GOOD YEAR BOOKS

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Women Scientists and Inventors

A Science Puzzle Book

Jacquelyn A. Greenblatt
Illustrated by Corasue Nicholas

GOOD YEAR BOOKS

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INTRODUCTION

This book contains puzzles that are fun and challenging. At the same time, it should help elementary and middle school students expand their vocabularies and improve reading comprehension. Each of the 42 puzzles consists of two parts. First, a short narrative describes and explains a discovery made by a female scientist or inventor. This text is followed by a puzzle that, when solved, reveals the name of the woman responsible for the accomplishment.

The female scientists and inventors included in this book were selected on the basis of the creativity and conceptual innovation of their work. Much still remains to be learned about the role of women in the history of science. Yet, even with the limited material presently available, women from nearly every important scientific area—mathematics, physics, chemistry, biology, and applied science—have been included. As examples of the scientific capabilities of women, these female scientists should be inspirational to both girls and boys.

The vocabulary used in the puzzles was dictated in part by the nature of the scientific discoveries. But the vocabulary was selected as much as possible for its suitability to students in the higher grades of elementary school and in middle school.

All words needed to solve each puzzle are found either in the puzzle itself or, more often, in the text that precedes it. Therefore, a careful reading of the narrative is essential before a student attempts to solve a puzzle. If this is done and a student still experiences difficulty with any question, the student should simply refer back to the text. In the more difficult puzzles, some letters of the missing words are provided as clues. Solutions to the puzzles appear at the end of the book.

Once students have completed all of the puzzles, they will have been introduced to hundreds of vocabulary words. Students will also become acquainted with varied scientific ideas and little-known biographical information about important women scientists and inventors. This knowledge should lead to better performance in school. Equally important, students will acquire new vocabulary and basic concepts necessary for learning in future years.

Curing Diseases: Forty-Five Patents and a Nobel Prize

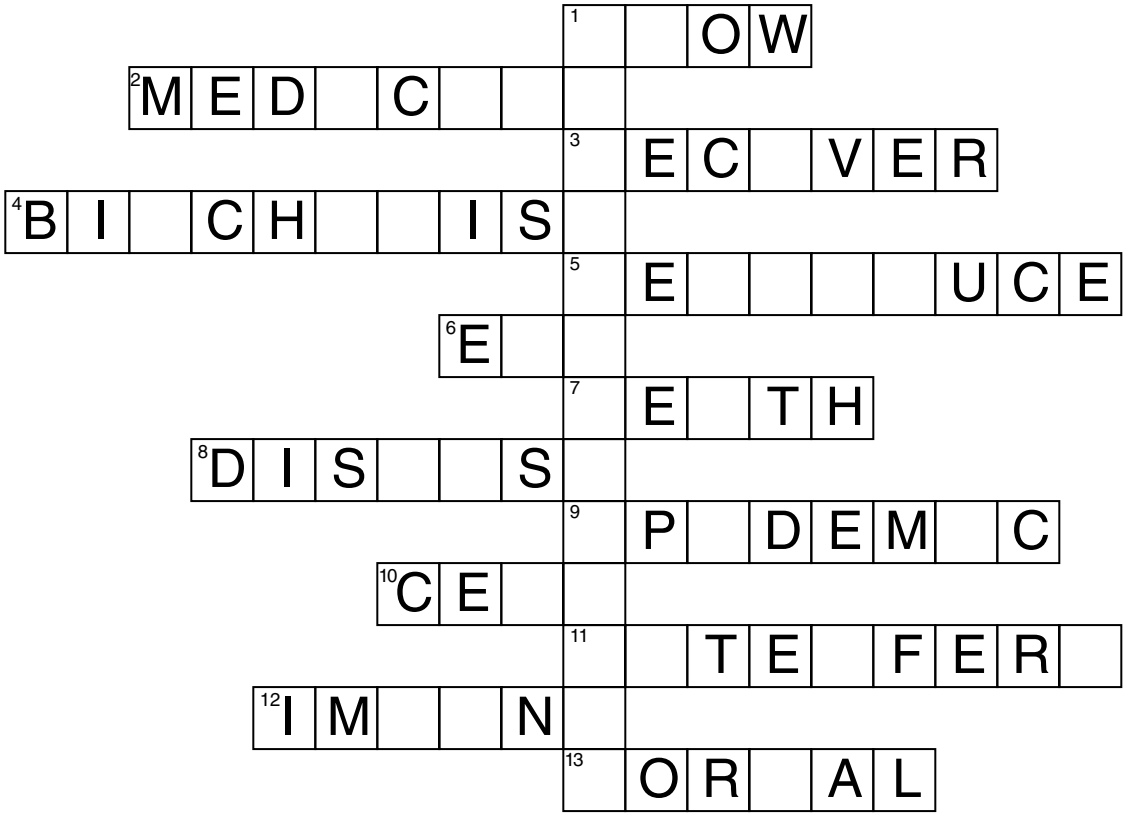
Have you heard about a person who recovered from leukemia? Do you know someone who received a successful kidney transplant with the help of immunosuppressant drugs, medicines that decrease the effectiveness of the body's immune system? Credit for these modern scientific "miracles" goes in large part to an ingenious American-born and educated female biochemist. Working between 1944 and the early 1980s, she developed and patented a total of forty-five medications. Her investigations involved not only leukemia and the rejection of transplanted organs, but also gout, malaria, and herpes.

As part of her efforts, this biochemist carefully observed the differences between the workings of normal human cells and the functioning of cancer cells and pathogenic or disease-producing organisms. These harmful organisms include bacteria, viruses, and microscopic animals called protozoa. Then she developed drugs that did not harm normal human body cells, but killed or interfered with the way cancer cells and pathogenic organisms grow and reproduce. This new approach to developing medicines has prevented numerous epidemics and deaths. In recognition of her achievements, this female biochemist, along with her associate, George Hitchings, received the 1988 Nobel Prize for Physiology or Medicine.

To find this woman biochemist's name, complete the crossword tree on the next page. Use the clues provided. All the words you need are included in the text above.

Name _____ Date _____

Puzzle 1 Curing Diseases: Forty-Five Patents and a Nobel Prize



Across

1. Increase in size; develop toward maturity
2. Drug or other substance used to treat disease
3. Regain health
4. Scientist who deals with chemistry of life processes
5. Produce others of one's own kind
6. First three letters of word meaning "trained" or "schooled"
7. Ending of life
8. Illness
9. Rapid spread of sickness
10. Basic structural and functional unit of living things
11. Oppose; come between for some purpose
12. Prefix meaning immune or immunity
13. Usual; average

Down

1. Female biochemist who received the 1988 Nobel Prize for Physiology or Medicine

The First Computer Programmer

Nowadays, many people are computer programmers, persons who create coded instructions that tell computers which operations to perform to solve a problem or to process information. But who was the first computer programmer?

The answer goes back to the mid-1830s. At that time, the English mathematician, Charles Babbage, drew up detailed plans for an "analytical engine," a new kind of calculating machine. This proposed machine was actually an early computer since the analytical engine was designed to contain punch cards. The position of the holes in these cards would be interpreted as numerical data and operating instructions by the analytical engine.

In 1840 at the University of Turin in Italy, Babbage lectured on his plans for the analytic engine. These lectures were eventually published in French, and in 1843 a British female mathematician agreed to translate the lectures into English.

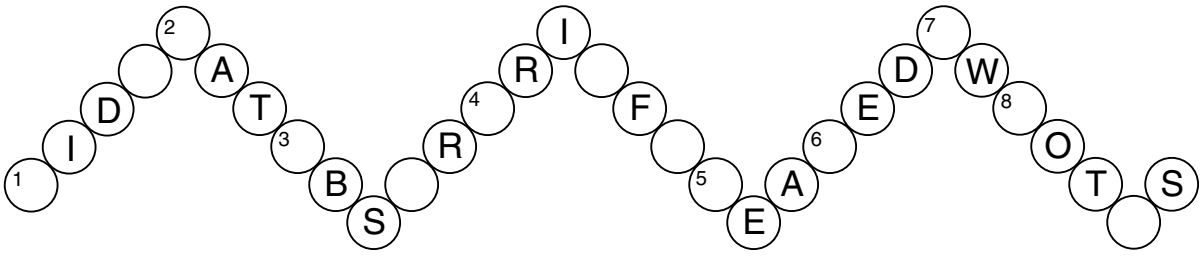
However, this woman mathematician did more than just study the lectures briefly, absorb Babbage's ideas, and then translate his work. Although she did not redo his lectures, during the course of a year, she added her own notes consisting of comments and explanations. These notes tripled the length of Babbage's lectures and aided in the understanding of his analytical engine. For example, in one of these notes she explained how to use the punch cards to write a program for the analytical engine. In another note, she actually wrote out a program.

Unfortunately, Babbage was unable to obtain financing and the analytical engine was never built. But in 1855, a Swedish firm produced a calculator incorporating some of his ideas.

Discover the name of the first computer programmer by completing the word links on the next page. In these links, the last letter of one word becomes the first letter of the next. All words can be found in the text above. After you have completed the puzzle, write, in order, the numbered first letter of each word.

Name _____ Date _____

Puzzle 2 The First Computer Programmer



1. Helped; assisted
2. Information
3. Take in; suck up
4. Concisely
5. 365 days
6. Do again; do over
7. Belonging or relating to oneself
8. Comments or explanations, frequently at the bottom of a page

__	__	__		__	__	__	__	__
1	2	3		4	5	6	7	8

Saving Blue Babies

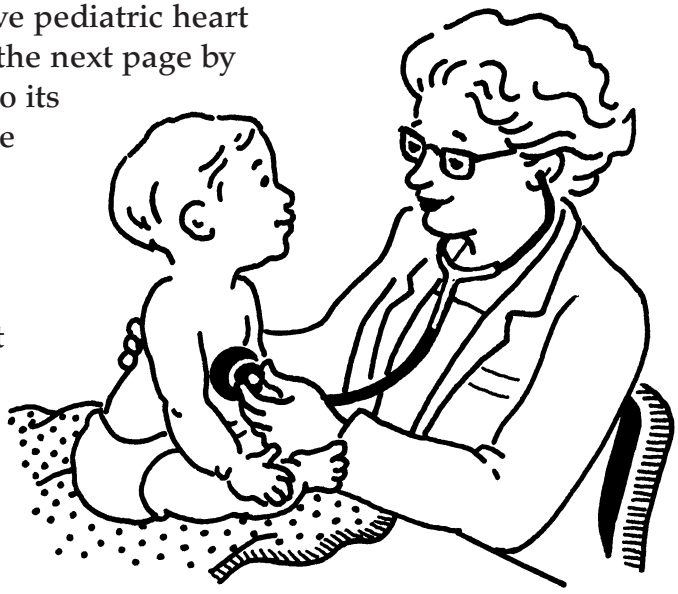
Before the middle of the twentieth century, one of the saddest sights in hospitals was small children with heart problems. These children often had a bluish tint to their skin and, as a result, were called "blue babies."

In the 1930s an American female pediatrician examining heart X rays discovered a series of internal structural defects in the hearts of these children. The defects included an opening in the wall between the two major heart chambers, an improperly working heart valve, and partial blockage of the artery leading from the heart to the lungs. An artery is a blood vessel that carries blood away from the heart.

Because of these defects, some of the blood returning to the right side of the heart from the body was pumped back into circulation without first going to the lungs. Since the lungs are the place where blood acquires oxygen, the blood failed to get all of the oxygen needed. This lack of oxygen caused the children to feel weak. Another effect was the bluish tinge to the skin, an indication that the blood underneath did not have enough oxygen.

Determined to help, this female pediatrician designed new surgical procedures. In one procedure, she joined two formerly separate arteries in order to bypass the problem area in the heart. The surgery was successful and the goal of carrying more blood to the lungs was achieved. Today, blue babies no longer face a negative future. Instead, they undergo surgery and then lead normal, active lives.

To find the name of this creative pediatric heart specialist, solve the puzzle on the next page by writing the correct word next to its definition. Use the words in the word box. All words can be found in the above text. After you have written the correct words, write the first letter of each word above its number at the bottom of the page.



Name _____ Date _____

Puzzle 3 Saving Blue Babies

artery	effect	examine	goal	heart	internal
lung	negative	structural	surgery	tinge	underneath

1. Body organ that pumps blood 1. _____
2. Consequence; result 2. _____
3. Body organ where oxygen is acquired 3. _____
4. Inspect 4. _____
5. Opposite of *positive* 5. _____
6. Slight coloring 6. _____
7. Blood vessel that carries blood away from the heart 7. _____
8. Below 8. _____
9. Relating to the way parts are constructed 9. _____
10. Medical operation 10. _____
11. Occurring inside 11. _____
12. Objective 12. _____

__	__	__	__	__		__	__	__	__	__	__	__
1	2	3	4	5		6	7	8	9	10	11	12

Formulas for Einstein

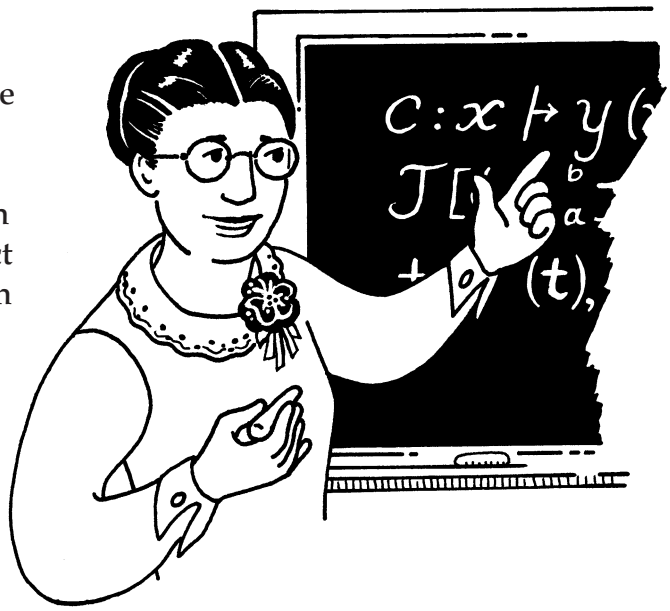
When Albert Einstein presented his revolutionary theory of relativity in 1905, the world was awed by its scope and originality. In an orderly fashion, this theory explained several complex subjects relating to the universe and the Earth and included the concept that matter and energy are equivalent.

Yet, as convincing as Einstein's explanations seemed, scientists could accept his theory only if it proved in agreement with accepted laws of physics. If inconsistencies or disagreements were found, either Einstein's theory or the accepted laws would have to be modified.

Among the accepted laws of physics are the laws of conservation of energy. The principle of conservation of energy states that energy can neither be created nor destroyed; it can only change in form. For example, an automobile engine changes the chemical energy of gasoline into motion energy and heat energy. But the total amount of energy in the system remains the same.

Initially, some physicists claimed that Einstein's theory was inconsistent with this principle. A female mathematician working in Germany between 1908 and 1919 responded to these claims. She not only used specific numbers but also devised general mathematical formulas showing that Einstein's theory is in agreement with the principle of conservation of energy. In this way, she overcame a major hurdle to the theory's acceptance.

Dismissed from her teaching position in Germany when the Nazis came to power, this theoretical mathematician immigrated to the United States. She then taught at Bryn Mawr and Princeton.



To find the name of this remarkable woman who used mathematics to bolster the theory of relativity, unscramble each jumbled word (on the next page) and write the correct word next to it. All correctly written words appear in the text above. After you have unscrambled the words, write the first letter of each word above its number at the bottom of the page.

Name _____ Date _____

Puzzle 4 Formulas for Einstein

1. TEESININ	__ __ N __ __ E I N
2. STAMTHECIAM	__ A __ H __ M __ T I C __
3. TATREM	__ A __ T E R
4. TEY	__ __ T
5. RENBUM	__ U M __ E R
6. REDYROL	__ R __ E __ L Y
7. YERNEG	__ N __ __ G Y
8. YORETH	__ H __ __ R Y
9. HELDRU	__ U R __ L E
10. RETHA	__ A __ T H
11. VITALYRITE	__ E L __ __ I V __ __ Y

1. Originator of the theory of relativity
2. Science that uses numbers and symbols to deal with quantities
3. Substance; material
4. However; nevertheless
5. Symbol or word telling how many
6. Systematic; neat in arrangement
7. Capacity for doing work
8. Statement of apparent underlying principles based on observation
9. Obstacle; difficulty
10. Our planet
11. Einstein's theory, presented in 1905

__	__	__	__		__	__	__	__	__	__	__
1	2	3	4		5	6	7	8	9	10	11

The Spiral Shape of DNA

Frequently newspapers announce that scientists have identified a new gene, the basic unit of hereditary matter. Each of these new genes is claimed to be linked to a particular disease, such as cancer or diabetes, or to a specific trait, such as height or weight.

The groundwork for these amazing findings was laid in the middle of the twentieth century when scientists determined the structure of the DNA molecule, the major component of genes. A molecule consists of two or more atoms. Atoms are the smallest particle of an element, which is a substance that cannot be broken down into a simpler substance by chemical means.

This breakthrough discovery of the structure of DNA is attributed to Francis Crick and Maurice Wilkins of Great Britain and James Watson of the United States. In recognition of their work, they received the Nobel Prize for Physiology or Medicine in 1962. Crick, Wilkins, and Watson had developed a double helix model of the DNA molecule. This model consisted of two spirals made up of chains of atoms wound around each other like a twisted ladder. These spirals separate and make copies of themselves during cell reproduction.

In the 1950s, before Crick and Wilkins won their award, a British female biophysicist had studied images produced by passing X rays through DNA. This process is called X-ray diffraction. Using this process, this biophysicist had determined the density of DNA and concluded that the DNA molecule is spiral-shaped. However, she did not suggest two intertwined spirals. Crick, Wilkins, and Watson, in constructing their prize-winning model, based their work partly on her data.

To find the name of this unheralded British biophysicist, solve the puzzle on the next page. First circle one letter in each box from left to right to make one 5-letter word, two 4-letter words, and one 3-letter word. Use the clues to help find the words in the text above. After you have circled the correct letters, start at the top and write the uncircled letters from left to right on the spaces at the bottom of the page.

Name _____ Date _____

Puzzle 5 The Spiral Shape of DNA

1.	HR	OE	SL	IA	LX
2.	IG	EN	DN	FE	
3.	RX	AR	AN	KY	
4.	DL	IN	NA		

1. Spiral
2. Hereditary unit occurring at specific points on a chromosome
3. Type of short-wave radiation that can produce images on photographic plates
4. Abbreviation for name of the molecule that is the major component of genes

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

The Atomic Nature of Radioactivity

In 1895 a French physicist named Antoine Becquerel discovered that uranium compounds emit radiation as high-energy rays. A Polish-born woman, then living in France, was fascinated by this discovery. She already had degrees in physics and mathematics and decided that for her graduate work she would investigate this radiation.

Her studies revealed that the magnitude, or amount, of radiation depended on the quantity of uranium in the compounds. The amount of radiation was unaffected by the type of uranium compound or by temperature or light. She therefore suggested that radiation is an atomic property caused by activity within the atom's nucleus, the central part of the atom where particles called protons and neutrons are located. In 1898 she made up the word *radioactivity* to describe this activity.

During her experiments, this woman scientist and her husband tested pitchblende, an ore of uranium. She found that the radioactivity of the pitchblende was far greater than she had expected based on the quantity of uranium in the ore. As a result, she proposed that the pitchblende contained an element even more radioactive than uranium. Eventually, she isolated or separated two new radioactive elements, polonium and radium, from the pitchblende.

For her work on radioactivity, this woman scientist, along with her husband and Antoine Becquerel, received the Nobel Prize for Physics in 1903. For her discovery of polonium and radium and the isolation of radium from pitchblende, she alone received the Nobel Prize for Chemistry in 1911.

To find the name of this female scientist, write the correct word next to each clue on the next page. All answers appear in the text above. After you have written the correct words, write the first letter of each word above its number at the bottom of the page.

Name _____ Date _____

Puzzle 6 The Atomic Nature of Radioactivity

1. Size; amount __ A G __ __ T U D __
2. Relating to atoms __ __ __ M I C
3. High-energy rays __ A D __ __ __ I O N
4. Separate; set apart from others __ S O __ __ T E
5. Substance that cannot be separated into different substances by ordinary chemical methods __ L E __ __ N T
6. Science that deals with the composition and properties of substances __ __ E __ I S __ R Y
7. Radioactive element studied by Becquerel __ R A __ __ U M
8. Radioactive element found in pitchblende __ __ D __ U M
9. Inquire into; study __ __ V E S __ I __ A T E
10. Procedure to test a possible explanation __ __ P E R __ __ E N T

__ __ __ __ __ __ __ __ __ __
1 2 3 4 5 6 7 8 9 10

Radial Tires and Bulletproof Vests

In 1965 an American female chemist working at DuPont Corporation laboratories did indeed invent the substance used in tires and bulletproof vests. Kevlar is DuPont's name for the tough, rigid fiber that is an important part of such objects as radial tires, helmets, bulletproof vests, airplanes, space vehicles, skis, sails, and boat shells.

A graduate of Carnegie Institute of Technology, this woman chemist joined DuPont in 1946 in order to earn money to attend medical school. At DuPont, she worked on chaining together simple molecules to form longer, more complex molecules called polymers. These polymers had new properties and formed the basis of many human-made fibers, including nylon. Her work proved so interesting that she never left for medical school.

One of this woman chemist's objectives at DuPont was to develop strong and stable polymers. In her experiments, she used liquid solutions containing crystals that dissolved at low heat and could be spun into fibers at room temperature. One such solution yielded exceptionally tough fibers that were even stronger than steel. These fibers formed the basis of Kevlar. By the time she retired from DuPont in 1986, she had 17 different patents.

To find this woman chemist's name, circle the one word that doesn't belong in each row of words on the next page. Then, starting with row 1, write the first letter of each circled word on the blanks at the bottom of the page.

Name _____ Date _____

Puzzle 7 Radial Tires and Bulletproof Vests

1.	complicated	complex	simple	elaborate
2.	property	temperature	trait	characteristic
3.	nylon	experiment	polyester	Kevlar
4.	stable	fixed	polymer	enduring
5.	heat	strong	durable	tough
6.	dissolve	melt	liquefy	airplane
7.	artificial	natural	counterfeit	synthetic
8.	objective	goal	invent	aim
9.	equation	basis	foundation	support
10.	rigid	inflexible	stiff	key
11.	produce	yield	ways	furnish
12.	link	ore	chain	connect
13.	liquid	make	form	fashion
14.	patent	trademark	copyright	environment
15.	mixture	combination	solution	know

__	__	__	__	__	__	__	__	__		__	__	__	__	__	__
1	2	3	4	5	6	7	8	9		10	11	12	13	14	15