School Students on Genetics was produced under grant No. 5R44RR020024-03 from the National Center for Research Resources. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Center for Research Resources of the National Institutes of Health.

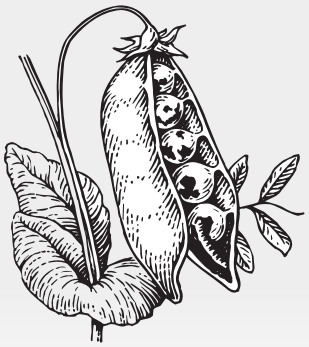
Table of contents

The Great DNA Extraction | **Module 1**



The Great DNA Extraction

Introduction



In 1865, Gregor Mendel was the first person to scientifically investigate the idea that all living organisms possess inherited material that serve as instructions for their appearance and functions. The inherited material determined an organism's traits. For many years, Mendel recorded observations about trait inheritance in pea plants. Through his observations, Mendel discovered that offspring inherit traits from their parents, and that most traits are inherited independently of one another. These discoveries, known as the *Mendelian Laws of Inheritance*, are the foundation of modern scientific discoveries about trait inheritance. In 1953, James Watson and Francis Crick built on Mendel's work, and discovered that an organism's traits are determined by genetic information that is stored in its deoxyribonucleic acid (DNA). DNA is a nucleic acid that contains the genetic instructions used in the development and functioning of all known living organisms.

Because DNA is stored in the nucleus of cells, many students think DNA cannot be seen without using a microscope, but it can be seen with the naked eye *(see Teacher Note 1)*. In this module, students will extract DNA from plant cells with techniques used by scientists. The main objective of the module is to show students that DNA is a tangible substance that is present in large quantities in cells, and is visible without a microscope.

Learning Objectives

- ✓ Recognize that all living things are made of cells
- ✓ Recognize that DNA is found in cells of living organisms
- ✓ Understand that DNA can be extracted from other cellular components
- ✓ Explain that detergent disrupts cell membranes so that DNA can be extracted

Prior Knowledge

To complete this module, students should already be able to:

- ✓ Recognize that the nucleus is the control center of the cell and contains most of a cell's DNA
- ✓ Recall that the cell membrane controls what comes in and out of a cell
- ✓ Recognize that wheat germ is a source of plant cells

Relevant Standards of Learning

National Science Education Standards
Life Science, Content Standard C

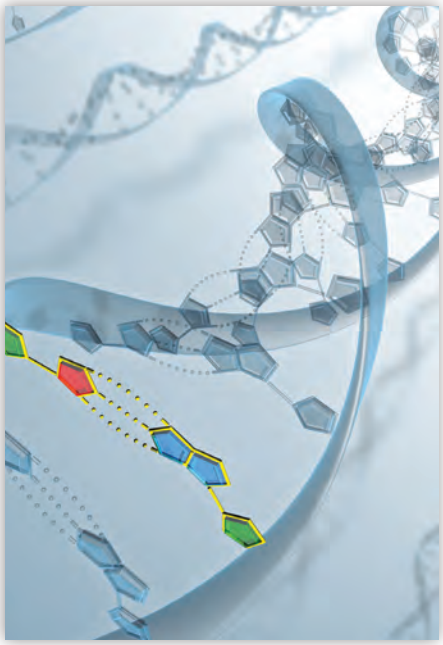
Structure and function in living systems

- Living systems at all levels of organization demonstrate the complementary nature of structure and function. Important levels of organization for structure and function include cells, organs, tissues, organ systems, whole organisms, and ecosystems.
- All organisms are composed of cells–the fundamental unit of life. Most organisms are single cells; other organisms, including humans, are multicellular.
- Hereditary information is contained in genes that are located in the chromosomes of each cell. Each gene carries a single unit of information. An inherited trait of an individual can be determined by one gene, or by many genes. A single gene can influence more than one trait. A human cell contains many thousands of different genes.

New York State Intermediate Science Standards (Grades 5 - 8)
Standard 4: The Living Environment

Major Understandings

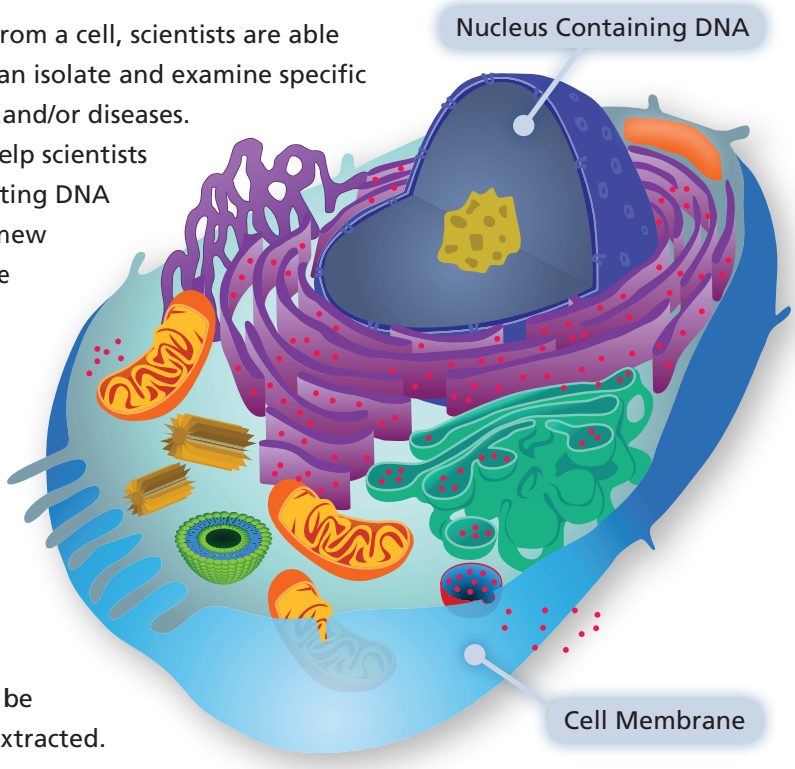
- 1.1a: Living things are composed of cells. Cells provide structure and carry on major functions to sustain life. Cells are usually microscopic in size.
- 1.1c: Most cells have cell membranes, genetic material, and cytoplasm. Some cells have a cell wall and/or chloroplasts. Many cells have a nucleus.
- 2.1a: Hereditary information is contained in genes. Genes are composed of DNA that makes up the chromosomes of cells.



Background

Many scientists built on Mendel's foundational work on genetic inheritance to contribute to modern understandings of the structure of **deoxyribonucleic acid, or DNA.** In 1929, Phoebus Levene showed that DNA contained nucleotides and the sugar, deoxyribose. In 1952, Alfred Hershey and Martha Chase conducted the Hershey-Chase experiment, which concluded that DNA was the molecule that controls heredity. In that same year, Rosalind Franklin and Maurice Wilkins created X-ray images of DNA crystals. Using the X-ray images of the DNA crystals, James Watson and Francis Crick identified the physical structure of DNA. In their famous essay in the journal *Nature* (Molecular Structure of Nucleic Acids: The Structure of DNA, 1953), Watson and Crick introduced DNA's double helix shape. More information on the experiments mentioned above can be found at the links in the *Additional Resources section.*

Through **DNA extraction**, or removing DNA from a cell, scientists are able to examine and manipulate DNA. Scientists can isolate and examine specific genes to look for potential genetic disorders and/or diseases. Studying DNA extracted from cells can also help scientists discover cures to genetic disorders. Manipulating DNA also gives scientists the potential to develop new genes that could be used to treat disease. The extraction of DNA from cells, therefore, unlocks tremendous potential for doctors and scientists to improve medical care.



A basic understanding of cell structure is helpful for students to appreciate where DNA is normally located and how it can be extracted. Each cell is surrounded by a **cell membrane**. The **cell membrane** is made of two layers of fats, called the **lipid bilayer**. The lipid bilayer, or the cell membrane, must be broken to expose the DNA so that it can be extracted.

A soap detergent solution is able to weaken the **lipid bilayer**, causing it to break apart. Breaking the lipid bilayer releases the cellular contents including the DNA.

Once the DNA is released from the cell, it is still not completely exposed. Within each cell, DNA is contained in the **nucleus**, which is also surrounded by a membrane. The nuclear membrane is also a lipid bilayer. Just as it is necessary to break the cellular membrane to release the contents of the cell, it is necessary to break the nuclear membrane to release the DNA from within the nucleus. The soap detergent solution also weakens and breaks the nuclear membrane. Once the cellular and nuclear membranes are broken, the DNA can be separated from the other cellular components.

Vocabulary

1. **Cell membrane**: Controls what goes into and out of a cell. A cell membrane is made up of proteins and two layers of lipids (fat molecules), called the lipid bilayer.
2. **DNA**: An acronym for deoxyribonucleic acid, which is a double-stranded nucleic acid that contains the genetic information for cell growth, division, and function.
3. **DNA extraction**: The process of breaking open the cellular and nuclear membranes to remove DNA and separate it from other cellular contents. The DNA can then be studied.
4. **Lipid bilayer**: The double layer of fat molecules that make up the cell membrane and nuclear membrane.
5. **Nucleus**: A cell organelle, surrounded by a lipid bilayer that controls the function of the cell and contains most of the cell's DNA.

Materials List

Before you begin, ensure that you have all of the items necessary to complete the module.

- ✓ **Student Handout**
- ✓ **50 ml conical tube**
- ✓ **Wheat germ–raw, not cooked** *(see Teacher Note 2)*
- ✓ **Warm water**
- ✓ **Palmolive dishwashing detergent, diluted to half water and half detergent** *(see Teacher Note 3)*
- ✓ **Something to stir with (e.g., chop sticks, coffee stirrers, pipettes, or glass rods)**
- ✓ **White distilled vinegar** *(see Teacher Note 4)*
- ✓ **Colored pencils to draw conical tube and contents**

Optional materials

- ✓ **Eppendorf tubes to save DNA**
- ✓ **Goggles to protect eyes from splashes**
- ✓ **Plastic transfer pipette**

Procedure

Prior to the Lesson

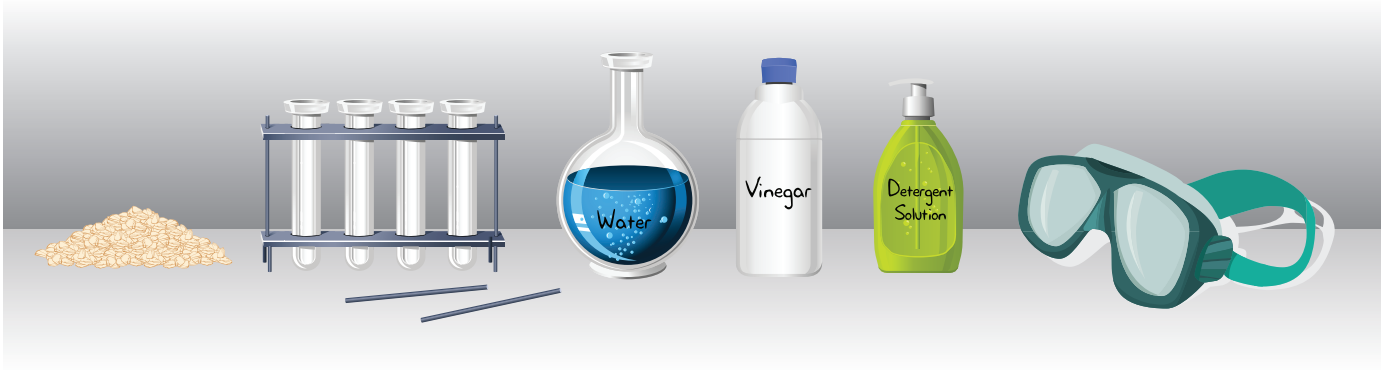
1. Prepare the following before students arrive:
   - Mix the dishwashing detergent and water at a 1:1 ratio (*see Teacher Note 5*).

     Complete this step in advance. It will minimize the risk of extraction failure that will occur if students use too much dish detergent.

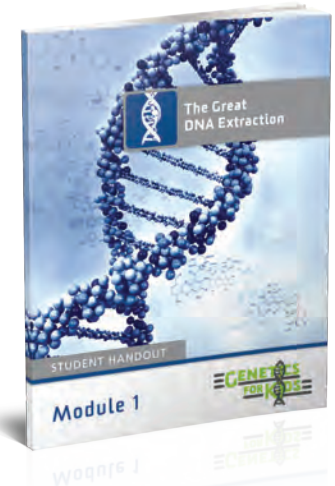
   - During the activity, you will divide students into groups of four. You will set up a lab station for each group, and create a roster so you can record the names of the students in each group.

Set these items up at each lab station:

- **(4)** 50 ml conical tubes (1) 20 ml wheat germ, or 5 ml per student
- **(1)** 500 ml beaker of warm water, around 110 degrees Fahrenheit
  - ➥ Water from the tap is fine. Cooler water also works, but complete the first protocol with warm water. Students can experiment with water temperature to see if it makes any difference.
- **(1)** 50 ml conical tube of detergent solution (diluted 1:1 with water)
- **(1)** 50 ml conical tube of distilled white vinegar
  - ➥ The vinegar needs to be in a sealed container.
- **(4)** Goggles
- **(4)** Stirring devices, such as chopsticks, coffee stirrers, glass rods, or pipettes
- **(2)** Conical tube racks
  - ➥ You may also use a beaker or anything that will hold the tubes upright. Each rack should hold at least two tubes.



Day of the Lesson



1. Seat students in groups of four.

   Inform students that in today's module, they will extract DNA from plant cells. DNA is located in the nucleus of the cell and contains all of the instructions for cells to function. Ask students, "Does anyone know what DNA looks like?

   When students have answered, tell them that they may get to see what DNA looks like in person, with or without a microscope.

2. Distribute a **Student Handout** to each student.

3. Instruct students to read **Part I: Introduction**.

   Ask students to silently read **Part I: Introduction** on the **Student Handout**. Provide students with enough time to read the introduction. Circulate around the room as students read. Redirect students with questions, and check for comprehension as needed.

   Ask students the question, "Can we see DNA without a microscope?" Give students time to write a hypothesis on their **Student Handout**. If necessary, explain to the students that a hypothesis is a testable prediction of the outcome. Make sure they provide a rationale for their hypothesis.

4. Demonstrate the procedure for DNA extraction.

   a. Add enough wheat germ to a 50 ml conical tube to fill the conical tip (approximately 5 ml).

   b. Add warm water to the 20 ml mark on the conical tube. If you prefer to use a more precise technique, students can measure specific amounts with a graduated cylinder.
   Explain that the warm water softens the membrane around the cell and the nucleus.

   c. Stir to mix the wheat germ and water. Do not vigorously swirl or shake the conical tube. The swirling and shaking will damage the DNA.

   d. Add no more than 5 ml of diluted detergent to the conical tube. If you are using Palmolive, the mixture will look slightly green. Stir again, gently. Do not invert or shake the conical tube. You do not want bubbles.

      Explain that the detergent removes the proteins and fats surrounding the cell and the nucleus in the same way that it removes the proteins and fats from dirty dishes. The detergent surrounds the fats to form a soap ball that makes it easy to wash away with water. In a cell, once the proteins and fats are surrounded and removed by the detergent, the nucleus releases the DNA.

   e. Emphasize that in the next step there should be NO MIXING. To extract DNA, there must be a layer of vinegar on top of a layer of soap. DNA will clump in the layer of vinegar. Mixing may disrupt these layers and make it difficult to extract DNA. Use a transfer pipette to slowly add the vinegar down the side of the conical tube to create a layer of vinegar over the wheat germ-water-soap mixture.

      If you do not have transfer pipettes, carefully pour the vinegar slowly down the side of the conical tube. Add enough vinegar to reach the 45 ml line on the conical tube.

      Explain that the vinegar separates the DNA from the other cell parts.

   f. Before students can see the DNA precipitating, cap the conical tube and immediately put it out of sight. Do not show the students your results but, rather, allow them to discover for themselves what "DNA slime" looks like.

5. Give students directions about how to get materials and begin the extraction.

   Instruct each student to examine the materials at the lab station and verify that all required materials are present. Then, have each student put on a pair of goggles and follow the "Method" section on their handout to extract the DNA. Each student will conduct the experiment for themselves.

6. Circulate around the room.

   Monitor student extractions and answer any questions. Emphasize to the students that they need to carefully conduct the lab.

   Remind students not to mix the contents of the tube in Step 4 on the Student Handout. Mixing the contents will disrupt the DNA and ruin the experiment. Students who mix the contents of the tube in Step 4 will have to start over (see Teacher Note 6).

   Once students have added the vinegar (see Step 5 on the Student Handout), explain again that the vinegar separates the DNA from the other cellular components. The DNA then collects in vinegar, above the water/wheat germ/detergent solution, where it can be seen as "DNA slime."

   Explain that scientists use a very similar technique to extract DNA from laboratory samples.

7. If students are saving their DNA, transfer it to an Eppendorf tube.

   Use a clean transfer pipette to put the DNA into an Eppendorf tube. Close the cap. The DNA can be stored for some time and is nontoxic, but students should not eat it.

8. Instruct students to clean their workstations.

   Dispose of all waste into a bucket or sealable jar for disposal in a trash bin. Do not dispose of it in the sink as it may clog the pipes. Rinse all conical tubes well and save for the next class. Replace all station materials. Wipe down work areas.

9. Lead a closing class discussion about the module's activities.

   Explain to students that the detergent solution weakens the lipid bilayer of the cell membrane and the nuclear membrane. The weakening of the lipid bilayer allows DNA to be extracted. The detergent solution breaks down the lipid bilayer the same way that soap breaks down fatty build-up on dishes.

   Students may ask questions such as:

   - Why can we see the DNA?

     There is a lot of DNA in cells.

   - Can we look at it under the microscope?

     You can, but you will not see much. The average classroom microscope is not strong enough to show smaller components of DNA

   - How does all of the DNA fit into the cells?

     It is tightly coiled.

Help make the activity personal by asking the following discussion questions:

- Imagine that you have just extracted DNA from your own cheek or blood cells. How might you use the information in your DNA?
- To whom would you allow access to your DNA– parents, doctors, future spouse, employers?

Extension Lesson

Experiment Modifications

As the students conduct the basic DNA extraction in the module, they may ask questions about modifications to the extraction process. These modifications may include using different DNA sources, water temperatures, soap sources, vinegars or extraction media, mixing differences, and different amounts. Students may also wish to try to extract DNA from other sources, such as fruits or vegetables.

Students can investigate these questions on their own using the template of the original extraction. They should keep careful notes about their modifications and results, and must be careful to conduct controlled experiments so they can identify the effects of individual changes. Students can present their findings to the class in a number of formats (i.e., posters, written reports, and verbal or PowerPoint presentations).

You will need to research safety information on any chemicals added to the protocol to determine safe usage and disposal.

Teacher Notes

1. Although experimental hypotheses are not usually expressed as "yes or no" questions, the format is used for the extraction lab because many students think that DNA cannot be seen without a microscope. Further, students may be unable to come up with a rationale for why or how DNA could be seen without a microscope.

2. Wheat germ must be raw. A little bit of wheat germ goes a long way. If you fill just the cone of the 50 ml conical with wheat germ, you will have approximately 5 ml, which is the recommended amount.

3. Lemon Fresh Joy, Dawn, and other detergents such as Woolite and Tide will work as well.

4. Ethyl and isopropyl alcohol are often used for classroom extractions. These are manufactured at varying concentrations. Generally, higher concentrations provide better extraction results. For example, 70 percent isopropyl alcohol does not work as well as 91 or 99 percent isopropyl alcohol. However, white distilled vinegar works very well, and is much less expensive than either type of alcohol.

5. Too much detergent is the one component that can cause the extraction to fail. To avoid student measurements and reduce the risk of extraction failure, mix the detergent and water prior to class.

6. Layering vinegar on top of the detergent and wheat germ without mixing layers is essential for good DNA extraction. If a student accidentally mixes the detergent and wheat germ mixture with the vinegar, he or she should begin again.

Sources for Materials

1. 50 ml conical tubes, Eppendorf tubes, and plastic transfer pipettes can be purchased online at VWR International. http://www.vwrsp.com/

2. Raw wheat germ, Palmolive dishwashing detergent, and vinegar should all be available at your local grocery store.

Additional Resources

1. Visionlearning: The Structure of DNA. This website offers a review of the developments in DNA research, including a section on Phoebus Levene. http://www.visionlearning.com/library/module_viewer.php?mid=160

2. The Hershey-Chase Experiment. This link has a diagram and a brief description of the Hershey/Chase Experiment. http://www.accessexcellence.org/RC/VL/GG/hershey.php

3. PBS, A Science Odyssey, People and Discoveries. This website offers a description of the experiments performed by Franklin, Wilkins, Watson, and Crick. http://www.pbs.org/wgbh/aso/databank/entries/do53dn.html

4. Access Excellence Resource Center. This website includes a collection of resources, such as animations, graphics, and topics related to DNA. http://www.accessexcellence.org/RC/

5. Dolan DNA Learning Center. This website includes information on current uses of DNA and many teacher and student resources. http://www.dnalc.org/home.html

6. The University of Utah, Learn. Genetics. This website includes an easy explanation with diagrams of the science of DNA extraction. http://learn.genetics.utah.edu/archive/wheatgerm/background.html

Part I: Introduction

All living things such as plants, animals, and microorganisms, are made up of cells. Every cell is surrounded by a **membrane** that controls what goes in and out of the cell. The cell membrane is made of two layers of fats, called the **lipid bilayer**. The **nucleus** of cells is also surrounded by a lipid bilayer called the nuclear membrane. The nucleus of cells contains **deoxyribonucleic acid (DNA)** *(see Image 1)*. DNA is the hereditary material that contains instructions that determine the way the parts of our body appear and function. DNA is the blueprint inside the nucleus of every cell that gives an organism its unique characteristics. For example, your DNA determines things like your eye color, hair color, and height.

DNA contains much useful information about a person. Doctors and scientists extract DNA from human cells to gain information about the likelihood of people getting certain diseases. For example, DNA found in skin cells or in hair cells can be used to identify the person those cells came from. Crime scene investigators often use DNA to identify victims and suspects involved in their cases. There are a lot of benefits associated with understanding DNA.

Today, we will extract DNA from wheat germ cells. Wheat germ is the part of the wheat seed that grows into a new plant *(see Image 2)*. Have you ever eaten whole wheat bread? It contains wheat germ, and each wheat germ cell has DNA.

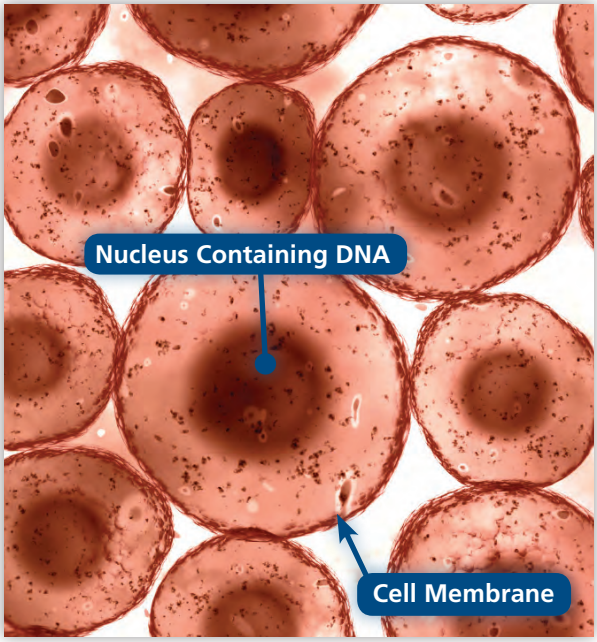


Image 1: An image of an animal cell magnified by a microscope.

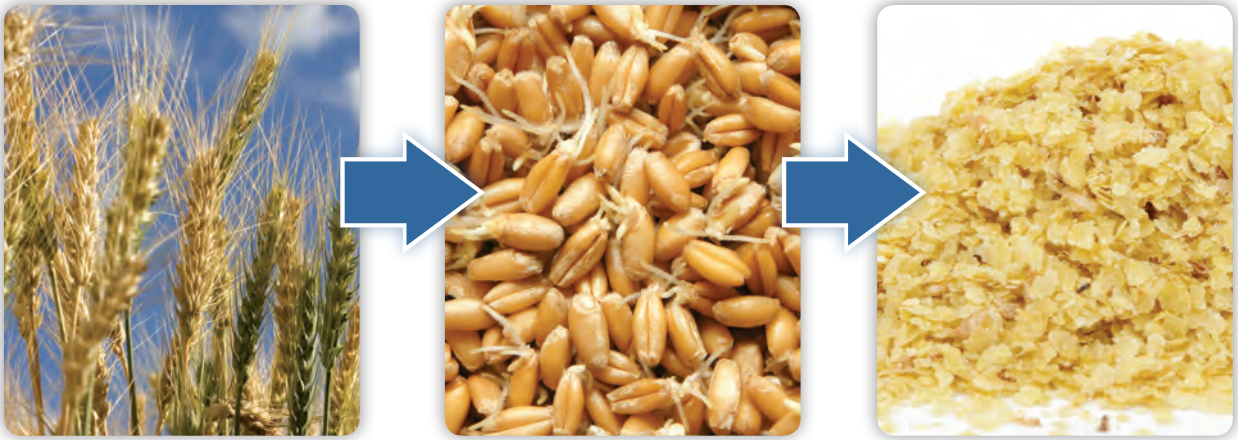


Image 2: Wheat in the field, harvested wheat seeds, and wheat germ from the seeds. Each wheat seed is made up of many cells.

Do you think we can see the DNA we extract without a microscope?

Part II: Vocabulary

1. **Cell membrane**: Controls what goes in and out of the cell, and is made up of proteins and two layers of lipids (fat molecules), called the lipid bilayer.
2. **DNA**: An acronym for deoxyribonucleic acid, which is a hereditary material that contains instructions for making proteins used in the body.
3. **DNA extraction**: The process of breaking open the cellular and nuclear membranes to remove DNA and separate it from other cellular contents. The DNA can then be studied.
4. **Lipid bilayer**: The double layer of fat molecules that make up the cell membrane and nuclear membrane.
5. **Nucleus**: Cell organelle, surrounded by a lipid bilayer, which controls the function of the cell and contains most of the cell's DNA.

Part III: Activities

Activity 1: DNA Extraction

Question: Do you think we can see the DNA we extract without a microscope?

Hypothesis: *"I think we (can or cannot) extract DNA from plant cells and see it without a microscope because…"*

Materials List

- ✓ 50 ml conical tube
- ✓ Wheat germ (raw)
- ✓ Beaker of warm water
- ✓ Detergent solution (water and dish detergent at a 1:1 ratio)
- ✓ Vinegar
- ✓ Stirrer
- ✓ Goggles
- ✓ Tube holder

Method:

1. Add 5 ml of wheat germ to a 50 ml conical tube.
2. Add enough warm water to reach the 20 ml line of the conical tube. Stir 1 minute.

   The warm water will soften the membranes (lipid bilayers) of the cell and the nucleus.
3. Add enough detergent solution to reach the 25 ml line of the conical tube. Stir one minute.

   The detergent solution will remove the proteins and fats around the cell and the nucleus so that the nucleus can release the DNA.
4. Allow mixture to sit for one minute. No more stirring!

5. Pipette vinegar SLOWLY down the side of the conical tube. **Do not mix the vinegar with your wheat germ mixture!** Fill up to the 45 ml line of the conical tube. The vinegar will separate the DNA from the other cell parts. The DNA will then collect in the vinegar.
6. Observe the contents of the conical tube. Write your observations below.

Draw and label your conical tube with these labels at a minimum:

- Conical tube
- DNA
- Vinegar
- Soap + water
- Wheat germ (plant cells)

7. Was your hypothesis correct? Why or why not?

Part IV: Conclusion questions

1. Explain how the detergent solution interacts with the lipid bilayers of the cell membrane and the nuclear membrane.

2. What has the DNA extraction activity shown us?

3. Why do scientists extract DNA? Why could DNA extraction be important to your life?

Part V: Notes

Part I: Introduction

All living things such as plants, animals, and microorganisms, are made up of cells. Every cell is surrounded by a **membrane** that controls what goes in and out of the cell. The cell membrane is made of two layers of fats, called the **lipid bilayer**. The **nucleus** of cells is also surrounded by a lipid bilayer called the nuclear membrane. The nucleus of cells contains **deoxyribonucleic acid (DNA)** *(see Image 1)*. DNA is the hereditary material that contains instructions that determine the way the parts of our body appear and function. DNA is the blueprint inside the nucleus of every cell that gives an organism its unique characteristics. For example, your DNA determines things like your eye color, hair color, and height.

DNA contains much useful information about a person. Doctors and scientists extract DNA from human cells to gain information about the likelihood of people getting certain diseases. For example, DNA found in skin cells or in hair cells can be used to identify the person those cells came from. Crime scene investigators often use DNA to identify victims and suspects involved in their cases. There are a lot of benefits associated with understanding DNA.

Today, we will extract DNA from wheat germ cells. Wheat germ is the part of the wheat seed that grows into a new plant *(see Image 2)*. Have you ever eaten whole wheat bread? It contains wheat germ, and each wheat germ cell has DNA.

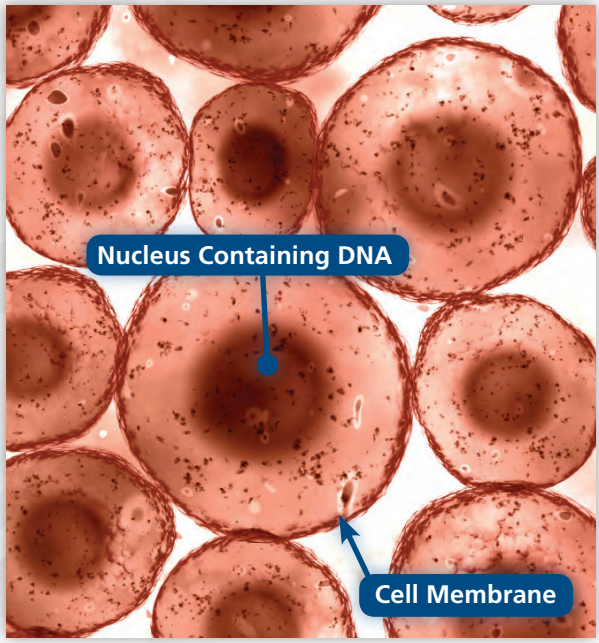


Image 1: An image of an animal cell magnified by a microscope.

Image 2: Wheat in the field, harvested wheat seeds, and wheat germ from the seeds. Each wheat seed is made up of many cells.

Do you think we can see the DNA we extract without a microscope?

Part II: Vocabulary

1. **Cell membrane**: Controls what goes in and out of the cell, and is made up of proteins and two layers of lipids (fat molecules), called the lipid bilayer.
2. **DNA**: An acronym for deoxyribonucleic acid, which is a hereditary material that contains instructions for making proteins used in the body.
3. **DNA extraction**: The process of breaking open the cellular and nuclear membranes to remove DNA and separate it from other cellular contents. The DNA can then be studied.
4. **Lipid bilayer**: The double layer of fat molecules that make up the cell membrane and nuclear membrane.
5. **Nucleus**: Cell organelle, surrounded by a lipid bilayer, which controls the function of the cell and contains most of the cell's DNA.

Part III: Activities

Activity 1: DNA Extraction

Question: Do you think we can see the DNA we extract without a microscope?

Hypothesis: *"I think we (can or cannot) extract DNA from plant cells and see it without a microscope because…"*

The hypothesis will vary for each student.

Materials List

- ✓ 50 ml conical tube
- ✓ Wheat germ (raw)
- ✓ Beaker of warm water
- ✓ Detergent solution (water and dish detergent at a 1:1 ratio)
- ✓ Vinegar
- ✓ Stirrer
- ✓ Goggles
- ✓ Tube holder

Method:

1. Add 5 ml of wheat germ to a 50 ml conical tube.
2. Add enough warm water to reach the 20 ml line of the conical tube. Stir 1 minute.

   The warm water will soften the membranes (lipid bilayers) of the cell and the nucleus.
3. Add enough detergent solution to reach the 25 ml line of the conical tube. Stir one minute.

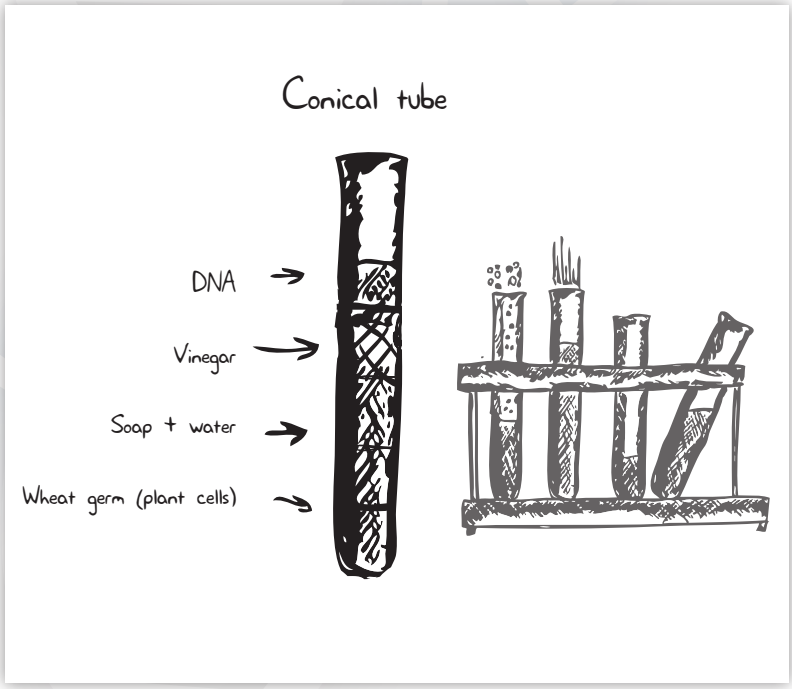
   The detergent solution will remove the proteins and fats around the cell and the nucleus so that the nucleus can release the DNA.
4. Allow mixture to sit for one minute. No more stirring!

5. Pipette vinegar SLOWLY down the side of the conical tube. **Do not mix the vinegar with your wheat germ mixture!** Fill up to the 45 ml line of the conical tube. The vinegar will separate the DNA from the other cell parts. The DNA will then collect in the vinegar.
6. Observe the contents of the conical tube. Write your observations below.

The answer to this question will vary for each student.

Draw and label your conical tube with these labels at a minimum:

- Conical tube
- DNA
- Vinegar
- Soap + water
- Wheat germ (plant cells)



7. Was your hypothesis correct? Why or why not?

The answer to this question will vary for each student.

Part IV: Conclusion questions

1. Explain how the detergent solution interacts with the lipid bilayers of the cell membrane and the nuclear membrane.

The detergent removes the proteins and fats surrounding the cell and the nucleus in the same way that it removes the proteins and fats from dirty dishes. The detergent surrounds the fats to form a soap ball that makes it easy to wash away with water. In a cell, once the proteins and fats are surrounded and removed by the detergent, the nucleus releases the DNA.

2. What has the DNA extraction activity shown us?

The activity has shown us that there is enough DNA in the nucleus of cells to be seen with the naked eye when the DNA is extracted.

3. Why do scientists extract DNA? Why could DNA extraction be important to your life?

Scientists extract DNA to examine and manipulate the DNA. DNA extraction is important to everyone because the information learned from DNA helps scientists understand human health and find genetic diseases.

Part V: Notes

GENETICS FOR KIDS

KDH
RESEARCH &
COMMUNICATION

730 Peachtree Street NE, Suite 820 • Atlanta, GA 30308
www.kdhrc.com • 404-968-8008

The Great DNA Extraction

module 1