Cleveland Clinic

OFFICE OF CIVIC EDUCATION INITIATIVES

healthCARE™

(**C**ultivating **A**cceptance and **R**espect through **E**ducation)

Unit 4: Childhood Cancer

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For information on the Cleveland Clinic Office of Civic Education Initiatives, please visit: http://www.clevelandclinic.org/CivicEducation

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Program Overview

healthCARE™ (**C**ultivating **A**cceptance and **R**espect through **E**ducation) is a dynamic educational program designed to teach children ages 5 through 10 about diversity and individual differences. Developed by the Cleveland Clinic Theatre Company and the Office of Civic Education Initiatives, the program provides free educational resources, including the script and the video of the award-winning children's play *Tall Tale*, as well as an accompanying lesson plan that meets state and national standards in a variety of subjects. healthCARE™ also offers disease-specific lessons so teachers can address diversity and individual differences as they relate to specific medical conditions.

The **Cleveland Clinic Theatre Company** is an award-winning theatre troupe devoted to educating and entertaining audiences of all ages through the use of the performing arts. Since it was established as a program of the Community Relations Department in the spring of 2004, the Company has written, performed and produced an impressive body of work, including interactive educational plays, radio and TV public service announcements, children's theatre programs, improvisational performances, and an educational CD. As a part of Cleveland Clinic's new Office of Civic Education Initiatives, the group has taken on even larger, more ambitious projects, including the video production of *Tall Tale.*

The **Office of Civic Education Initiatives** was established to fulfill the Cleveland Clinic's commitment to promote education throughout Northeast Ohio. In partnership with area schools, local businesses, and fellow nonprofit organizations, the Office creates innovative programs designed to enhance children's learning in the areas of math, science, health and wellness, the arts, and innovation.

Cleveland Clinic, located in Cleveland, Ohio, is a not-for-profit multispecialty academic medical center that integrates clinical and hospital care with research and education. Cleveland Clinic was founded in 1921 by four renowned physicians with a vision of providing outstanding patient care based upon the principles of cooperation, compassion and innovation. U.S. News & World Report consistently names Cleveland Clinic as one of the nation's best hospitals in its annual "America's Best Hospitals" survey. Approximately 1,500 full-time salaried physicians at Cleveland Clinic and Cleveland Clinic Florida represent more than 100 medical specialties and subspecialties. In 2005, 2.7 million patients came for treatment from every state and 100 countries. Cleveland Clinic's website address is www.clevelandclinic.org.

CHILDHOOD CANCER

The word cancer strikes fear into the heart of everyone who hears it. When the patient with cancer is a child, the diagnosis is especially devastating. Teachers who have a student with cancer in the classroom may be at a loss when trying to come up with a way to teach the student's classmates about the illness without scaring them or glossing over the facts. This series of lessons will help students learn about cancer, it's treatments and the side effects their classmate might experience while acquiring skills in a number of academic areas.

Unit Objectives: *Students will*

- *Learn the biological mechanisms behind cancer diagnoses*
- *Learn how cancer may affect their classmate*
- *Reinforce academic skills while helping their classmate to stay connected*
- *Develop critical thinking skills while learning about medical research*

Students will meet many state and national standards in science, mathematics, technology, language arts and fine arts as listed at the end of this unit.

Pre-Assessment:
While there are many websites and books that deal with issues surrounding cancer, few are appropriate for young children to explore on their own. Helpful resources for teachers and students will be listed throughout this series of lessons, including a cancer hotline teachers or students can call with any questions they may have regarding cancer and its effects. Listed below are a few facts students should know right off the bat:

- Cancer is not contagious. Students cannot "catch" cancer from a friend.
- Most children diagnosed with cancer survive (over 80%).
- Getting cancer is not anyone's fault. No one knows exactly how cancer develops
- Cancer may change how a person looks, but it does not change who that person is inside.

A number of short videos are available that can help students sort out their feelings and learn more about cancer. The Charles M. Schultz video *Why, Charlie Brown, Why? A Story About What Happens When a Friend Is Very Ill* is available to teachers in the Cleveland area from the Cleveland Clinic department of Pediatric Oncology/Hematology (see hotline listed below). Another video that may be more appropriate for older students is *With a Little Help From My Friends*, available on loan from the Leukemia and Lymphoma Society through their Back to School Program. Watching one of these videos can help stimulate a discussion about cancer and how best to deal with the diagnosis.

- **Call 216/444-5517 or 800/223-2273, ext. 45517, option 1 for the Children's Cancer Answer line at the Cleveland Clinic Children's Hospital**

Resources for Teachers:

- www.survivorshipguidelines.org/pdf/**EducationalIssues**.pdf
  Article describing the educational issues surrounding cancer treatment
- http://cms.clevelandclinic.org/childrenshospital/body.cfm?id=176
  Informational page on brain tumors for teachers. Very thorough.
- http://cms.clevelandclinic.org/childrenshospital/body.cfm?id=167
  Informational page on acute lymphoblastic leukemia. Dense.
- www.clevelandclinic.org/health/health-info/docs/3700/3778.asp?index=12194
  Helpful overview of cancer
- http://www.leukemia-lymphoma.org/all_page?item_id=310798
  Lending library for cancer resources. See "multimedia" section for videos.
- http://www.cancer.gov/cancertopics/youngpeople/page13
  Table summarizing types of childhood cancer, useful links.

Resources for Students:

- http://www.kidshealth.org/kid/health_problems/cancer/cancer.html
  Kids website about cancer
- http://www.kidshealth.org/kid/health_problems/cancer/chemo.html
  Article for kids about chemotherapy

Lesson 1: Project Virtual Classroom

One of the most difficult parts of the recovery process for students who have cancer is keeping up with their peers socially and academically. Children with cancer may need to spend an extended time away from the classroom, either in the hospital or recovering at home. This time can be very lonely and time can seem to pass very slowly. Upon returning to the classroom, students may feel overwhelmed with trying to catch up to their classmates. While teachers will often send assignments home or arrange for home tutoring, the students will still be missing out on a lot that is going on in the classroom. The following project will help the student to feel more in touch with what is going on at school while providing a way for his or her classmates to help in the recovery process.

The website listed below links to a wonderful story about a boy, Alex, who has a brain tumor. While the story was written for the nine to twelve year old age range, it can be understood by those as young as seven. Read Alex's story to the class or have students take home a copy to read for homework. Take time to discuss all that Alex went through, using the questions below to guide your discussion. If you feel that the story is inappropriate for your students, another good book is "Taking Cancer to School" by Kim Gosselin. This book may be available in your local library or is available online through amazon.com.

- http://www.abta.org/kids/learning/video.htm
  Site from which you can download Alex's Journey. The video is also available.

Discussion Questions:

- What are some things that make a stay in the hospital so difficult?
- What are some things that might cheer up a patient in the hospital?
- What might be difficult for our friend when he/she returns to school?
- How can we help our friend pass the time in the hospital and feel more comfortable when he/she returns to the classroom?

Activity

Tell students that they are going to help their classmate keep up with all that is going on in the classroom by creating a newspaper, journal or news show to be viewed at home or at the hospital. First, divide the students into groups of four to five students each. Each student group is to cover one aspect of classroom life; either a subject such as reading, math or social studies or an activity such as recess, show and tell or a holiday party. Students are to put together a lesson or news-type story to inform their classmate about all aspects of their topic.

Depending on the equipment available, a project segment could consist of a videotaped story, a webpage, a collection of artwork, stories and poems bound into a book, an original song recorded on a tape or CD, a giant mural, a videotaped play, a collection of photographs, charts, graphs and diagrams explaining a science lesson, or a board game teaching a lesson in social studies. Allow students time to discuss how they would like to present their segment. Use the project guidelines that follow to keep students on track and to ensure that they produce quality work. It may be best to have a rolling timetable where the absent student gets one or two segments a week rather than all the project segments at once. Allow students to send their work on as soon as it's ready. Use the guidelines provided to assess student work.

Teacher Guidelines

This project may be most powerful as a learning tool when the teacher assigns both the student work groups and the topic each group will cover. Students who are having difficulty mastering a concept in math, for example, may improve dramatically in that area by recreating the week's math lesson while working with a student who excels in math. However, students may be most enthusiastic about the project when they self-choose their groups and topics. A compromise where students are allowed to have some say in their work groups and can choose from a limited list of topics may be best. Be sure that each group is reasonably compatible but includes a range of ability levels for best results.

Assign one student from each group to each of the following roles:

Project Coordinator: This student's job is to be sure all other students are focused and on task. The coordinator records other students' accomplishments each work period on a work log, troubleshoots and asks for teacher assistance if necessary. This student works wherever he or she is needed, to ensure the project will be completed on time.

Primary Researcher: This student gathers all the information and data necessary to complete the project. For example, if the topic is social studies, the student will put together a list of all the important dates, names and historical facts from the lesson being covered. This person is also responsible for checking over the work to ensure that all information is used accurately.

Media Production Manager: This student coordinates the actual production of the material to be sent to the student. This person directs the formatting or layout of the project and decides how the finished product will look. This person is in charge of the aesthetics of the project, ensuring that the work is done neatly, carefully and with polish.

Technology Advisor: This student handles all the technological aspects of the project, whether it's running the video camera, handling computer problems or simply making copies and binding student work. This person is responsible for making sure all delicate equipment is handled properly and put away safely at the end of each work session.

Quality Control Supervisor: This student checks all work to be sure that it is done correctly and is free of errors. This person makes sure that the topic has been covered completely, that all facts presented are accurate and that the finished product is clean, neat and high quality. This person also checks for technological glitches.

Assessing Student Work:

Since every student project will be different, it is impossible to have a detailed rubric that will address every aspect of the project. However, the following guidelines may be useful in determining how to grade each project.

1. Accuracy: If these projects are to be used by the student with cancer to keep up with classroom lessons, the work must be accurate. The Primary Researcher and Quality Control Supervisor are responsible for providing accurate facts and checking all material for accuracy.
2. Completeness: Each project should be a comprehensive review of a particular lesson or some aspect of classroom life. The Project Coordinator should work with the Quality Control Supervisor to be sure the topic is covered thoroughly and nothing important is left out.
3. Technological Glitches: The Technology Advisor is responsible for fixing any technological problems or finding someone who can help with such problems. If a technological problem cannot be overcome and the problem severely compromises the clarity of the lesson, a new method must be found to convey the information.
4. Aesthetics: The Media Production Manager is responsible for making sure everything looks nice. Lettering or fonts should be legible, artwork should be well-done and sound quality on recordings should be good. Sloppy work should not be tolerated.
5. Cooperation: It is every student's responsibility to work cooperatively with all group members. The Project Coordinator is responsible for reporting to the teacher any problems with students being uncooperative.
6. Originality and creativity: All students are responsible for producing an original, creative and thoughtful project. While students may copy the format of another project, the content of their project should be entirely original.

STUDENT JOB DESCRIPTIONS **HANDOUT 1**

Find your job title and read the job description to learn what your job will be. Follow your job description carefully. Be sure to cooperate with others in your group. Create a project that you and your groupmates will be proud of!

Project Coordinator: Your job is to make sure everyone works well together and does their work properly. You must record the work completed by each group member every day. Keep this record for your teacher to see. Help out wherever you can so that the project gets finished on time. Alert the teacher if you have any problems.

Primary Researcher: Your job is to gather all the information and data for the project. For example, if your project is about a history lesson, you will need to gather all the facts, dates, names and other important information to include in your project. Make sure that everything is accurate! Also, be sure that everyone in your group uses the information you give them correctly!

Media Production Manager: Your job is to be sure the finished project looks good and is well done. Work with the other group members to come up with a creative, original idea. Make sure the work is done with polish (neatly and carefully). You want the finished product to looks as though it were made by professionals!

Technology Advisor: Your job is to gather all the supplies your group will need and to handle technological problems. If there's a problem with a computer, a video camera or any other piece of equipment, you must try to fix it, or find someone to help you out. Do not try to fix a problem you don't understand! If you are not sure how to correct a problem, ask the teacher!

Quality Control Supervisor: Your job is to make sure that everything in your project is correct and looks professional. You must check all facts for accuracy and make sure that the finished project is complete. Help out wherever necessary to make sure the project is as good as it can possibly be! Be sure to check for technological glitches!

Lesson 2: Math Activity - How Small is a Cell?

Cell biology is at the heart of all cancer studies. To understand cancer, you first must understand the cell. Oncologists, scientists who study cancer, spend a tremendous amount of time looking at cells through a microscope or studying micrographs (photographs of cells taken through microscopes). To give your students an idea of what a cell looks like, go to cellsalive.com (link below). Here, students can watch a video of a cancer cell reproducing in real time and can view a wide variety of cells in the cell gallery, a collection of unique micrographs. Click on "How Big" to show students the relative sizes of many tiny things.

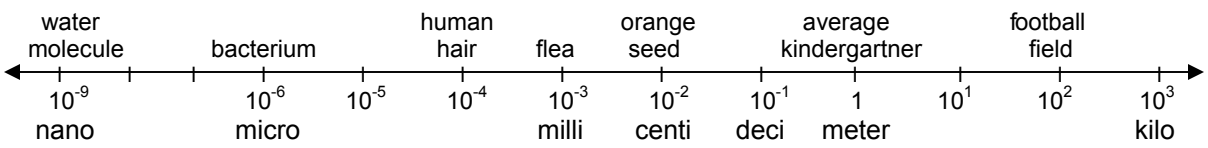
Resources:

- www.cellsalive.com
  Visit this very worthwhile site. Highly recommended.
- www.sacsplash.org/mather/manual/lowres/lesson05.pdf
  Excellent lesson for younger students on size and scale. The tattoos referenced in the "materials" section aren't necessary if you skip the last page of the lesson.
- http://www.cancerhelp.org.uk/help/default.asp?page=96
  Very useful description of the differences between cancer cells and normal cells written in laymen's terms with good diagrams.

Activity: How Small is a Cell?

Recreate the number line below on the blackboard or along a blank wall. The metric scale shown increases and decreases by powers of ten, a concept that younger students may not be able to understand. However, students should be able to understand that each step down along the scale indicates a size that is ten times smaller than the last step, and each step up along the scale indicates a size that is ten times larger than the last step. If possible, give each student a metric ruler and allow them a few minutes to measure various items such as a pencil, book, paper clip, etc., to become familiar with centimeters and millimeters.

Cut up and distribute the game cards on pages 10 and 11, one to each student. Ask the students to draw a picture of the item listed below the word on their card. Explain to students that the number one in the center of the number line stands for one meter. Everything to the right is larger than one meter, and everything to the left is smaller than one meter. Discuss the items listed on the number line and their relative sizes. Then, call students up one at a time to place their card at the correct spot on the number line. Cards may be affixed using tape, paper clips or magnets (if on a magnetic blackboard). See if students can come up with other items that could be listed on the number line.



Dime (thickness)	**Dime (diameter)**	**Large Ant**
Marble	**Upright Vacuum**	**Small Ant**
Baseball	**Pin (width)**	**Finger (width)**
Grain of Salt	**Gold Atom**	**Dust Mite**

Airplane - 747 (length)	**Freight Train (length)**	**Pollen Grain**
Strep Germ (Bacterium)	**Red Blood Cell**	**Cold Germ (Virus)**
White Blood Cell (lymphocyte)	**Yeast Cell**	**Cheek Cell**
Hula Hoop (diameter)	**Lunch Counter (height)**	**Tallest Tree (height)**

Teacher's Guide: Approximate sizes for items in game cards:
Note: Sizes may vary; freight trains, for example can be much shorter or longer than stated below

Airplane (length): 100 meters
Ant (large): 1 centimeter
Ant (small): 1 millimeter
Baseball: 10 cm
Cheek Cell: 60 µm
Cold Germ: 0.03 µm
Dime (diameter): 1 cm
Dime (thickness): 1 mm
Dust Mite: 300 µm
Finger (width): 1 cm
Freight Train (length): 1 km
Gold Atom: 1 nm
Grain of Salt: 1 mm
Hula Hoop (diameter): 1 m
Lunch Counter (height): 1 m
Marble: 1 cm
Mold Spore: 0.1 µm
Pin (width): 1mm
Pollen Grain: 50 µm
Red Blood Cell: 7 µm
Tallest Tree (height): 130 m
Upright Vacuum (height): 1 m
White Blood Cell: 14 µm
Yeast Cell: 24 µm

ABBREVIATIONS

nm = nanometer	µm = micron or micrometer	mm = millimeter
cm = centimeter	m = meter	km = kilometer

Lesson 3: Modeling Cancer

In this lesson, students will create a model of the blood interspersed with roving cancer cells. Acute Lymphocytic Leukemia (ALL) or cancer of the blood, is the most common type of childhood cancer. While the child in your classroom may not have this type of cancer, cancer cells may still exist in the blood due to metastasis of the cancer. This model will also serve as an excellent teaching tool to help students understand how chemotherapy works.

MATERIALS: small red, white and yellow plastic beads, small metal ball bearings or BB's, 8 - 10 feet of flexible plastic tubing (~ ½ inch diameter, available from a pet supply store), electrical or masking tape, magnets and plastic or paper cups.

PROCEDURE:

1. Divide students into groups, give each group about a foot of plastic tubing and three cups of red, white and yellow beads, sorted, a cup with a few metal bearings or BB's, an empty cup and a magnet.
2. Tell students that they are going to make a model of the cells circulating in our bloodstreams. While one student holds the piece of tubing bent into a U shape, have other students drop 40 red, 4 yellow and 1 white bead into the tubing, and then tape the ends together to form a closed loop.
3. Explain to the students that we have three categories of cells in our blood:
    - Red blood cells to carry oxygen throughout the body (red beads)
    - Platelets to help our blood clot if we get a cut (yellow beads)
    - White blood cells to fight infection (white beads)
4. Have students swirl their models around to simulate blood circulating through the body. Tell them this is how a healthy bloodstream looks.

5. Now have students untape their tubing and drop several metal balls in. These represent cancer cells. They are immature white blood cells produced in the bone marrow that don't do the body any good.
6. Tell students that when someone gets cancer, cancer cells move into the bloodstream and can take the place of good blood cells. This makes the body weak and unhealthy. When this happens, the cancer patient must get a special medicine called "chemotherapy" to kill the cancer cells.
7. Now tell students that they get to play the doctor. Have students pour the beads and metal balls into the empty cup and move the magnet through the cup to attract the cancer cells. The magnet represents the medicine.
8. Have students put some, but not all of the beads back into the tubing. Balls that are clinging to the magnet should not be returned to the tubing, but balls that are free can be put back in. Leave some plastic beads in the cup. This new model represents a patient who has gone through only a few rounds of chemotherapy. Most of the cancer cells are gone, but some of the good cells are gone too. The chemicals in the medicine impair the body's ability to make new cells. All fast-growing cells (such as hair follicles and the cells that line mouth) are affected. After several rounds of chemotherapy, the cancer cells will be gone (hopefully), but so will many of the good cells, leading to the following side-effects.
    - anemia, pale complexion, fatigue
    - inability to fight off infections
    - inability to clot blood properly leading to easy bruising

At the end of the simulation, discuss some of the precautions students will need to take when their classmate with cancer returns, such as frequent and thorough hand-washing and covering the mouth and nose when they cough or sneeze. Also explain that their classmate may not have hair and may be embarrassed about it. They will need to do all they can to make their classmate feel comfortable in the classroom.

Technology Extension:

(Read the following out loud to students)
Dr. Zborowski is a medical researcher at the Cleveland Clinic who is working on new ways to cure and prevent cancer. He is developing a way to sort various types of cells using magnets. He tags the cells he wants to sort out with a magnetic material and then runs the cells through the magnetic sorting machine. Using the magnets and tubing you have available, could you develop a way to sort the metal balls from the plastic beads as they run through the tubing? Try it and see!

Resources:

- www.kidshealth.org/.../body_basics/blood.html
  A good source of information for students.
- www.idahoptv.org/dialogue4kids/season4/blood/facts.cfm
  Nice site with pictures of blood cells and lots of links.

The math activity on the following page will develop students' graphing skills while giving them an idea of how quickly cancer cells can multiply.

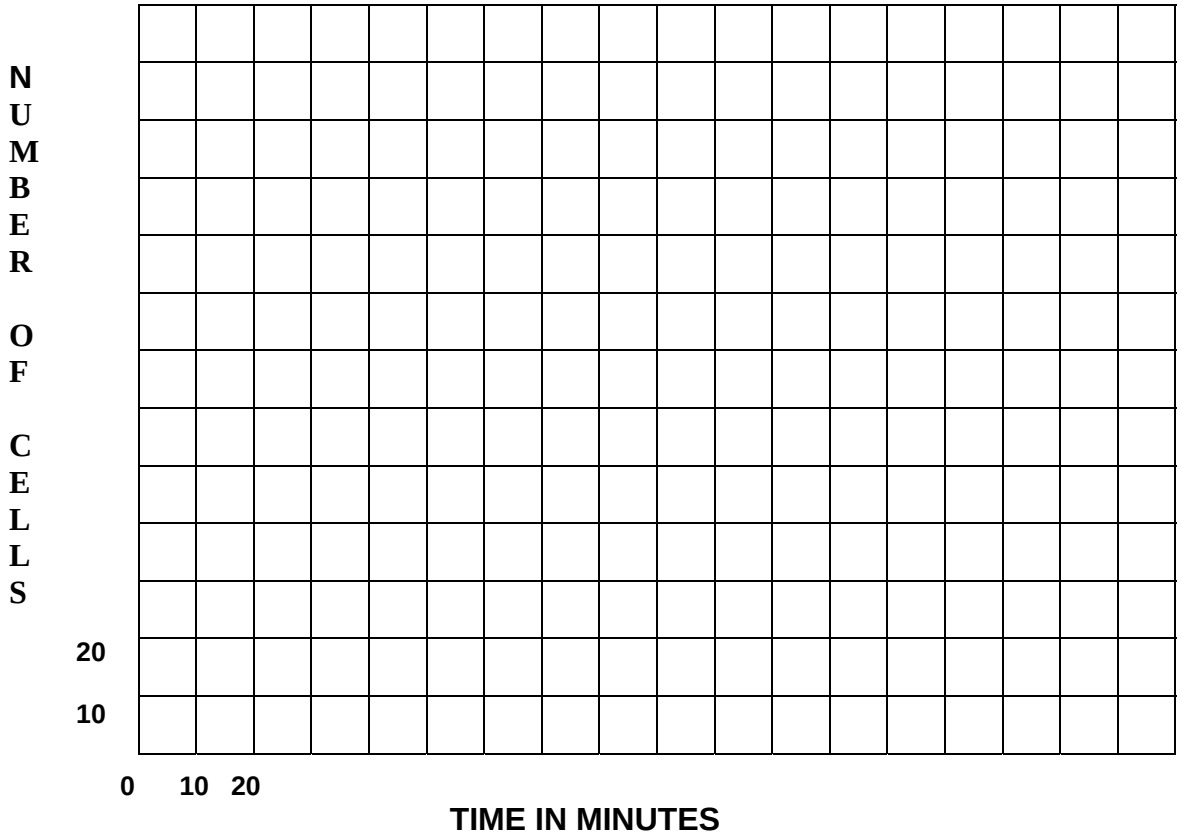
MATH ACTIVITY: DOUBLING **HANDOUT 2**

A cell can make a copy of itself every 20 minutes by splitting itself in two! Complete the table below to see how many cells can be made from a single cell in 3 hours time.

TIME IN MINUTES	NUMBER OF CELLS
0	1
20	2
40	4
60	
80	
100	
120	
140	
160	
180	

Part II: Graph the Results

1. Finish labeling the bottom of the graph (x axis) with the time in minutes.
2. Finish labeling the side of the graph (y axis) with the number of cells.
3. Plot your points on the graph from the table above. Draw a line through the points.
   (There will not be room on the graph for all the points. Leave off the last two points)



Lesson 4: Laboratory Activity - The Scientific Method

Scientists at the Cleveland Clinic are working very hard to develop cancer treatments that will destroy cancer cells while leaving the patient's own body cells intact. To test a new type of anti-cancer medication, cancer researchers first apply the drug to cancer cells grown in the laboratory to be sure the treatment will kill the cancer cells. Students can recreate this investigative process in the classroom with the experiment described below that follows the scientific method, the standard method followed by researchers around the world.

MATERIALS: yeast packets, small (3 oz or bathroom size) paper cups, sugar, white vinegar, very warm water (100°-110°F), measuring spoons, coffee stirrers

PROCEDURE:

1. Split class into lab groups of 2 – 4 students. Each lab group will need one yeast packet, some sugar, a half-teaspoon measuring spoon, 3 cups and 3 stirrers.
2. Have the students label their cups "control", "experiment 1" and "experiment 2".
3. Have students measure a half teaspoon of yeast from their packet and a half teaspoon of sugar into each cup. Explain to the students that the yeast are live cells that will grow when given food (sugar) and a proper environment (warm water) to grow in. The yeast cells are a model for the cancer cells used in a cancer research lab.
4. Have students fill their cups halfway with warm water. The exact amount of water added is not important, so long as each cup contains an equal amount of water. Have students use a marker to mark the waterline outside each cup.
5. Now students may create their experimental conditions. Have students set aside the cups marked "control". These cups represent cancer cells that are not treated. In the cups labeled "experiment 1", have students add one teaspoon of vinegar. This represents a known cancer treatment. Then in the cups labeled "experiment 2", students may add one teaspoon of any substance they think might kill the yeast cells. They could try food items like milk or soda, or they could try cleaners like dish soap or even mimic a radiation treatment by putting their cup in the microwave for a few seconds (don't leave it in longer than 15 seconds or so – it might explode!).
6. Stir the contents of each cup and set aside for twenty minutes or so while students record their hypothesis, experimental procedure and create a table for recording results in their lab book or on the activity sheet provided.
7. After 20 minutes, check the level of the yeast in each cup. The yeast in the control cup should have grown significantly, pushing a foamy column of carbon dioxide bubbles to the edge of the cup. The yeast in the cups with the vinegar should not have grown much, if at all. The acid in the vinegar kills the yeast. Have students record their results and draw conclusions about whether their experimental treatments were effective in killing the yeast cells, or at least preventing their growth.
8. Discuss which treatments worked and which did not. How does this compare to treatments researchers might be trying in their laboratories? What precautions must doctors take before trying any experimental treatment on a patient?

Resource:

- http://content.scholastic.com/browse/article.jsp?id=1631
  Magic school bus activity about growing yeast cells. Fun and informative.

TESTING CANCER DRUGS

In this experiment, you will get to test two treatments to kill yeast cells grown in your classroom. The first treatment, vinegar, is known to kill yeast cells. The second treatment is one you will make up. Think about what might make a good treatment for killing a living cell. Your work here will be like what scientists do when they look for treatments to kill cancer cells. Before any treatment can be tried on a patient, it must first be tested on cells grown in a laboratory. Scientists use the same method for testing these treatments as you will be using today!

The substance I wish to test today is:_____

Write your hypothesis below (what you think will happen):

Record the steps you took to set up your experiment:

STUDENT SCIENCE ACTIVITY SHEET – page 2

Record your results in the table below:

CUPS	TREAT-MENT	RESULTS (RECORD HOW MUCH THE YEAST GREW, WHAT IT LOOKED LIKE, HOW IT SMELLED, ETC.)
Control	None	
Exp. 1	Added 1 tsp Vinegar	
Exp. 2		

Record your conclusions below: Is vinegar a good treatment for killing yeast cells? Was the treatment you designed successful?

How is this experiment like what a real scientist would do in a cancer lab?

Lesson 5: Integrating Art and Science

A popular summer program at the Cleveland Clinic matches high school students with doctors and nurses to learn about medical research. The research these students assist with is cutting-edge, yielding exciting new ways to treat and prevent disease. In the fall, students return to their schools and tell their classmates about the experience. Art students at these high schools then have the opportunity to participate in a crossover program called eXpressions™ where artistic interpretations of the research projects are submitted for judging and public display at the Cleveland Clinic. In this lesson, your students will create their own artistic interpretation of a recent summer internship project.

Introduction: Show students the art pieces shown in "Student Handout 3" and read to them the artists' statements and the research summaries. These works represent two very different approaches to the same assignment. Discuss with students which artwork they prefer and why. Discuss the interesting aspects of each piece and its relevance to the research project interpreted.

Activity: Read the following research summary to students. Answer any questions the student may have and give them time to discuss possible ways to interpret the research. Tell students which art materials will be available to them. Give students time to sketch a rough draft of their artwork before they begin on the final piece. Ask students to write an artist's statement to go with the piece.

Student Research: Imagine working in a lab that grows cancer cells! Sixteen-year-old Tasheena Cheeks (middle) spent her summer growing cancer cells and then trying to kill them. Tasheena zapped some cells with radiation and gave strong medicine to others to see which treatment worked best. Tasheena worked side-by-side with doctors and lab technicians, learning to use delicate micropipettes and handle toxic chemicals safely. Some day, Tasheena hopes to become a medical researcher.

Wrap-up: If time permits, have each student present their work to the class. Have the students explain their artistic choices. Encourage students to give constructive feedback and ask questions of the artist.

Resource:

- www.clevelandclinic.org/civiceducation/expressions.asp
  Click on the virtual eXpressions™ exhibit to see student artwork.

eXpressions™: The Intersection of Art and Science

Research Summary:
The research represented here studied whether heart patients participating in a hospital program were more likely to follow their doctor's orders to adopt a healthy lifestyle than patients who did not participate in such a program.

Artist Statement:
My artwork is a picture of a tree, large and sturdy, being held up or supported by a heart. The tree in turn supports the life of all the creatures around it. It was done in pen & ink and watercolor.

Student Artist: Allegra D. Sewell
Student Researcher: Jill Peysha

Research Summary:
This piece interprets two research projects in one interesting symbol. The student researchers both worked with doctors who were investigating ways to improve health care. One doctor was investigating ways to prevent cancer while the other was trying to determine the best way to treat a certain type of heart condition.

Artist Statement:
This piece entitled …What Comes Around represents the circle of life as a solid ring containing holes of various sizes cut through it. The holes represent the many challenges large and small that occur within our lives. After hearing both the presentation on breast cancer awareness and on atrial fibrillation I made this piece to show the beauty of health. Even with the imperfections that challenge us, such as cancer carves into lives, with hard work and a little help everything can come together in the end. The teardrop in the middle represents the pain of the people who have had to fight terminal diseases and memorializes those who did not survive the battle.

Student Artist: Jennifer Smith

Student Researchers: Konrad Sawicki and Sameer Shakir

EDUCATIONAL STANDARDS MET

LANGUAGE ARTS

Ohio Language Arts Standards:	GRADES K – 2	GRADES 3 - 4	GRADES 5 - 7
Writing Processes	A - G	A - I	A - H
Writing Applications	A	D	D
Writing Conventions	A - D	A - D	A - C
Research	A, B	A - D	A - E
Communication: Oral and Visual	A, B, C	A, G	A - F

National Language Arts Standards:

Standard 2: Understanding the human experience
Standard 4: Communication skills
Standard 5: Communication strategies
Standard 6: Applying Knowledge
Standard 12: Applying language skills

SCIENCE

Ohio Science Standards:	GRADES K – 2	GRADES 3 - 5
Life Sciences	A, B, C	
Science and Technology	A	A, B
Scientific Inquiry	A, B, C	A, B, C
Scientific Ways of Knowing	A, B, C	A, B, C, D

National Science Standards:	GRADES K – 4 and 5-8
Unifying Concepts and Processes	Systems, order and organization Evidence, models and explanation Change, constancy and measurement Form and function
Science as Inquiry	Abilities necessary to do scientific inquiry Understanding about scientific inquiry
Life Science	Characteristics of organisms (K-4) Structure and function in living systems (5-8) Regulation and behavior (5-8)
Science and Technology	Abilities of technological design Understanding about science and technology
Science in Personal & Social Perspectives	Personal health Science and technology in society
History and Nature of Science	Science as a human endeavor

Technology

Ohio Technology Standards:	GRADES K – 2	GRADES 3 - 5
Technology and Society Interaction	A, C	A, D, E
Technology for Productivity Applications	A, B, C	A, B, C
Technology and Communication Applications	A, B, C	A, B, C
Technology and Information Literacy	A, B, C	A, B, C, D
Design	A, B, C	A, B, C

National Technology Standards:
Basic Operations and Concepts
Social, Ethical and Human Issues
Technology Productivity Tools
Technology Communication Tools
Technology Research Tools
Technology Problem-Solving and Decision-Making Tools

MATHEMATICS

Ohio Math Standards:	**GRADES K – 2**	**GRADES 3 – 4**	**GRADES 5 - 8**
Number, Number Sense and Operations	A, B	A	
Measurement	A – E	A – C	A, B
Patterns, Functions and Algebra	A, D	A, F	A, B, E, F
Data Analysis and Probability	A, B, C	A, B, C	A, B, E

National Mathematics Standards:
Standard 1: Number and Operation
Standard 2: Patterns, Functions and Algebra
Standard 4: Measurement
Standard 6: Problem Solving
Standard 8: Communication
Standard 9: Connections
Standard 10: Representation

FINE ARTS

Ohio Fine Arts Standards: Visual Art	**GRADES K – 4**	**GRADES 5 - 8**
Historical, Cultural and Social Contexts	C	C
Creative Expression and Communication	A, B, C, D	A, B, C, D, E
Analyzing and Responding	A, B, C	A, B, C
Valuing the Arts/ Aesthetic Reflection	A, B, C	A, B

National Fine Arts Standards: Visual Arts, Grades K - 4, 5 - 8
Standard 1: Understanding and applying media techniques and processes
Standard 2: Using knowledge of structures and functions
Standard 3: Choosing and evaluating a range of subject matter, symbols and ideas
Standard 5: Reflecting upon and assessing the characteristics and merits of their work and the work of others
Standard 6: Making connections between visual arts and other disciplines