THE JOURNEY TO END CANCER

FROM CAUSE TO CURE

PRESENTED BY

Cancer®

UT MD Anderson

CLASSROOM TEACHER'S GUIDE — GRADES 3-5

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The Journey to End Cancer: From Cause to Cure is presented by The University of Texas MD Anderson Cancer Center.

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WELCOME TO THE JOURNEY TO END CANCER: FROM CAUSE TO CURE

Partnering with leading researchers and clinicians, The Journey to End Cancer: From Cause to Cure guides your students through the most up-to-date scientific investigations into cancer – one of the biggest health challenges of all time. Cancers, and there are many, affect millions of people around the world every year. Most likely, they impact the lives of many of your students, your colleagues, and maybe even yourself.

The Journey to End Cancer is an innovative, interactive science exhibition that examines the complex nature of cancer. Your students will experience firsthand how groundbreaking research and cutting-edge technologies unlock the mysteries of cancer and reveal solutions to end it once and for all.

How? By asking the right questions. Ones that unveil advances in cancer science, detection, treatment, prevention, and collective action.

- What is cancer?
- How do we detect cancers?
- How do we treat cancers?
- How can you reduce your risk?
- Can we end cancer together?

To answer these questions, the exhibition **The Journey to End Cancer** offers your students a unique glimpse into the world of scientific research and its direct effect on their personal health decisions. They will meet heroes on the front lines of ending cancer, from researchers to cancer care specialists, to survivors and caregivers, all who will inspire them to act in their own communities.

You will find something to engage students of all skill levels and interests on a field trip to **The Journey to End Cancer**. There are opportunities to connect the educational themes of the exhibition to the mandated national and local STEAM content requirements. Teachers of Science, Math, Language Arts, Social Studies, and Health will find this experience relevant to their classroom lessons and activities.

This Teacher's Guide features a curriculum that is interdisciplinary across several grade levels and areas of study. It is important to note that it is not intended to be used in addition to what you already must teach, but rather as a multidisciplinary, standards-compliant way to meet your daily instructional requirements.

The Journey to End Cancer is an opportunity for your students to see the real-world impact of their STEAM learning. On this interactive journey, they will discover how the ever-evolving world of science and research connects them to the discoveries of the past and prepares them for breakthroughs in the future. Ask your students: Are you ready to join the movement to end cancer?

WHAT TO EXPECT ON YOUR FIELD TRIP

The accessible messages and welcoming tone of *The Journey to End Cancer* break things down for your students in ways they will understand and remember.

The Journey to End Cancer invites your class to learn about the groundbreaking progress toward ending cancer. Five questions. Five galleries. Each unlocks new powers to eliminate cancer.

1. **KNOW IT.** What is cancer? Unlock the power of scientific understanding.
2. **FIND IT.** How do we detect cancers? Unlock the power of earlier and better detection.
3. **TREAT IT.** How do we treat cancers? Unlock the power of more effective and precise treatments.
4. **PREVENT IT.** How can you reduce your risk? Unlock the power of healthy actions.
5. **DEFEAT IT.** Can we end cancer together? Unlock the power of collective impact.

To help your students along their journey, each gallery will feature inviting displays:

- **Guideposts** to spark curiosity about the topic explored in that gallery.
- **Multimedia experiences** to involve students with story-based moments of wonder and discovery.
- **Unique science interactives** to explore cancer science in surprising and empowering ways.
- **Animations and graphics** to deliver cancer science and data in engaging, bite-sized moments.
- **Print Infographics** to break down science content to its essence so it is easier for students to grasp.
- **Story Pods** to feel connected and ready to act through inspiring video stories from diverse cancer survivors, caregivers, scientists, and others.

LOVE YOUR CELLS

Your field trip begins with a dynamic experience in the first gallery, showcasing the science of cells. Stunning visuals, dynamic lighting, and dramatic zoom-ins and zoom-outs draw students into the latest advances. These discoveries are leading to new ways of detecting cancers earlier and better, treating cancers more effectively, and preventing cancers before they start.

KNOW IT

To end cancer, we must first understand it. Cancer always starts with errors — gene variants — in the DNA of cells. But we do not always know what causes these errors. "MISTAKES HAPPEN" is a quick-fire activity where students try to beat the clock to match rapidly changing visual patterns and colors. In real life, replication in cells happens much, much faster and with way more information. When your cells replicate, they copy billions of nucleotides — little, tiny bits of information in your cellular instructions — in a flash. During this game, students come to realize how easy it is for mistakes to happen during cell division.

A visual introduction to how cancer starts identifies some of the recognized sources of the gene mutations that lead to cancer, some by chance and others with known causes. Understanding both origins can help your students make choices to lower their cancer risk.

Cancer happens when a healthy, hardworking cell in the body changes, enabling it to "go rogue" and multiply and spread uncontrollably. An animated "ROGUES GALLERY" follows a healthy cell through a series of mutations that transforms it from vital to cancerous, making a complex idea engaging and memorable for your class.

Science is constantly unveiling discoveries about cancer. "WAIT, WHAT?" is a wall with interactive circles that reveal some surprising facts about cancer.

So, who gets cancer? Studying clues about cancer in humans and animals helps us understand what cancer is and how we can better detect, treat, and prevent it. Students will find information about cancer in humans, animals, and back in time (even dinosaurs got cancer!).

FIND IT

For many cancers, early detection dramatically improves five-year survival rates. This is particularly true for cancers of the lung, breast, prostate, colon, and cervix, all of which can be effectively screened for at appropriate times in life.

In this gallery, students take on the role of a "CANCER DETECTIVE" and investigate a variety of methods to uncover cancers in various parts of the body. They will use simulated tools and technologies like MRI,

Q. Which body part rarely gets cancer?

A. The Heart. Because heart muscle cells do not multiply often.

PET scan, molecular test, tissue biopsy, and more, to look for cancer. They can even add the power of AI to boost their detective skills through enhanced imaging. Students will come away reassured that if cancer is lurking somewhere in the body, science will find it.

"FUTURE DETECTION" is a large visual highlighting the exciting — and unusual — advances that are transforming cancer detection and diagnosis. Imagine cancer-sniffing dogs and cancer-smelling bees! Wild ideas today could become life-saving tools tomorrow.

For some cancers, a powerful way to detect early signs is to "go inside" the body and look. This is particularly true for cancer of the colon, or large intestine, currently the third most common cancer worldwide. In "POLYP PURSUIT," students perform a virtual colonoscopy, searching for growths that can potentially develop into cancer. They will navigate a virtual camera through a simulated colon and use computer-generated tools to remove polyps until the colon is clear.

"THE POWER OF EARLY DETECTION" shows what happens when diverse types of cancer are found early versus those that are discovered at later stages. Understanding the stages of cancers helps doctors, cancer survivors, and their families determine the best treatment strategy. The typical stages of cancer are illustrated to show students that the addition of more variants in the DNA of cancer cells allows them to grow and spread more aggressively.

Every cancer diagnosis experience is unique. "I HAVE CANCER?" features interviews with survivors and others as they share their personal stories.

TREAT IT

How do we treat cancers? And how do today's breakthroughs build on the past? Cancer treatments are advancing faster than ever, revolutionizing the effort against cancer, saving lives, and sparking new optimism.

"BREAKTHROUGH!" takes students on a video journey through time, celebrating the bold ideas and pioneering science that mark monumental breakthroughs in cancer treatment. From ancient practices to tomorrow's technologies, they will witness how progress is speeding up and bringing us closer to ending cancer as we know it.

Navigating an interactive timeline, students discover the advances behind today's "Five Pillars" of cancer treatment. They are encouraged to think about what could come next among the future of cancer care.

"SUPER CELLS" is a game-based experience where students supercharge immune cells to better defend against cancer. They will learn the basics of how T cells work as they track down, identify, and eliminate as many rogue cancer cells as possible. This high-energy, hands-on introduction to the science of immunotherapy makes it easier for your students to understand it. Discovering how science can power up our immune systems to outmaneuver cancer is an exciting frontier in cancer treatment.

Fiber in your diet keeps your gut healthy and may help reduce your risk of certain cancers. It may even help improve the effectiveness of some cancer treatments. With "GUT CHECK," an eye-catching infographic spotlights the power of fiber in your diet. Fiber works to keep your colon running smoothly and supports a healthy gut microbiome, which is crucial for a strong immune system.

Undergoing treatment for cancer can be very tense and demanding. Stress weakens the immune system and complicates the healing process. In "CALM," students learn about the power of stress-busting techniques for cancer patients, caregivers, or anyone who might benefit from them. They will explore calming techniques that, used regularly, can improve emotional wellness and keep you healthier.

Considering the entirety of the individual is so important in cancer treatment. "THE WHOLE PERSON" emphasizes the significance of integrative therapies in enhancing cancer outcomes. Practices like yoga, acupuncture, healthy eating, and art and music therapy are backed by science and can improve cancer treatment. Students discover that caring for mind-and-body is a secret superpower in the effort to end cancer. And for everyone to live happier and healthier lives!

Just as everyone's cancer is unique, every treatment journey is too. In "HEROES," students will hear personal stories from diverse cancer survivors, caregivers, treatment team members, and behind-the-scenes staff who contribute valiantly to the cancer care effort. These stories are reminders that heroes come in many forms, and it takes a whole team to support the effort to treat an individual cancer patient.

Every cancer treatment in the U.S. needs approval from the Food and Drug Administration (FDA) to make sure it is safe and effective. As part of this process, treatments are tested in clinical trials involving real people. "TRIALBLAZERS" celebrates these brave participants and emphasizes the need for greater diversity and inclusion

in clinical trials. These research studies conducted throughout the U.S. test how well new medical approaches work in people.

PREVENT IT

What is the best way to end cancer? Prevent it from starting in the first place. You can take steps to lower your risks through healthy habits that protect your cells.

"RISKY BUSINESS" reimagines the topic of cancer prevention as a digital game, involving strategy along with some elements of chance. At each stop in the game, students get to make a choice: a healthy choice or a not so healthy choice. A personal risk meter measures the impact of their selections. Students learn that even small daily choices—eat a donut or walk the dog—will lower their risk of getting cancer.

The "POWER OF PREVENTION" highlights compelling statistics that students can analyze, compare, and contrast to see the effectiveness of cancer prevention. Research shows that 40% to 50% of cancers are associated with modifiable risk factors. Lifestyle choices linked to meaningful reductions in cancer risk include avoiding smoking, and alcohol, maintaining a healthy weight, getting routine cancer screenings, eating a cancer-wise diet, scheduling regular exercise, protecting your skin from ultraviolet (UV) radiation, and getting vaccinated against HPV and hepatitis.

Video stories in "A PATH FORWARD" capture the range of emotions and experiences that come with surviving cancer or having cared for someone through treatment. It is another opportunity for your students to make an emotional connection to the science of cancer prevention.

DEFEAT IT

Can we end cancer? That depends on all of us doing our part, both individually and together, to ensure that everyone has fair access to the best cancer prevention, detection, and treatment.

"THE POWER OF US" is a collaborative interactive where students physically move and play to reveal a celebratory image on a reactive wall. The more students work together, the more the image comes into focus — driving home the power of collective action.

"WORLDWIDE EFFORT" reveals initiatives that people all over the world are working on to end cancer. Students can spin a globe to see major centers of action on each continent and tap on hotspots to learn about different international efforts. The fight against cancer even extends into space with cancer research aboard the International Space Station!

"IN IT TOGETHER" uses simple graphics and easy-to-understand facts to show how important it is for everyone to have the resources they need to stay healthy and safe from cancer. Every student in your class can make a difference in the movement to end cancer. Each step adds up to change. Band together at your school to create a world without cancer!

CANCER STRIKETHROUGH

As they exit **The Journey to End Cancer**, students are welcomed to leave a personalized message on UT MD Anderson's interactive "Cancer Strikethrough" wall. Here, they can express their own thoughts, feelings, experiences, and hope. A nearby QR code links to trusted online resources.

Teachers, a field trip to the exhibition **The Journey to End Cancer** is a memorable way to help your students see the real-world impact of their STEAM learning. Let your voices be heard. Join the chorus of people committed to ending cancer once and for all.

USING THIS TEACHER'S GUIDE

As a companion to your field trip experience, this Teacher's Guide has been developed to complement your classroom instruction and make the most of your school field trip to The Journey to End Cancer. It contains original, assessable, STEAM-related classroom lesson plans featuring dynamic activities and assignments for students in grades three through five. There is also a Teacher's Guide for Middle School, grades six through eight. Both resources have been created to be flexible. Use them to best meet the needs and capabilities of your class. You know your students better than anyone else.

Following this introduction, you will find **Ignite:** four interdisciplinary classroom lesson plans and project-based inquiries addressing national and local curriculum standards. The lesson plans begin with instruction pages for teachers that include answer keys and a list of the content areas and skills addressed by the activities. You will see how concepts and content used to create cures for cancer in the future have their foundations in the curriculum you must teach your students today.

Rounding out the lessons are ready-to-copy Student Activity pages that center on key STEAM topics featured on your visit to **The Journey to End Cancer** and include "Terms to Know" for vocabulary development. Using a scaffolding approach, the parts of each lesson consider a variety of instructional techniques. Use these to move your students progressively toward a stronger understanding of the content, with both objective and subjective assignments for assessment.

The first lesson, **A Model Cell**, reviews key terms of cell biology, especially as they relate to a basic explanation of how cancer develops and grows in the body. In Part 2, your class will apply this foundational knowledge to construct a pliable, 3D model of a cell.

In the second lesson plan, **Your Detection Invention**, students review six basic anatomical systems and body parts likely to be affected by the kinds of cancers that scientists hope will someday be detected early. Working with partners or in groups, students will then imagine and design a new, noninvasive testing tool incorporated into an everyday item that could check for biomarkers.

For the third, **Treatment Over Time**, students will read a source adapted from a 1921 article describing the case of an owner of a mail-order company who pled guilty to charges related to his fake cancer cures and claims. Next, they will practice their math skills as they analyze and interpret data on the increase of FDA-approved cancer treatments since 1949.

The fourth lesson, **Eat It to Defeat It!**, is based on the fact that diet is a choice made every day, and it can help reduce risks of some cancers. Students will study a chart of nutritious foods, their food groups, and the nutrients in them that help support better nutrition and then compare them to their typical school lunch menu. Then, they will evaluate the ingredients, food groups, and nutrients in a selection of Super Snack recipes.

The next section, **Evolve**, has themed games and puzzles you can assign for extra credit or earmark for your bus ride to and from the exhibition. **Inspire** includes additional classroom resources for your own background knowledge and context, and to use with your students as you see fit. These include a timeline of developments in cancer treatments, glossary of scientific cancer terms, and data on cancer treatments.

We know how important it is to be able to justify field trips and document how instructional time is spent outside of your classroom. In **Understand**, this Teacher's Guide is directly correlated to the Next Generation Science Standards, Common Core State Standards for Mathematics and English Language Arts, C3 Framework for Social Studies State Standards and National Health Education Standards.

You can readily see how the lesson plans and your field trip fit into your required curriculum making it easier than ever to connect a field trip to **The Journey to End Cancer** with your classroom teaching. These educational resources can be used before your group visit to help prepare students for the teachable moments found throughout exhibit as well as when you return to school to further explore connections between these educational themes and your daily STEAM instruction.

Ending cancer is not just a job for scientists and doctors. By asking the right questions and working together, you and your students can make even more progress. Take action to KNOW IT, FIND IT, TREAT IT, PREVENT IT, and DEFEAT IT!

LESSON PLAN 1 — A MODEL CELL

Teacher Instructions

Science, Fine Arts, Life Science, Visual Art

At their age, your students' bodies are made up of about 17 trillion cells. It is hard to picture just how many 17 trillion of anything is but let's try! If we counted 17 trillion seconds, it would be over 538,000 years. Going back in time, this would put us in an ice age with mammoths, saber-toothed cats, and giant ground sloths. If we lined up 17 trillion pennies, they would stretch 269 billion miles, which is far beyond our own solar system.

As we grow, that number of cells increases. The body makes new cells with one "parent" cell, dividing into two cells, called the "daughters." The parent shares its DNA with the daughters. DNA tells each cell what it will become and what its job in the body will be. Cancer can start with mistakes inside the DNA of just one cell. These mistakes are gene mutations.

Your students will need to know some of the parts of a cell and how a cell works in order to understand how cancer grows inside the body. DNA is found in the nucleus of the cell. It delivers its genetic instructions to the rest of the cell by sending out messengers, called mRNA. The ribosomes read the instructions from the mRNA to find out which proteins it needs to make to get things started. Now the rest of the cell is ready to get its working orders!

Cancer means that a cell cannot do the work it was made to do, according to the directions in the DNA. Something happens to the DNA and the wrong message gets sent out on the mRNA to the ribosomes. Cancer changes the cell from its original assignment to doing just one thing and one thing only: making more cancer cells.

In Part 1 of this lesson plan, your students will review key terms of cell biology, especially as they relate to a basic explanation of how cancer develops in the cell. In Part 2, your class will construct a pliable, 3D model of a cell. The instructions for that model are included below with options to customize it to the abilities and interests of your students.

PART 2 — TEACHER'S INSTRUCTIONS

A 3D cell model building activity using balloons appears in Part 2. The materials and steps are detailed here in the Teacher Instructions section. Decide if you want your students to build smaller models in groups or if you would prefer to do one large model as a demonstration. Prepare the supplies proportionally and accordingly. Warning! This craft can get a little messy, so protect the work surfaces before you begin!

The goal is to fill a balloon, as the cell membrane, with "cytoplasm" and various repurposed objects to stand for key organelles. Clear balloons are available online and from party supply stores. They come in a variety of sizes. The "minis" (5-inch) are appropriate if your students work in small groups, but a larger balloon (12-inch) is better if this activity is done as a demonstration in front of the whole class. Water balloons are preferable but not required. Translucent balloons are also an option if the items inside can be seen from the outside.

The viscous cytoplasm is made from light corn syrup and water. For students working in groups, pre-measure the mixture and provide an adequate amount in a ziplocked bag at each workstation. Objects like water beads, plastic beads, buttons, pieces of ribbon, scraps of colored paper etc. should be assorted sizes. If you build the model as a class demonstration, you will not need as many items to serve as organelles. Incorporate as many of the organelles as your students have mastered.

NOTES ON CYTOPLASM:

- Cytoplasm is a 2:1 light corn syrup to water mixture.
  - This means you use 2 units of corn syrup for every 1 unit of water; for example, 2 tablespoons of syrup and 1 tablespoon of water; or 2 cups of syrup and 1 cup of water
  - Adjust water amount to achieve desired consistency
- Volume:
  - About 1 liter (36 fl oz) cytoplasm per 5-inch balloon
  - About 14 liters (500 fl oz) per 12-inch balloon
  - Adjust measurements as needed based on the balloon sizes you use
- If you want students to mix their own cytoplasm solution at their workstations, provide the separate liquids, mixing containers, and utensils needed.

NOTES ON ORGANELLES:

- Tell your students how many organelles you expect them to add to their model. They will have a list, ranked largest to smallest and including shapes, with terms from Part 1 and other cell parts.
- For student groups, prepackage a random assortment of these items in baggies and distribute one at each workstation.
- For a whole group demonstration with the big cell, you will not need as many "organelles," but they need to be larger to be visible.
- Provide a range of items in each collection to account for details like relative size and shape of the organelles.
  - For example, the largest bead can be the nucleus, small beads for mitochondria, tiny beads or seeds for ribosomes, etc.

MATERIALS (TEACHER VERSION):

- Clear balloons (small/5-inch or large/12-inch)
- Colorful repurposed, crafting items: water beads, small plastic beads of various sizes, buttons, seeds, glitter, short pieces of ribbon or yarn, plastic counters, scraps of colored paper, fuzzy poms-poms, etc.
- Water
- Light corn syrup
- Measuring cups and spoons
- Ziploc bags
- Mixing bowl and spoon to make the cytoplasm
- Funnel(s)
- Scissors
- Chopstick or paint brush with long handle

STEPS (TEACHER VERSION):

1. Mix the cytoplasm (2:1 syrup to water) using the light corn syrup, water, measuring tools, mixing bowl, and mixing utensils. The amount will depend on whether you are structuring the model as a class demonstration or for multiple small groups to build.
2. Pour cytoplasm into a Ziploc bag.

PART 2 — TEACHER'S INSTRUCTIONS (cont.)

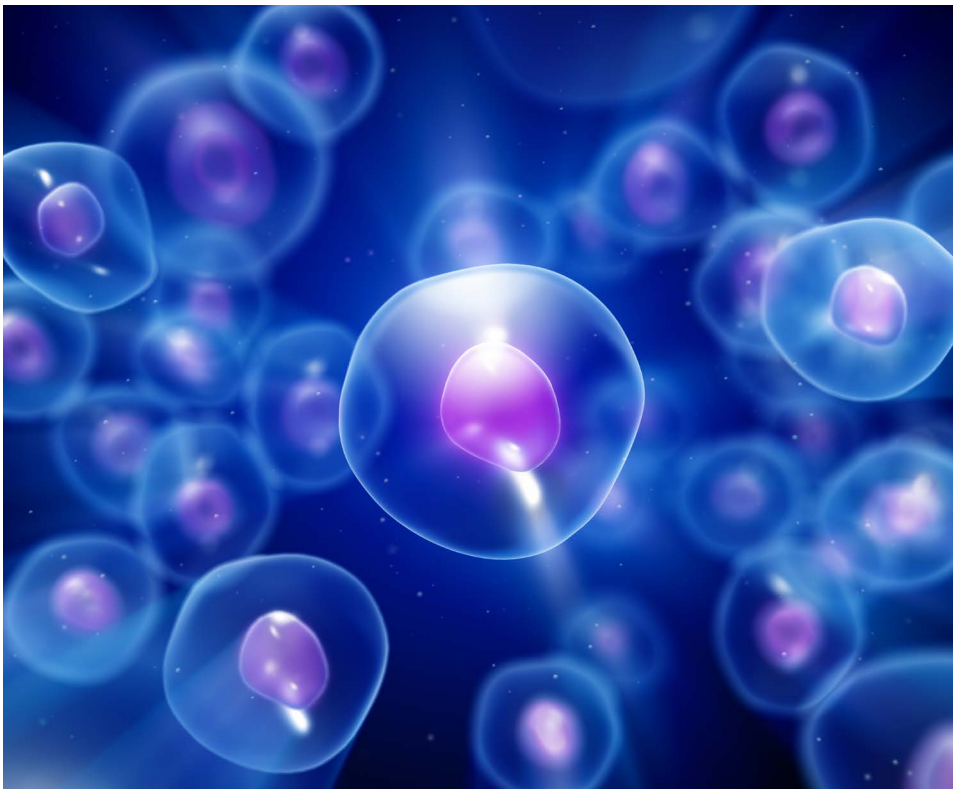
3. Insert the small end of the funnel into the mouth of the balloon.
4. Snip a corner off the plastic bag with the cytoplasm and use that opening to pour the mixture into the funnel.
5. Squeeze the cytoplasm mixture through the bag and funnel into the balloon until it is 2/3 full.
6. Set the cytoplasm aside. Pay attention to how you put the bag down, so it does not leak.
7. Insert the organelles through the funnel. Carefully use a chopstick or paintbrush as a tool to move the organelles gently around in the cytoplasm. Don't pop the balloon!
8. Keep track of which objects stand for which organelle. Students can fill in this part on their own Activity Page if you are demonstrating to the whole class.
9. Finish filling the balloon, if needed, and tie it off. The balloon does not need to expand all the way. Students may need help tying off their own balloons.

ANSWER KEY: *Part 1:* 1b, 2e, 3g, 4f, 5c, 6i, 7h, 8a, 9d, 10j. *Part 2:* Answers in the student chart will vary based on the organelles in the models. For the process of the mRNA traveling to the ribosomes, verify that the organelles they describe match their key.

NAME _____ CLASS _____ DATE _____

A MODEL CELL

Student Activity



Did You Know? Almost all mammals can get cancer, except for naked mole rats! Scientists really want to know why and how this discovery can help humans Know It, Find It, Treat It, Prevent It and Defeat It.

Terms to Know: expand, funnel, genetic, helix, molecule, mutation, trillion

Right now, your one body is made up of about 17 trillion cells. It is hard to picture just how many 17 trillion of anything is but let's try! If we counted 17 trillion seconds, it would be over 538,000 years. Going back in time, this would put you in an ice age with mammoths, saber-toothed cats, and giant ground sloths. If we lined up 17 trillion pennies, they would stretch 269 billion miles, which is far beyond our own solar system.

As you grow, that number of cells increases. Your body makes new cells with one "parent" cell, dividing into two cells, called the "daughters." The parent shares its DNA with the daughters. DNA tells each cell what it will become and what its job in the body will be. Cancer can start with mistakes inside the DNA of just one cell. These mistakes are gene mutations.

You will need to know some of the parts of a cell and how a cell works to understand how cancer grows in the body. DNA is inside the nucleus of the cell. It delivers its genetic instructions to the rest of the cell by sending out messengers, called mRNA. The ribosomes read the instructions from the mRNA to find out which proteins it needs to make to get things started. Now the rest of the cell is ready to get its working orders!

Cancer means that a cell cannot do the work it was made to do, according to the directions in the DNA. Something happens to the DNA and the wrong message gets sent out on the mRNA to the ribosomes. Cancer changes the cell from doing its original job to now doing just one thing and one thing only: making more cancer cells.

NAME _____ CLASS _____ DATE _____

PART 1

Review these key parts of the cell. Match the words to their meanings below. Use your science class resources or search online.

a.	cell	d.	cytoplasm	g.	nucleus	j.	endoplasmic reticulum (ER)
b.	cell membrane	e.	DNA	h.	organelles		
c.	chromosomes	f.	mRNA	i.	ribosomes		

1. _____ a thin covering that goes around a cell and holds all its parts together inside

2. _____ instructions for the cell's job (for example, how to become blood, skin, a taste bud, part of the lungs, etc.), written as a code and formed as a double helix

3. _____ largest organelle, it directs all a cell's activities, like its brain or control center

4. _____ thread-like pieces of a coded messenger-chain; they copy instructions from the DNA, take the copy out of the nucleus, and deliver it to the ribosomes

5. _____ molecules inside the nucleus that hold and organize the cell's DNA

6. _____ organelles that make special proteins for the one job that cell has, after they get the instructions delivered by the mRNA

7. _____ parts of a cell floating around in cytoplasm working together to carry out the cell's job

8. _____ the basic unit or "building block" of everything that is alive, like animals, plants, bacteria, fungi, etc.

9. _____ the clear, jelly-like substance inside the cell that all the organelles float in (like the water in a water balloon, but thicker like gel or clear slime)

10. _____ the bumpy part of this organelle shapes and packages the cell's instruction proteins from the ribosomes and gets them ready to send out to the rest of the cell

NAME _____ CLASS _____ DATE _____

PART 2

Build a 3D cell model, beginning with a balloon for the cell membrane

Materials

- Clear balloon
- Small, colorful objects: plastic beads, buttons, seeds, glitter, short pieces of ribbon or yarn, plastic counters, fuzzy pompoms, scraps of colored paper, etc.
- Cytoplasm mixture (2 parts light corn syrup and 1 part water)
- Funnel
- Scissors
- Chopstick or paint brush with long handle

Steps

1. Mix the cytoplasm if it is not ready. (Ask your teacher.)
2. Insert the small end of the funnel into the mouth of the balloon.
3. Cut a corner off the plastic bag with the cytoplasm and use that opening to pour the mixture into the funnel.
4. Squeeze the cytoplasm mixture through the bag and funnel into the balloon until it is 2/3 full.
5. Set your cytoplasm aside. Pay attention to how you put the bag down, so it does not leak!
6. Review this list of organelle sizes and shapes to decide which items you want to use to stand for your organelles inside the balloon. The organelles in italics are required.
   - Nucleus (sphere or oval)—largest
   - Mitochondria (rod/oval)
   - Endoplasmic Reticulum (rough: bumpy, folded sheets; smooth: tubes)
   - Golgi Apparatus (flat, round)
   - Lysosomes (sphere)
   - Ribosomes (sphere)
   - mRNA (flexible ribbon)—smallest
7. Insert the organelles through the funnel. Use a chopstick or paintbrush as a tool to gently move the organelles around in the cytoplasm. Don't pop the balloon!
8. Keep track of which objects stand for which organelle in the chart on the next page.
9. Finish filling the balloon and tie it off (or ask your teacher to help tie it). The balloon does not need to expand all the way.
10. Admire your cell and fill in the chart below describing your cell model.

NAME _____ CLASS _____ DATE _____

This chart is your key for your 3D cell model. Part of the chart is filled in for you, beginning with the terms from Part 1. Describe the object that stands for each part in your model. There are spaces for additional organelles.

CELL PART	MODEL
cell membrane	balloon
cytoplasm	water and syrup
nucleus	
mRNA	
ribosome	

Draw your cell model:

NAME _____ CLASS _____ DATE _____

Reread this part from the Introduction:

> *DNA is inside the nucleus of the cell. It delivers its genetic instructions to the rest of the cell by sending out messengers, called mRNA. The ribosomes read the instructions from the mRNA to find out which proteins it needs to make to get things started. Now the rest of the cell is ready to get its working orders!*
>
> *Cancer means that a cell cannot do the work it was made to do, according to the directions in the DNA. Something happens to the DNA and the wrong message gets sent out on the mRNA to the ribosomes.*

Describe what your model would look like if the cells could not do their job, based on the items you used for the parts of the cell. (Note: DNA is not visible because it stays inside the nucleus.)

LESSON PLAN 2 — YOUR DETECTION INVENTION

Teacher Instructions

Science, Health, Fine Arts

Life Science, Engineering & Technology; Functional Health; Visual Art

If people know their body has just started making cancer cells, they can get help from doctors and start getting better before they even feel sick. With new tools like tests that can be used at home, it is getting easier for people to check to see if they have cancer. But how do they work? They look for the same clues that doctors do in labs and hospitals. These clues are called biomarkers.

If your students' grownups have ever taken them to the doctor to see if they had the flu, COVID, or strep throat, the doctor took samples from their noses and mouths to look for special signs of those sicknesses, called biomarkers. A positive test tells the doctor if an illness was found, and which one. Cancer biomarkers, signs that a person might have cancer, are similar. They are usually found by checking some blood. But new testing tools could check for biomarkers without blood and without leaving home!

At **The Journey to End Cancer**, your class will learn about exciting ideas that could change how we find cancer. Imagine wearing a bracelet or watch that could tell if there were hidden tumors (lumps caused by cancer) in our bodies! This device would notice changes over time and help find problems before they become big issues. How about a toilet that checks our poop every day? This "smart toilet" would look for signs of sickness like cancer when we go to the bathroom! It sounds funny but catching problems early can save lives.

Both inventions would check for biomarkers like pieces of RNA or DNA from cancer cells just starting to grow, proteins made by cancer cells, and even actual parts of those cells. Where do we find such valuable clues? They are in our breath when we exhale, the saliva in our mouth, sweat on our skin, and hair on our scalp, among other places.

We already have tests for biomarkers in blood and urine, especially for lung and breast cancer. But those are only the beginning. What kinds of wearable technology and everyday things found in your home will hold the cancer tests of the future? What types of cancer will they look for? The sooner we find it, the quicker we can defeat it! With technology changing so fast, who knows what amazing things will come next? Maybe your students know!

Part 1 reviews, or introduces, six basic anatomical systems with biomarkers and body parts likely to be affected by the kinds of cancers the new inventions will detect. Students will briefly identify each system and then sort a list of the body parts and organs under the correct one.

Part 2 is Detection Invention time! Working with partners or in groups, students will design new technology to test cancer biomarkers noninvasively at home someday. Questions are provided to help them think through their ideas and plan their design, which will culminate in a flyer announcing their product to the medical community. Let your students know if they should be designing and creating on the computer or using real paper/poster board. They will pitch their ideas to the class at the end and vote for the best invention.

PART 2 — TEACHER'S INSTRUCTIONS

ANSWER KEY: *Part 1:*

Circulatory: body's transportation system for blood: blood
Digestive: breaks down the food you eat so the body can use it: mouth, stomach, throat, colon, esophagus, pancreas, liver
Nervous: body's communication network, sending out and taking in information: brain, eye
Respiratory: how your body breathes: lungs, throat
Urinary: system for cleaning the blood and getting rid of extra water: bladder, kidney

1. Throat because you breathe and eat through parts of your throat
2. Digestive
3. Answers will vary based on grade level and could include skeletal, muscular, reproductive, endocrine, etc.; those do not get cancer as often, or perhaps students have not learned about them yet

Check diagram for accurate placement

ANSWER KEY: *Part 2:*

There are six planning sections with three questions each. Answers will be based on the students' invention ideas and used in their flyer.

RUBRIC	POINTS (24 POSSIBLE)
Information from Question #1	3
Information from Question #2	3
Information from Question #3	3
Information from Question #4	3
Information from Question #5	3
Information from Question #6	3
Picture or Diagram • Labeled (2 points) • Neatness (2 points) • Color (2 points)	6

NAME _____ CLASS _____ DATE _____

YOUR DETECTION INVENTION

Student Activity

Terms to Know: bladder, colon, device, esophagus, kidney, kinetic, liver, organ, noninvasive, pancreas, saliva

If people know that their bodies are starting to make cancer cells, they can get help from doctors and start feeling better before they even get sick. New tools, like tests you can use at home, are making it easier to check for cancer. But how do these tests work? They look for clues called biomarkers, just like doctors do in labs and hospitals.

If your grownup has ever taken you to the doctor to see if you had the flu, COVID, or strep throat, the doctor took samples from your nose and mouth to look for signs of those sicknesses. Those signs are called biomarkers. When the test is positive, it tells your doctor and your adult what you might have. For cancer, biomarkers are usually found by checking blood. But new testing tools could look for these signs without needing blood and without leaving home!

At **The Journey to End Cancer**, you'll learn about exciting ideas that could change how we find cancer. Imagine wearing a bracelet or watch that could tell if there are hidden lumps (tumors) caused by cancer in your body! This device would notice changes over time and find problems before they become big issues. How about a toilet that checks your poop every day? This "smart toilet" would look for signs of sickness like cancer while you go to the bathroom! It sounds funny but catching problems early can save lives.

Both inventions would test for biomarkers like pieces of RNA or DNA from cancer cells just starting to grow, proteins made by cancer cells, and even parts of those cells. Where do we find such valuable clues? They are in your breath when you exhale, the saliva in your mouth, sweat on your skin, and hair on your scalp, among other places.

We already have tests for biomarkers in blood and urine, especially for lung and breast cancer. But those are only the beginning. What wearable technology and everyday things in your home will hold the cancer tests of the future? What cancers might they find? The sooner we find it, the quicker we can defeat it! With technology changing so fast, who knows what amazing things will come next? Maybe YOU know!

NAME _____ CLASS _____ DATE _____

PART 1

What kinds of cancer can new inventions find? Match six systems of the human body with the parts and organs on the list below. These are places in the body with types of cancer that scientists hope will someday be detected early, using devices like the one you are going to design.

Fill in the chart below for these six systems. Describe each one, then sort the body parts and organs under their correct system. Use your Science and Health books for help or check online. One system has been done for you as an example. (Hint—one of the body parts can appear in two systems!)

bladder	colon	kidney	mouth	stomach
blood	esophagus	liver	pancreas	throat
brain	eye	lungs	skin	

INTEGUMENTARY SYSTEM	CIRCULATORY SYSTEM	DIGESTIVE SYSTEM
Your body's outer layer includes hair and nails		
skin		

NERVOUS SYSTEM	RESPIRATORY SYSTEM	URINARY SYSTEM
Your body's outer layer includes hair and nails		
skin		

Compare your chart with a partner or small group in class. Talk about the questions on the next page and write your answers together.

NAME _____ CLASS _____ DATE _____

1. Which part of the body did you list in two systems? Why?

_____

_____

2. Which system has the most parts listed?

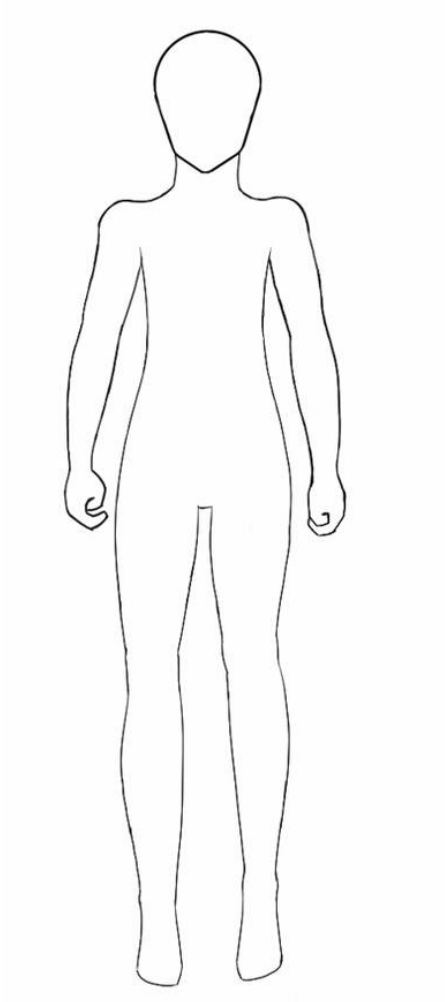
_____

3. Which organ systems are not on the list? Why?

_____

_____

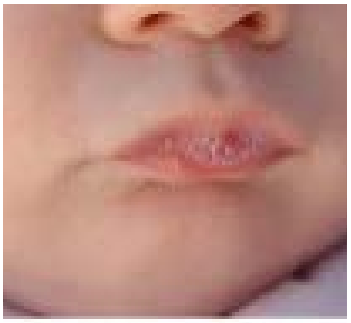
Draw and label the systems, organs, and other parts of the body listed in your chart. Do as best you can using this diagram.



NAME _____ CLASS _____ DATE _____

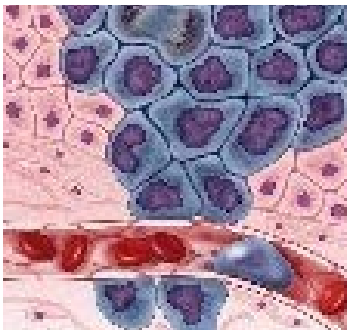
PART 2

It's Detection Invention time! Work with your partners to design new noninvasive technology to check for cancer biomarkers at home someday. These questions will help you plan. There are six sections here with three questions in each one. Answer all the questions asked about your invention in the "Your Ideas" sections. You will put this same information in a flyer for your amazing new product!



1. Where are you checking for biomarkers? What will your invention test?
   - For example: saliva, tears, sweat, hair, blood, breath
   - How will your invention collect the sample noninvasively?

   Your ideas: _____



2. Where are you checking for biomarkers? What will your invention test?
   - Is it for one kind of cancer? Or a few kinds in the same system or place in the body?
   - Should it check other signs of your health like temperature, oxygen level, heart rate, etc.?

   Your ideas: _____

3. What kinds of technology and/or everyday household object(s) will your invention use?
   - For example: toilet, hairbrush, jewelry, toothbrush, mirror, etc.
   - Is it something that we wear? Something we use every day? Is it built into our homes?

   Your ideas: _____

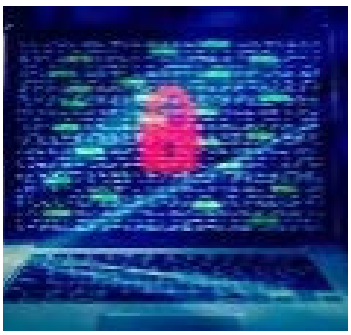
4. How does your invention get its power?
   - For example: batteries, charging cords, solar power, kinetic energy, etc.
   - Will you invent a new way to power your invention? How will it work?

   Your ideas: _____

NAME _____ CLASS _____ DATE _____

5. What happens to the health data that is collected? Where does it go and who checks it?
   - For example: stored within your invention, sent to an app on a phone, sent to your doctor, etc.
   - What happens next if a biomarker for cancer is detected in the data?

   Your ideas: _____



6. What problems might people find with your new cancer-detecting invention?
   - For example: too expensive, hard-to-find replacement parts, too big, too small, worried about the privacy of personal information, etc.
   - What will be your biggest design challenge? Have you already started thinking about how to solve these problems?

   Your ideas: _____

NAME _____ CLASS _____ DATE _____

Design Time!

1. Make a flyer to announce your cancer biomarker Detection Invention of the future. Create a picture of your device with its important parts labeled. Your flyer should explain how it will work and include all the information about your idea from questions #1-6 above. Be ready to present your flyer to the class and convince them that your idea is the future of cancer detection. At the end, everyone will vote for the best invention.

RUBRIC	POINTS (24 POSSIBLE)
Information from Question #1	3
Information from Question #2	3
Information from Question #3	3
Information from Question #4	3
Information from Question #5	3
Information from Question #6	3
Picture or Diagram • Labeled (2 points) • Neatness (2 points) • Color (2 points)	6

Honeybees smell with their antennae and scientists discovered they can sniff out more than just flowers! USGS Native Bee Inventory and Monitoring Lab

Did You Know? Dogs can smell cancer biomarkers! With their super-sensitive noses, dogs are being trained to detect the unique odors that cancers leave in our breath, sweat, and pee—offering a new way to find cancers early. Current research also shows that bees can smell lung cancer!

LESSON PLAN 3 — TREATMENT OVER TIME

Teacher Instructions

Science, Mathematics, English Language Arts, Social Studies; Life Science; Interpreting Data; Informational Reading; US History

How do we treat cancer? And how are the discoveries made today built on what people learned in the past? In the "TREAT IT" gallery on your field trip to The Journey to End Cancer, your students will travel through time to explore the brave ideas and inventions that have helped us defeat cancer so far. From old-time treatments to new technologies coming soon, they will see how far we've come and how we get closer to finding ways to defeat cancer every day!

But how do we know that cancer treatments are safe and that they work? Since 1906, a government group called the Food and Drug Administration (FDA) has made sure medical treatments are safe and do what they are supposed to, for cancer and other illnesses. They fight back against quacks and quackery! Not ducks, but fake doctors, fake medicines, and health fraud.

At first, medicine makers only had to say what was in their medicines and no one really bothered to check. In 1938, after many people got sick or died from unsafe medicines, new rules were made. These rules make sure that all ingredients and instructions for using medicines were correct. In 1962, the FDA started requiring clinical trials for new drugs. Clinical trials are research studies that test how well new medical approaches work in people. What kind of stuff was in those secret cures before there were laws against untested medicines? You might be surprised! Sometimes the ingredients included sand, baking soda, alcohol, and even poisons that cause cancer and death. Keep reading to learn how the government tried to stop dangerous drugs early in the FDA's history. Then see how scientists, researchers, and doctors have been working ever since to approve as many safe treatments as possible.

In Part 1, your students will read a primary source adapted from an article "Nostrums and Quackery" collected in Cancer Cures and Treatments, from the Bureau of Investigation at the Journal of the American Medical Association, 1921. It describes the case of an owner of a mail-order company in the early twentieth century who pled guilty to charges related to his fake cancer cures and claims. For emerging readers, this section can be read in groups or as a class.

Part 2 features data on the increase of FDA-approved cancer treatments over time, beginning in 1949 with the first approved chemotherapy drugs. Students will practice their math skills in representing and interpreting data with number operations and algebraic thinking, and look for trends in the growth rate of approved treatments.

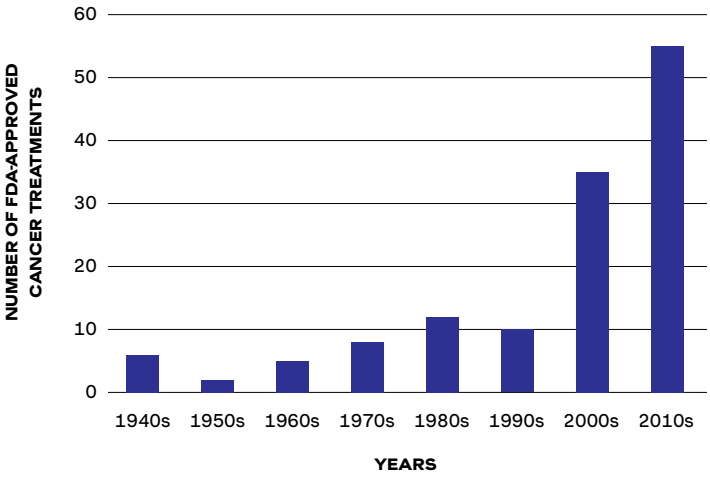
PART 2 — TEACHER'S INSTRUCTIONS

ANSWER KEY: *Part 1:*

1. C.W. Mixer
2. Hastings, Michigan
3. Getting money through the mail by "false and fraudulent pretenses, representations and promises"
4. Newspapers
5. They were sent letters in which they were urged to send money for the Drs. Mixer's "treatment"
6. From answers which the victims might give to a list of questions on a form; answers will vary but a diagnosis was most likely inaccurate because he never saw any of these victims in person or even spoke to them
7. No
8. 1910
9. He pled guilty
10. No, he just changed the name of the company and kept going
11. Answers will vary and may discuss being desperate for a cure, too far from a real doctor, lack of technology, communication, and transportation back then, etc.

ANSWER KEY: *Part 2:*

1.

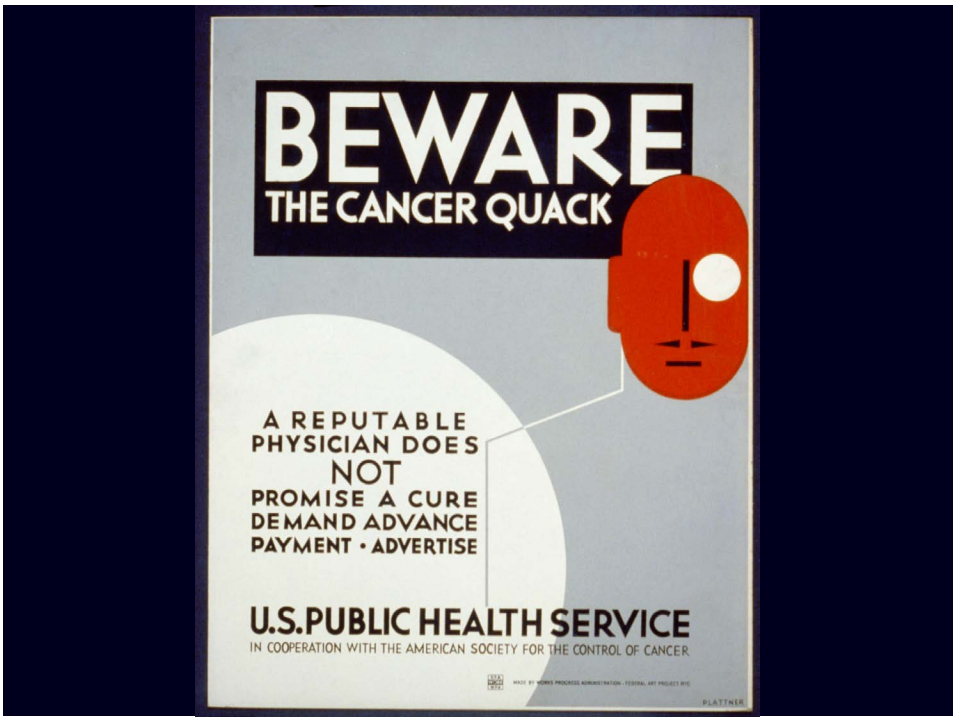


2. 133
3. 2010s, 55
4. 1950s, 2
5. 49
6. 1980s
7. 1950s, 60s, 40s, 70s, 90s, 80s, 2000s, 10s
8. 16.6 or round to 17
9. increasing
10. 15 over 5 years is 3 per year average so 30 for this decade; much less
11. Answers will vary based on students' ideas and understanding of US history and the history of science/technology

NAME _____ CLASS _____ DATE _____

TREATMENT OVER TIME

Student Activity



In the 1930s, the US government put posters up in medical offices warning patients with cancer to beware of "quacks"—fake doctors. WPA Poster Collection, Library of Congress Prints & Photographs Division

Terms to Know: arsenic, chemotherapy, clinical, decade, diagnosis, fraud, incisions, poultice, pretenses, quackery, tuberculosis, tumor

Have you ever wondered how we treat cancer and how today's discoveries build on what people learned in the past? In the "TREAT IT" gallery on your field trip to the exhibition, **The Journey to End Cancer**, you will travel through time to explore the brave ideas and inventions that have helped us fight cancer. From old treatments to exciting new technologies, you'll see how far we've come and how we are getting closer to defeating cancer every day!

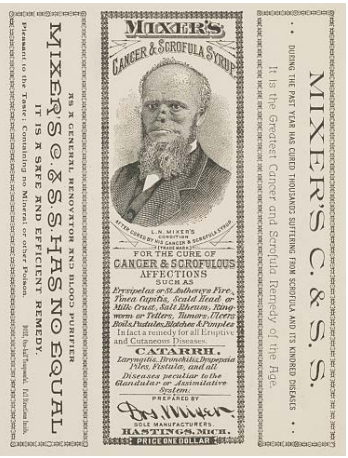
But how do we know that cancer treatments are safe and will work? Since 1906, a government group called the Food and Drug Administration (FDA) has been making sure that medical treatments are safe and effective for cancer and other illnesses. They protect us from quackery: fake doctors and bad medicines!

In the beginning, medicine makers only had to tell people what was in their medicines, and nobody really checked. In 1938, after many people got sick or even died from unsafe medicines, new rules were created. These rules make sure that all the ingredients and instructions for using medicines are correct. In 1962, the FDA began conducting clinical trials for new drugs. Clinical trials are research studies that test how well new medical approaches work in people.

What kind of stuff was in those secret cures before there were laws against untested medicines? You might be surprised! Sometimes they included sand, baking soda, alcohol, and even poisons that cause cancer and death. Keep reading to learn how the government tried to stop dangerous cancer "cures" early in the FDA's history. Then see how scientists, researchers, and doctors have been working ever since to approve as many safe treatments as possible.

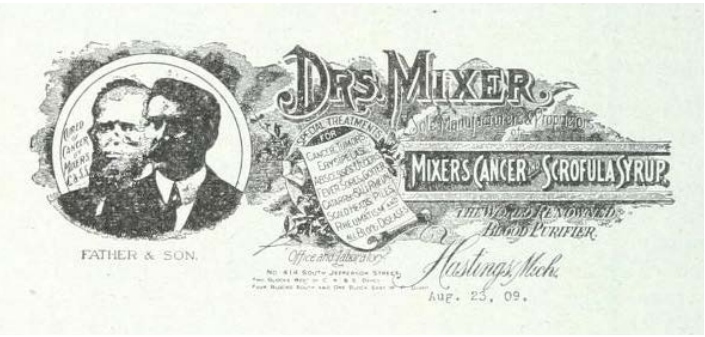
NAME CLASS DATE

PART 1: The Department of Agriculture and the Post Office helped the FDA keep Americans safe from fake doctors and their potions. One company caught cheating people was called "Drs. Mixer." They sold "Mixer's Cancer and Scrofula Syrup" through the mail. Their advertisements claimed it could cure cancer, skin rashes, infections, stuffy noses and throats, all blood diseases, and something called "scrofula" (a type of tuberculosis).



A bottle label for Drs. Mixer cancer cure from 1885. Mr. Lyman Mixer, the man pictured, started the company after he lost his nose to cancer, so he thought people would believe he was an expert. US Patent Office, Library of Congress Prints and Photographs Division

Does that sound too good to be true? It was—in fact, everything in the ads was false! On the next page, take a look at the official report from a courtroom trial against this company. After you read it, answer questions about these fake cancer medicines from Drs. Mixer.



This ad from 1909 shows Lyman with his son Charles Mixer. It came out right before real doctors and scientists studied the treatments and found out everything was fake. Nostrums and Quackery, Articles on the Nostrum Evil and Quackery Reprinted, with Additions and Modifications, from The Journal of the American Medical Association, 1912.

The dishonest "Dr. Mixer" was caught lying about fake cancer treatments and making a lot of money doing it. Read these reports from his 1911 court case. Answer the questions after each section.

"Drs. Mixer" was the name under which C. W. Mixer of Hastings, Michigan, had a mail-order "cancer cure" business. In 1909 Mixer was asked by the postal authorities to show why a fraud order should not be issued against his company. The charges brought against Mixer were that he was had a scheme [plan] for getting money through the mail by "false and fraudulent pretenses, representations and promises."

1. Who had the mail-order "cancer cure" business?

2. Where did he live?

3. What were the charges against him (his crimes)?

NAME _____ CLASS _____ DATE _____

Advertisements were put in newspapers asking people who believed themselves to have cancer, to write to Drs. Mixer for a "cure." Those who answered the advertisements were sent letters in which they were urged to send money for the Drs. Mixer's "treatment" for the cure of cancer. His company further said that a diagnosis of cancer could be given from the answers which the victims might give to a list of questions on a form.

4. Where did people see the advertisements?

_____

5. What happened after the people who thought they might have cancer wrote to Drs. Mixer?

_____

6. How was a cancer diagnosis made? How well do you think that worked?

_____

_____

It came out that there was no Dr. Mixer. Charles W. Mixer, who ran the business, had no medical education. His company was started by his father, L. N. Mixer, who had been dead for many years. ... Following the investigation, a fraud order was issued in January 1910. And November 1910, the food and drug officials called Mixer into court, where he pleaded guilty to misnaming his "treatment."

7. Was Charles Mixer a doctor, or did he have any medical education?

_____

8. When was Mr. Mixer brought to court?

_____

9. What was the outcome of the trial?

_____

_____

Mixer, however, continued his business by simply changing the name of his company from "Drs. Mixer" to "Mixer Medicine Company, successor to Drs. Mixer." This change was made using a rubber stamp on the old paperwork of the company.

10. Scientists found out that Mixer treatments did not have real cancer medicine in them. Do you think Mr. Mixer started being honest after that? Why or why not?

_____

_____

11. Why do you think people believed "Dr. Mixer" and other "quacks" selling fake cures?

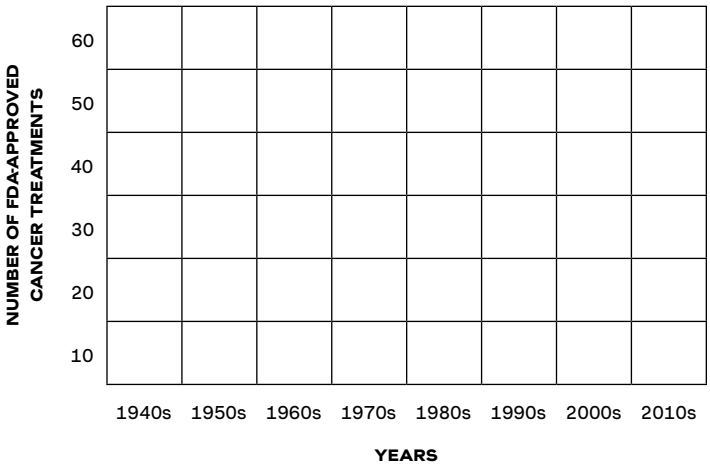
_____

NAME _____ CLASS _____ DATE _____

PART 2: When the FDA approves a treatment, it means that it is ready for doctors to give to their patients. This chart shows how many cancer treatments the FDA approved each decade since they began checking in 1949. Those first treatments were for a kind of medicine called chemotherapy. Today, we have many more treatment options and amazing discoveries are made every year.

YEARS	NUMBER OF FDA-APPROVED CANCER TREATMENTS
1940s	6
1950s	2
1960s	5
1970s	8
1980s	12
1990s	10
2000s	35
2010s	55

1. Use this grid to make a bar graph showing how many cancer treatments the FDA approved in each decade, using information in the chart above.



NAME _____ CLASS _____ DATE _____

Dr. Jane C. Wright (1919-2013) was the first African American woman to lead a cancer research program in the US. Her discoveries, especially in chemotherapy, were part of many FDA-approved cancer treatments. *National Institutes of Health, National Library of Medicine*

2. How many FDA-approved cancer treatments were there in total from the 1940s through the 2010s?

3. Which decade had the highest number of FDA-approved cancer treatments? How many were there?

4. How many more treatments were approved in the 2010s than in the 1940s?

5. Which decade had more cancer treatments approved, the 1980s or the 1990s?

6. List the decades in order from least to greatest number of FDA-approved cancer treatments.

7. What is the average number of treatments per decade from the 1940s through the 2010s?

8. Overall, is the trend in the number of cancer treatments going up or going down?

9. From 2020 to 2024, there were 15 new approved cancer treatments. At that rate, how many could we predict there might be for the 2020s decade (2020-2029)? How does that amount compare to 2010s?

10. Why might some decades have fewer or more treatments approved?

Did You Know? People have been trying to treat cancer for a long time. Around 2600 BC in ancient Egypt, a doctor and architect named Imhotep used sharp tools to cut out tumors and put special plant mixtures on them for treatment. We know now that the disease has been around even longer—from at least 80 million years ago! Scientists find signs of cancer in dinosaur fossils, like the leg bone of a Centrosaurus and the spines of Hadrosaurs.

NAME _____ CLASS _____ DATE _____

LESSON PLAN 4 — EAT IT TO DEFEAT IT!

Teacher Instructions

Science, English Language Arts, Health;

Life Science; Informational Reading; Health Behaviors

The best way to end cancer is to stop it from starting. Half of all cancer cases are connected to things we can change. We can make choices now that keep us from getting sick later, like wearing sunscreen to protect against skin cancer. At The Journey to End Cancer, you will play a "Fun in the Sun" game that shows you how to save your skin and eyes from sun damage.

Your diet is another choice you make every day that can help reduce the risks of getting some cancers. Eating healthily keeps you strong and lowers your risk of cancer. Scientists know that 5% of all cancer cases are linked to bad diets. If someone already has cancer, eating the right foods and avoiding the wrong ones will help them feel better and heal faster.

Food by itself is not a miracle cure, but a habit of healthy eating protects you from illness for a long time. Start by adding nutritious foods that create better snacks and meals every day. How do these nutrient-rich foods work? What are their superpowers? Where do we find them? It might be easier than you think!

In Part 1 your students learn that the secret to nutritious foods is the science in their snacks. It is the natural chemicals in their vitamins, minerals, fats, fiber, and proteins that help our bodies grow, stay healthy, and give us energy. These are called "nutrients," and some help reduce the risk of some cancers. Your students will answer questions using a chart with some examples of these nutritious foods, their food groups, and their nutrients.

This activity can be done individually or with partners. The last question has students compare the sample foods in the chart to the school lunch menu. You can make copies of a recent day's menu to distribute or display the current day's choices for the whole class. Students might enjoy addressing this question as a group discussion to show what they have learned and how it applies to their daily life.

Part 2 features recipes for some nutritious snacks. This activity for student groups is as simple as an informational reading exercise, or you can allow your students to prepare the snacks in the recipes. Six recipes are provided in the Student Activity pages along with a site to find additional ideas. More recipes for kids using nutritious ingredients are easy to find online and in cookbooks. Conducting research themselves will extend the learning experience for students.

You can set up stations around the room, pre-stocked with the necessary ingredients, and assign one group to each station to prepare the snack for the whole class to enjoy. Check which supplies will be needed, too, like bowls, spoons, parchment paper, etc. Ask room parents to help with preparations. Be aware of food allergies and your school's policies on bringing in outside food as you plan for this part.

PART 2 — TEACHER'S INSTRUCTIONS

ANSWER KEY: *Part 1:*

1. fruits and vegetables
2. 3
3. 5
4. nuts, fish, avocado
5. it's orange (like carrots, sweet potatoes, mangoes), vitamin A
6. antioxidants (with the red, blue berries)
7. answers will vary, look for 3 items
8. compare the chart to the menu

ANSWER KEY: *Part 2:* Answers will vary based on recipes used

NAME CLASS DATE

EAT IT TO DEFEAT IT!

Student Activity

Terms to Know: anti-inflammatory, antioxidants, diet, fiber, folate, nutrients, omega-3 fatty acids

The best way to end cancer is to stop it from starting. Half of all cancer cases are connected to things we can change. We can make choices now that keep us from getting sick later, like wearing sunscreen to protect against skin cancer. At **The Journey to End Cancer**, you will play a "Fun in the Sun" game that shows you how to save your skin and eyes from sun damage.

Your diet is another choice you make every day that can help reduce the risk of some cancers. Eating healthily keeps you strong and lowers your risk of cancer. Scientists know that 5% of all cancer cases are linked to bad diets. If someone already has cancer, eating the right foods and avoiding the wrong ones will help them feel better and heal faster.

Food by itself is not a miracle cure, but a habit of healthy eating protects you from illness for a long time. Start by adding nutrient-rich foods that support better nutrition from your snacks and meals every day. No foods have been shown to prevent cancer; however, they can generally add nutritional value, important in following a diet that can help lower risks.

How do these nutritious foods work? What are their superpowers? Where do we find them? It might be easier than you think!

NAME _____ CLASS _____ DATE _____

PART 1: The secret to nutritious foods is the science in your snack! Natural chemicals in their vitamins, minerals, fats, fiber, and proteins help our bodies grow, stay healthy, and give us energy. For example, antioxidants and anti-inflammatories are types of nutrients that act like a shield for our cells. They fight off things that cause cancer and they help repair damaged DNA.

In the chart on the next page, you will find examples of just a few nutritious foods, their food groups, and the nutrients in them that contribute to a nutritious diet. Use the chart to answer the questions under it.

Samples

FOODS	FOOD GROUP	HOW THEY CAN SUPPORT NUTRITION
brown rice, whole wheat bread, oatmeal	whole grains	fiber
nuts, fish, avocado	healthy fats	anti-inflammatories, omega-3 fatty acids
garlic, turmeric	spices	antioxidants, anti-inflammatory
carrots, sweet potatoes, mangoes	fruits and vegetables	vitamin A
spinach, kale	fruits and vegetables	antioxidants, folate
broccoli, cabbage, cauliflower	fruits and vegetables	antioxidants, anti-inflammatory
blueberries, blackberries, strawberries, cherries	fruits and vegetables	antioxidants
oranges, lemons, limes	fruits and vegetables	fiber, vitamin C
chicken, turkey, eggs	protein	less fat than red meat (beef, pork, lamb)
tofu, beans, lentils, quinoa	protein	antioxidants, anti-inflammatory, fiber

1. Which food group is on the list the most?

   _____

2. How many times is fiber on the chart as a nutrient?

   _____

3. How many times are antioxidants on the chart?

   _____

4. Which foods are healthy fats?

   _____

5. Sometimes, the nutrients also give foods their colors. Thinking about colors, predict what pumpkin has in it that gives it its nutritious value.

   _____

6. How do raspberries help? Think about their color.

   _____

7. Name 3 foods from the chart that you like to eat.

   _____

8. Look at the lunch menu for your school. Which choices on the menu have ingredients that support a nutritious diet?

   _____

NAME CLASS DATE

Fruits and vegetables have many antioxidants. They can support a more nutritious diet to help reduce cancer risks. Plus, they come in a lot of yummy flavors and colors!

The fiber in whole grain cereals at breakfast and whole grain pastas at dinner will support nutrition for the large intestine (colon).

Spinach has folate, a nutrient that can fix mistakes in DNA.

Did You Know? Eating well helps you stay at a healthy weight when you grow up. Unhealthy food choices can lead to obesity, which means having too much body fat. Obesity causes changes in your body that make it easier for some cancers to grow. Scientists know that obesity is linked to at least 13 types of cancer!

NAME _____ CLASS _____ DATE _____

PART 2: Are your favorite snacks healthy? Check the ingredients next time you reach for one. Do they have nutritious ingredients? Do the ingredients sound like real food? Let's make a super snack instead! Find a snack recipe that helps promote a nutritious diet. Choose one from the six below or find one on your own. Look for ingredients with antioxidants, anti-inflammatories, fiber, and healthy fats. Hopeful words can greatly impact mental health, especially for those battling cancer. Encouragement and resilience can bring optimism during tough times. Solve this cryptogram to reveal an inspirational quote from Jimmy Carter, the 39th President of the United States, offering support to fight against childhood cancer.

BANANA SUSHI

Ingredients:

- Bananas
- Peanut butter (or any nut/seed butter)
- Rice cereal or granola

Instructions:

1. Peel the bananas.
2. Spread a layer of peanut butter over and around each banana.
3. Roll the bananas in rice cereal or granola to coat them.
4. Slice the coated bananas into bite-sized pieces.

FRUIT KABOBS

Ingredients:

- Favorite fresh fruits like grapes, strawberries, melon, pineapple, etc.
- Wooden skewers

Instructions:

1. Wash and cut the fruits into bite-sized pieces.
2. Thread the fruit pieces onto the wooden skewers, making patterns with the different fruits.
3. Keep making kabobs until all the fruit is used up.

FRUIT SALAD WITH HONEY-LIME DRESSING

Ingredients:

- Favorite fresh fruits (like apples, bananas, oranges, strawberries)
- 2 tablespoons honey
- Juice of 1 lime
- Shredded unsweetened coconut for topping (optional)

Instructions:

1. Wash and chop all the fruits into bite-sized pieces.
2. In a small bowl, mix the honey and lime juice together to create the dressing.
3. Slowly pour the honey-lime dressing over the chopped fruits and gently stir to combine.
4. Serve or chill in the fridge for later. Makes 4-6 servings.
5. Sprinkle with shredded unsweetened coconut before serving (optional).

COLORFUL VEGGIE WRAPS

Ingredients:

- Whole wheat tortillas
- Hummus or avocado (to mash)
- Spinach leaves
- Sliced bell peppers (any color)
- Shredded carrots
- Cucumber slices
- Ranch dressing or extra hummus

Instructions:

1. Spread a layer of hummus or mashed avocado on a tortilla.
2. Place spinach leaves on top.
3. Layer sliced bell peppers, shredded carrots, and cucumber slices.
4. Roll the tortilla tightly and slice it into smaller pieces like sushi rolls.
5. Serve with your favorite dipping sauces like ranch or extra hummus.

NAME CLASS DATE

BERRY YOGURT PARFAIT

Ingredients:

- Greek yogurt (plain or vanilla)
- Fresh berries (strawberries, blueberries, raspberries, blackberries, etc.)
- Granola
- Honey (optional)
- Shredded unsweetened coconut (optional)

Instructions:

1. In each cup, layer Greek yogurt at the bottom.
2. Add a layer of mixed fresh berries on top of the yogurt.
3. Sprinkle granola over the berries.
4. Repeat the layers until you reach the top of the cup.
5. Drizzle honey and sprinkle with unsweetened coconut if desired.

NO-BAKE ENERGY BITES

Ingredients:

- 1 cup rolled oats
- ½ cup peanut butter or other nut/seed butter
- ¼ cup honey or maple syrup
- ½ cup ground flaxseed (optional)
- Optional add-ins: chocolate chips, dried fruit (like raisins or cranberries), seeds

Instructions:

1. In a large mixing bowl, combine rolled oats, peanut butter (or other butter), honey (or maple syrup), and ground flaxseed, if using.
2. Mix well until combined. It should stick together easily.
3. Stir in any add-ins like chocolate chips, dried fruit, seeds, etc. if desired.
4. Once mixed thoroughly, use clean hands to roll small portions into bite-sized balls (about one inch in diameter).
5. Place them on a baking sheet lined with parchment paper and refrigerate for at least an hour to firm up before eating. (Makes 20-24)

VEGGIE PIZZA FACES

Ingredients:

- Whole wheat pita bread or mini pizza crusts
- Tomato sauce
- Shredded mozzarella cheese
- Sliced veggies (bell peppers, cherry tomatoes, olives, mushrooms, etc.)
- Baby spinach leaves

Instructions:

1. Preheat the oven to 375°F (190°C).
2. Spread a layer of tomato sauce on each pita bread or mini pizza crust.
3. Sprinkle shredded mozzarella cheese on top.
4. Use the sliced veggies and baby spinach leaves to create fun faces or designs on the pizzas.
5. Bake in the oven for about 10 minutes, or until the cheese is melted and bubbly.
6. Let the pizzas cool slightly.

SWEET POTATO FRIES

Ingredients:

- 1 large sweet potato (per 2-3 servings)
- Olive oil
- Salt and pepper
- Optional spices (like paprika, garlic powder, or cinnamon)

Instructions:

1. Preheat the oven to 425°F (220°C).
2. Wash and peel the sweet potato. Cut it into thin fries.
3. In a bowl, toss the sweet potato fries with a drizzle of olive oil, salt, pepper, and any optional spices.
4. Spread the fries in a single layer on a baking sheet lined with parchment paper.
5. Bake for about 20-25 minutes or until they are crispy and golden brown, flipping halfway through.
6. Cool slightly before serving.

NAME _____ CLASS _____ DATE _____

Super Snack Recipe Review

Recipe name
Why did you choose it?
Which ingredients in the recipe can help support a diet that reduces risks for some cancers?
Which food groups are they in? (Hint: Check the chart in Part 1)
What are the important nutrients in these ingredients that can help reduce the risks of some cancers? (Hint: Check the chart in Part 1)
Is this something you would actually choose to eat? Why or why not?

NAME _____ CLASS _____ DATE _____

HOPEFUL WORDS: CRYPTOGRAM

Games and Puzzles

Kind and hopeful words can make people feel better, especially those who are sick with cancer. When we encourage each other and stay strong, it can bring happiness during tough times.

Solve this fun cryptogram puzzle to read an inspirational message from singer Taylor Swift. Her words will inspire us to work together to end childhood cancer.

Use the key to match the numbers to their letters. Two letters have been filled in to get you started (T = 4 and I = 18).

KEY

A	B	C	D	E	F	G	H	I	J	K	L	M
13	25	19	6	3	21	8	16	18	12	22	15	14

N	O	P	Q	R	S	T	U	V	W	X	Y	Z
26	9	24	10	11	5	4	7	1	20	17	2	23

“ D

4 2 3 7 11 12 1 3 11 5 22 9 12 24 2 16 8 18

15 16 4 2 24 12 6 24 3 11 16 6 26 13 16 11 3 26

D

17 26 4 22 12 18 1 22 24 12 4 3

G ”

9 22 11 24 2 12 6 25 3

After you solve the puzzle, keep the key and use it to send coded messages back and forth to your friends with tips to end cancer.

ANSWER KEY

D J J H L **S I N C L A I R** H
R E Y E M E K L I H Z G C J
V I Q E C X T K I A E X V Q
A E A T E A N Q I V P V X L
X A L M T V **P** S **H** V I I **D** K
L J I X L N **A** Y **A** R Q K **L** I
V Z S J I T **T** N **N** I X K **A** D
D X S T Q A **T** H **S** Q L T **N** H
E N N **K** K **L E** M **E** Q K R **O** X
J F P **A** N **O R** Y **L** X B U **D** B
M G Y **E** L **W S** P **M** X G K **C** O
B M H **P** R **E O** D **A** P W M **A** N
F J U **C** O **R N** W **N** H H E **M** S
U Z Y **M** O **Y** C C **W A G N E R**

Cryptogram: “A brighter future awaits children with cancer through our collective efforts.”

MILESTONES — DECADES OF CANCER HISTORY

A long time ago, people didn't know much about cancer. Over the years, doctors and scientists have made amazing discoveries to help treat and understand this disease. Take your students on a journey through time to learn about some important moments in cancer history. Your class will discover more about these important moments in cancer research and treatment in this Teacher's Guide and within the galleries at The Journey to End Cancer.

Ancient Times

- Over 3,000 years ago in Ancient Egypt, people wrote about cancer for the first time. They tried to treat breast cancer by using a hot tool to burn the tumor.
- Around 460 BCE a Greek doctor named Hippocrates called cancer "carcinos," which means "crab" in Greek because the shape of tumors reminded him of a crab.

1600s-1700s

- In the 1600s a German surgeon named Wilhelm Fabricius made surgeries better by carefully studying how to remove tumors.
- In 1775 an English doctor named Percivall Pott found that chimney sweeps (people who cleaned chimneys) often got cancer from being around soot and smoke.

1800s

- In 1846 doctors began using a special medicine called anesthesia to help patients sleep during surgery so they wouldn't feel pain.
- In 1895 Wilhelm Roentgen discovered X-rays, which allowed doctors to see inside the body to find tumors.

1900s

- In 1937 the National Cancer Institute was formed.
- In 1943 scientists discovered that certain chemicals could shrink cancer, leading to the first chemotherapy treatments.
- In 1956 E. Donnall Thomas, MD, performed the first successful bone marrow transplant, which helps treat blood cancers like leukemia.
- In 1971 the U.S. government started a "War on Cancer" to give more money to cancer research and find better treatments.

2000s to Today

- In 2006 the first vaccine to prevent HPV, a virus that can cause cancer, was approved.
- In 2017 a new treatment called CAR T cell therapy was approved to help children with a serious type of leukemia.
- In 2023 a 14-year-old student named Heman Bekele created a special soap to help treat skin cancer.

Why This Matters: Thanks to these discoveries, doctors can find and treat cancer more easily. With each new breakthrough, we get closer to ending cancer for good. Who knows? Maybe one day, one of your students will become a scientist who helps find the next big cure!

GLOSSARY

Key Terms Related to Cancer

Teachers: This glossary contains important words related to cancer. Keep this list handy for you and your class. It can help with learning new vocabulary and checking your understanding. Students can also add new words and definitions they find during their visit to The Journey to End Cancer and while doing lessons and activities in this Teacher's Guide.

A

Adenocarcinoma: A type of cancer that starts in glands that make mucus.
Adjuvant Therapy: Extra treatment given after the main treatment to help improve the chances of getting better, often used after surgery.
Anemia: A condition where there are not enough red blood cells, which are important for carrying oxygen in the body.

B

Benign Tumor: This means that a growth or change to a body tissue is not cancer. A benign tumor can grow but doesn't spread to other parts of the body.
Biopsy: A small sample of tissue taken from the body to check for cancer cells.
Blood Cancer: A cancer that starts in blood cells. Leukemia and lymphoma are blood cancers.
Bone Marrow Transplant: A treatment where unhealthy stem cells (cells that develop into blood cells) are destroyed and then replaced with healthy ones. The healthy cells usually come from the bone marrow of a donor.
BRCA1 and BRCA2: Two genes that help fix damaged DNA. If there's a change (mutation) in one of these genes, it can raise your risk of certain cancers, like breast, ovarian or pancreatic cancer.

C

Cancer Survivor: Anyone who has had cancer, starting from the time they're diagnosed through the rest of their life. This includes people still living with cancer and those who are now cancer-free. Some people may choose a different word to describe themselves.
Carcinogen: Something that can damage DNA in our cells and lead to cancer. Carcinogens can be in the air, in what we eat or drink, or in materials we use. Some examples are chemicals in tobacco, ultraviolet (UV) rays from the sun or tanning beds, and harmful substances like asbestos, radon, and air pollution.
Carcinoma: A type of cancer that starts in the cell's lining organs. Most cancers are carcinomas.
CAR T Cell Therapy: A cancer treatment where doctors take out some of a person's T cells, "reprogram" them in a lab to better fight cancer cells, and then put them back into the body. It's mostly used for blood cancers, but scientists are testing it for other types of cancer too.
Catheters: Thin tubes placed in veins to give medicine or drain fluids.
Chemotherapy: A strong medicine that attacks cancer cells or stops them from multiplying. "Chemo" works best on cells that multiply quickly, like cancer cells do. But it can also affect healthy cells that multiply fast, like hair cells. That's why people sometimes lose their hair during treatment.
Chronic Myeloid Leukemia (CML): A type of cancer where too many myeloid cells grow in the bone marrow and blood.
Clinical Trials: Research studies that test how well new medical approaches work in people.
Colonoscopy: A procedure where a doctor looks inside the colon to check for polyps or cancer.
Computerized Tomography (CT): A method that takes detailed pictures of the inside of the body using X-rays.

GLOSSARY (cont.)

D

Diagnosis: Figuring out what kind of cancer someone has and whether it has spread in the body. Doctors develop a diagnosis using scans, biopsies, or other tests.
Distant Metastasis: Cancer that has spread from where it started to other parts of the body.
Dysplasia: Abnormal cells that may lead to cancer if not removed.

E

Early Detection: Finding cancer early, which can help with treatment.
Endometrial Cancer: Cancer that starts in the lining of the uterus.
Epithelial Cells: Cells that line the surfaces of organs; many cancers start in these cells.

F

Fecal Occult Blood Test (FOBT): A test used to check for blood in poop, which can be a sign of bowel cancer.
Follicular Lymphoma: A slow-growing type of non-Hodgkin lymphoma.

G

Grading: When doctors check how abnormal cancer cells look under a microscope, to see how fast the cancer might grow.
Gleason Score: A score that helps describe how aggressive prostate cancer is to help plan treatment.

H

Hematologic Cancer: Cancers affecting blood and bone marrow, like leukemia and lymphoma.
Hormone Replacement Therapy: Hormones given to women after menopause that can increase the risk of some cancers.
Hepatitis B and C Viruses (HBV and HCV): A sickness that causes swelling in the liver. Hepatitis B and C can raise the risk of liver cancer. Hepatitis B can be prevented with a vaccine.
Hepatocellular Carcinoma: The most common type of liver cancer.

I

Immune Checkpoint Inhibitor: A medicine that helps the immune system spot and destroy cancer cells better. It works by blocking checkpoints that normally tell immune cells not to attack.
Immunotherapy: A cancer treatment that gives the superheroes of the immune system a power-up! It helps the body's defense team find and destroy cancer cells more easily.
Invasive Cancer: Cancer that has spread into nearby tissues.

K

Kaposi Sarcoma: A cancer that causes abnormal growth of blood vessels, leading to spots on the skin and other areas.
Keratinocyte Skin Cancer: A type of nonmelanoma skin cancer that starts in cells on the skin's surface.

L

Leukemia: A type of cancer that starts in the blood or bone marrow where new blood cells are made.
Leukopenia: Having low white blood cell counts.
Lumpectomy: Surgery to remove a breast lump and some surrounding tissue.
Lymph Nodes: Tiny, bean-shaped organs found throughout your body that help keep you healthy by filtering a fluid called lymph. Immune cells in the lymph nodes identify harmful cells, including cancer cells and dangerous bacteria, and destroy them or mark them for destruction by other immune cells. Also known as lymph glands.
Lymphoma: A type of cancer that starts in the lymph nodes or other part of the lymph system.
Cancer-Related Lymphedema: Swelling that happens when the lymphatic system is blocked or damaged by cancer or treatments.

GLOSSARY (cont.)

M

Malignant: Another word for cancerous.
Mammography: A screening tool that uses X-rays to take pictures of the inside of the breast. It helps doctors look for early signs of breast cancer.
Margin: The normal tissue around a tumor that is removed during surgery to make sure all cancer is gone.
Mastectomy: A surgery to remove breast tissue, usually to treat or prevent breast cancer. It can help stop cancer from spreading in the body.
Medical Oncologist: A doctor who specializes in treating cancer.
Melanoma: A serious type of skin cancer that starts in the melanocytes, cells that give the skin its color.
Menopause: The time in a woman's life when she stops having periods.
Mesothelioma: A cancer that affects the lining of the chest or abdomen, often due to asbestos exposure.
Metastasis: When cancer cells break away from where they started, travel to other parts of the body, and start causing trouble there too.
Mutation: A change in the DNA of a cell that can lead to cancer.

N

Neuroblastoma: Cancer that starts in young nerve cells, mostly affects infants and children.
Neutropenia: A low number of neutrophils, a type of white blood cell that fights infections.

P

Palliative Care: A special type of medical care that aims to improve the quality of life for people with serious diseases like cancer. It focuses on easing pain and other symptoms caused by the illness, and on relieving side effects from treatment.
Pathology Report: A report from a doctor that explains what a tissue sample shows, including the type of cancer and how severe it is.
Ports: Devices placed in the body to give medicine or take blood samples.
Prognosis: A doctor's best estimate for what may happen with a person's cancer. The doctor may mention how likely the person is to be cured, how long they may live, or the chances the cancer could come back after treatment.
PSA (Prostate Specific Antigen): A protein made by the prostate; high levels can suggest cancer.

R

Radiation Therapy: A cancer treatment that uses powerful invisible beams of radiation to destroy cancer cells. The patient doesn't feel the radiation during treatment, but side effects such as vomiting, skin changes, or feeling very tired can happen afterward.
Retinoblastoma: A rare eye cancer that affects the retina, mainly in young children.

S

Sarcoma: A type of cancer that occurs in the bones, muscles, and other connective tissues.
Stage (of a cancer): Describes how advanced the cancer is and whether it has spread from where it started.
Surgery: When a doctor makes a cut into the body to remove or fix a problem. This is a common way to remove cancers.
Systemic Therapy: Treatment that affects the whole body, usually through the bloodstream.
Targeted Therapy: A cancer medicine that zooms in on a specific characteristic of cancer cells. Targeted therapies are designed to precisely focus on cancer cells while leaving healthy cells alone.
Tumor: A group of cells that multiply and form a lump or bump in the body. Some tumors are cancer and some are not.

U

Uncontrolled Cell Growth: A sign of cancer, where cells divide and grow without control.
Ultraviolet (UV) Radiation: Rays from the sun that can damage skin and cause skin cancer.

W

Wilms Tumor: A type of kidney cancer that mostly affects children.

FACTS & FIGURES — CANCER BY THE NUMBERS

Let statistics (and maybe a little math!) help your students better understand the impact of groundbreaking cancer treatments and pioneering research on the successful movement to end cancer.

This information can be used in a variety of ways in your classroom. For example, it can serve as a **Reference Tool** for student research; as a focal point for relevant **Data Analysis** in a statistical investigation; or as the basis for student-created **Infographics** to display in your classroom or school media center.

KNOW IT: What is Cancer?

Cancer happens when some cells in the body grow too much and don't stop. These extra cells can form lumps called tumors or travel to other parts of the body.

What Are The Most Common Types Of Cancers?

These are the most common types of cancer:

- Breast cancer: About 298,000 women will get it.
- Lung cancer: About 236,000 people will get it.
- Prostate cancer: About 200,000 men will get it.
- Colorectal (colon) cancer: About 150,000 people will get it.
- Skin cancer (melanoma): About 100,000 people will get it.

Who Gets Cancer?

- Most people who get cancer are over 50 years old.
- About 1 in 2 men and 1 in 3 women in the U.S. will get cancer sometime in their lives.
- More than 17,000 children in the U.S. are diagnosed with cancer each year.

FIND IT: How do we detect cancer?

Doctors use special tests to find cancer early, including:

- **Mammograms:** A screening tool that uses X-rays to take pictures of the inside of the breast. It helps doctors look for early signs of breast cancer.
- **Colonoscopy:** A procedure where a doctor looks inside the colon to check for polyps or cancer.
- **Blood Tests:** Some cancers can be found by looking for signs of cancer in the blood.

New Ways to Find Cancer

- **Liquid Biopsies:** A blood test that looks for tiny bits of cancer cells floating in the blood. It can sometimes help detect cancer early, though it can't pinpoint exactly where it is in the body.
- **AI Imaging:** Smart computers help doctors find cancer on X-rays and other images.

TREAT IT: How do we cure cancers?

- **Immunotherapy:** A cancer treatment that gives the superheroes of the immune system a power-up! It helps the body's defense team find and destroy cancer cells more easily.
- **CAR T cell Therapy:** A cancer treatment where doctors take out some of a person's T cells, "reprogram" them in a lab to better fight cancer cells and then put them back into the body. It's mostly used for blood cancers, but scientists are testing it for other types of cancer too.
- **Clinical Trials:** Research studies that test how well new medical approaches work in people.

PREVENT IT: How can you reduce your risk?

You can make healthy choices to lower your risk. Nine ways to lower your cancer risks:

- Avoid tobacco
- Keep a healthy weight
- Skip alcohol
- Be sun safe
- Eat healthy foods
- Move your body
- Know your family history
- Get recommended screenings
- Get protective vaccines

DEFEAT IT: How can we end cancer together?

- More people are surviving cancer than ever before!
- Today, about 68 out of 100 people with cancer live at least five years. In the 1970s, 49 out of 100 people survived five years.
- Some cancers, like breast and prostate cancer, have survival rates over 90% when found early.

By learning about cancer, staying healthy, and supporting research, we can all be part of the fight to end cancer. Together.

UNDERSTAND — CURRICULUM CORRELATIONS

We know how important it is for you to justify field trips and document how instructional time is spent outside of your classroom. With this in mind, both the activities in this Teacher's Guide and the experiences your students have during their field trip to The Journey to End Cancer are correlated to the Next Generation Science Standards, Common Core State Standards for Mathematics and English Language Arts, the C3 Framework for State Social Studies Standards, the National Health Education Standards, and the National Core Arts Standards for Visual Arts.

The connections to national standards are arranged by content area and grade level to assist with your planning needs. For teachers in the Texas region, the Texas Essential Knowledge and Skills are also outlined below by grade.

NATIONAL CONTENT STANDARDS

Next Generation Science Standards

- Grade 3: 3-LS3-1, 3-LS3-2, 3-LS4-2
- Grade 4: 4-LS1-1, 4-LS1-2, 4-PS3-2, 4-PS4-1
- Grade 5: 5-PS1-1
- Grades 3-5: 3-5-ETS1-1, 3-5-ETS1-2

Common Core State Standards for Mathematics

- Grade 3: CCSS.Math.Content.3.OA.D.8, CCSS.Math.Content.3.MD.B.3
- Grade 4: CCSS.Math.Content.4.OA.A.3
- Grade 5: CCSS.Math.Content.5.OA.A.2
- Standards for Mathematical Practice: 1, 3, 4, 6

Common Core State Standards for English Language Arts

- Grade 3: CCSS.ELA-Literacy.RI.3.1, CCSS.ELA-Literacy.RI.3.2, CCSS.ELA-Literacy.RI.3.3, CCSS.ELA-Literacy.RI.3.4, CCSS.ELA-Literacy.RI.3.7, CCSS.ELA-Literacy.RI.3.8; CCSS.ELA-Literacy.W.3.7; CCSS.ELA-Literacy.SL.3.1, CCSS.ELA-Literacy.SL.3.2
- Grade 4: CCSS.ELA-Literacy.RI.4.1, CCSS.ELA-Literacy.RI.4.2, CCSS.ELA-Literacy.RI.4.3, CCSS.ELA-Literacy.RI.4.4, CCSS.ELA-Literacy.RI.4.7, CCSS.ELA-Literacy.RI.4.8; CCSS.ELA-Literacy.W.4.7; CCSS.ELA-Literacy.SL.4.1, CCSS.ELA-Literacy.SL.4.2
- Grade 5: CCSS.ELA-Literacy.RI.5.1, CCSS.ELA-Literacy.RI.5.2, CCSS.ELA-Literacy.RI.5.3, CCSS.ELA-Literacy.RI.5.4, CCSS.ELA-Literacy.RI.5.7, CCSS.ELA-Literacy.RI.5.8; CCSS.ELA-Literacy.W.5.7; CCSS.ELA-Literacy.SL.5.1, CCSS.ELA-Literacy.SL.5.2

C3 Framework for Social Studies State Standards

- Civics: D2.Civ.4.3-5
- Economics: D2.Eco.15.3-5
- Geography: D2.Geo.2.3-5, D2.Geo.11.3-5
- History: D2.His.2.3-5, D2.His.5.3-5, D2.His.10.3-5, D2.His.14.3-5

UNDERSTAND — CURRICULUM CORRELATIONS (cont.)

National Health Education Standards: 1, 2, 5, 7

National Core Arts Standards: Visual Arts

- Grade 3: VA:Cr1.1.3a, VA:Cr2.2.3a
- Grade 4: VA:Cr1.1.4a, VA:Cr2.2.4a
- Grade 5: VA:Cr1.1.5a, VA:Cr2.2.5a

TEXAS ESSENTIAL KNOWLEDGE AND SKILLS

Grade 3

- Science: 3.2, 3.3, 3.4, 3.13
- Math*: 3.1A, 3.1D, 3.1F, 3.1G, 3.5.A, 3.8A, 3.8B
- ELA: 3.3, 3.6, 3.7, 3.10, 3.13
- Social Studies: 3.1A, 3.13B, 3.14. 3.15
- Health: 3.1, 3.2, 3.6, 3.8B
- Art: 3.1A, 3.2, 3.3D

Grade 4

- Science: 4.2, 4.3, 4.4, 4.13B
- Math: 4.4H
- ELA: 4.3, 4.6, 4.7, 4.10, 4.13
- Social Studies: 4.18A, 4.19, 4.21, 4.22
- Health: 4.1, 4.2, 4.6, 4.9
- Art: 4.1A, 4.2, 4.3D

Grade 5

- Science: 8.2, 8.3, 8.4, 8.5, 8.6, 8.13A
- Math: 8.11C
- ELA: 8.1, 8.2, 8.5, 8.6, 8.11, 8.12
- Social Studies: 8.28, 8.29, 8.30
- Health: 7-8.1, 7-8.2, 7-8.23C, 7-8.23M

*TEKS for mathematics were updated in April 2012 and K-8 were implemented in the 2014-2015 school year. The TX SBOE initiated a revision process for math in the 2022-2023 school year. Adoption was scheduled for that year with implementation in the 2026-2027 school year. The adoption schedule was revised and intended to begin in the 2024-2025 school year.