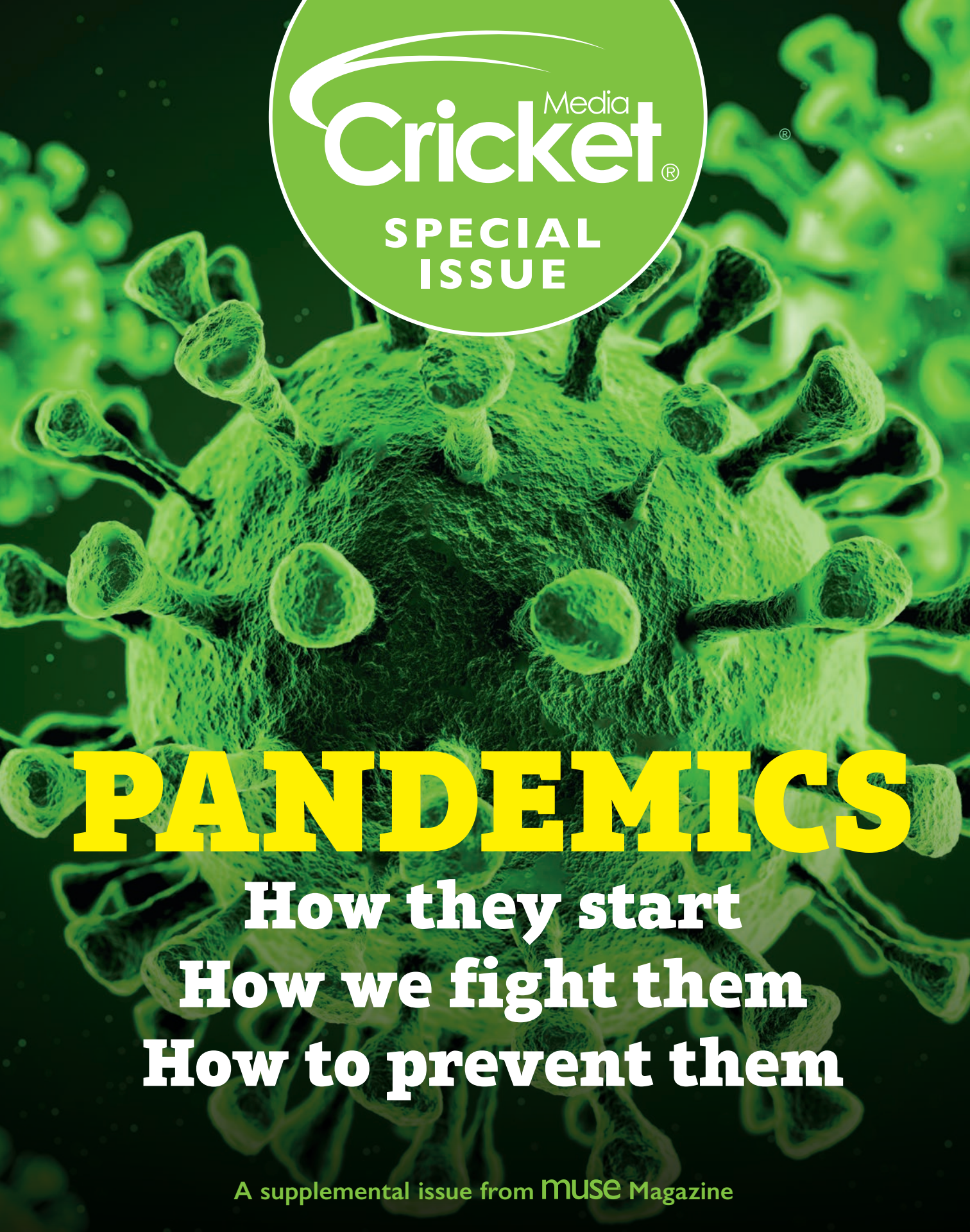

Media Cricket®

SPECIAL ISSUE

PANDEMICS

How they start
How we fight them
How to prevent them

A supplemental issue from muse Magazine

FROM THE EDITORS

As COVID-19 continues to spread, more and more schools close, and families spend more time at home, children feel anxious about this disruption to normal life. Naturally, they have questions.

Our company is made of readers who like to discuss what they've read, so Cricket Media put together this collection of articles and stories to help families better understand germs, pandemics, and healthy precautions. We're big believers in families reading articles and stories together as a way to increase understanding. Often, the discussion that follows the reading helps children share their thoughts and anxieties.

We also enlisted Dr. Daniel Park to speak from his perspective as an expert in epidemiology. We hope this issue both answers questions and inspires curiosity. Like everyone, we also hope COVID-19 is contained quickly and those that are ill recover soon.

The Cricket Media Family

Dear Readers,

We understand the concern and confusion around coronavirus disease 2019 (COVID-19). It's important to know that researchers and healthcare providers around the world are working hard to keep people safe and healthy. Epidemiologists study the spread of disease. We've learned a lot from researching early COVID-19 cases and from our experience with SARS (severe acute respiratory syndrome) and MERS (Middle East respiratory syndrome).

COVID-19 symptoms include fever, cough, and shortness of breath. Thankfully these symptoms tend to be milder in children and younger healthy adults. However, we all want to keep the virus from older adults or people with other health conditions who have a tougher time fighting off COVID-19.

The virus is mainly shared by sneezes or coughs from an infected person. The methods for slowing the spread of COVID-19 are simple: regularly wash your hands with soap for 20 seconds, stay home when you are sick, and practice social distancing—avoiding crowded public settings and staying six feet away from others when possible.

In the coming weeks and months, it will be important to not panic. Knowing and sharing facts will be critical for fighting the virus, and for fighting the fear and stigma that accompany it. The information in this issue is a great start—I'm excited to use it as a conversation starter with my own daughter. The Centers for Disease Control and your local state department also have up-to-date resources. Each of us has an important role to play, whether it's developing treatments and vaccines, or simply reminding friends and family to wash their hands.

Thank you for doing your part!

Daniel Park

Daniel is trained in Global Disease Epidemiology and Control. His research has focused on pediatric pneumonia, including a landmark study evaluating viral and bacterial causes of pediatric pneumonia in countries around the world.

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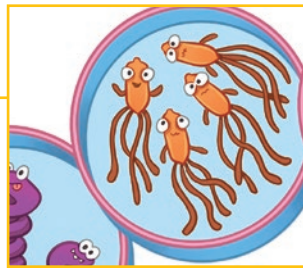

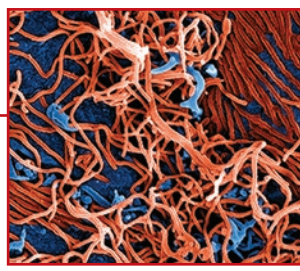

Answers to "Stop the Spread!" from page 32: 1. c, 2. b, 3. a, 4. c, 5. b, 6. c, 7. a, 8. c.

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The Greek word *epi* means "on" or "upon," while *demos* means "people." An **epidemic** is something that spreads quickly and widely across a population and infects many people at the same time.

Endemos can be broken into two Greek words: *en,* which means "in," and *demos,* which means "people." So, **endemic** describes something that is found or is present in a specific location or group of people.

The Greek word *pandemos* means "of all the people." From this root word we get **pandemic,** which means a widespread epidemic over a vast geographic area.

WHAT'S A GERM?

art by Chris Jones

Gazillions of tiny, tiny, tiny creatures live on and in your body. And not just there. They're in the air, in water, in dirt, in and on plants and animals—everywhere! They are called microbes, and you need a microscope to see them.

We couldn't live without microbes.

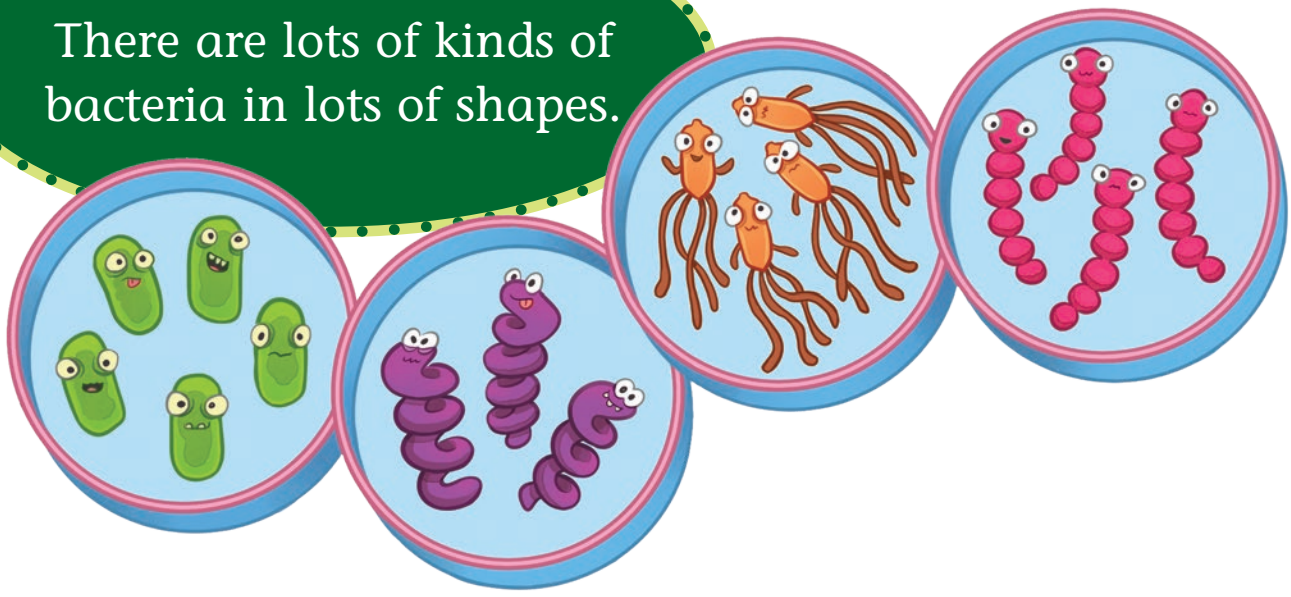
Some microbes are used to make cheese and chocolate and other food.

Some help plants grow.

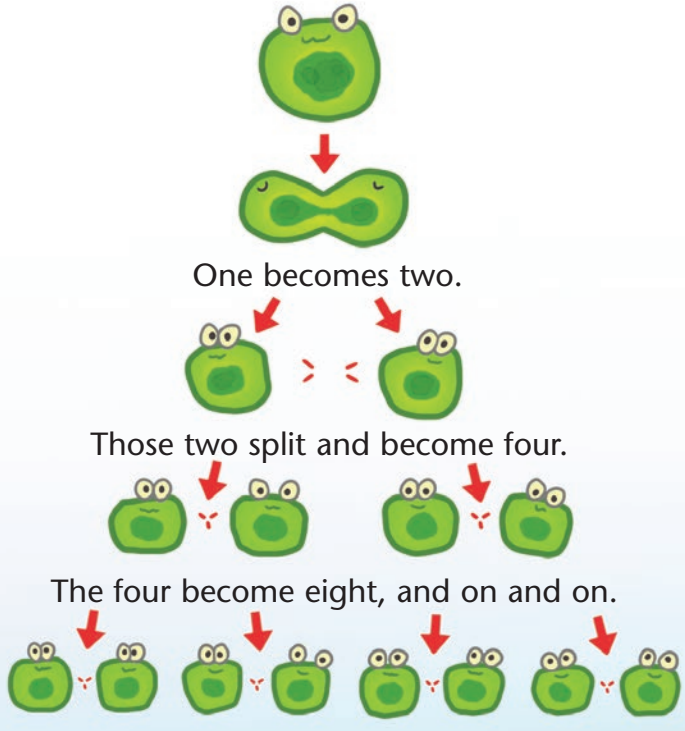
Some keep your body healthy.

But a few can make you sick. We call those ones germs, and they are usually either bacteria or viruses.

There are lots of kinds of bacteria in lots of shapes.

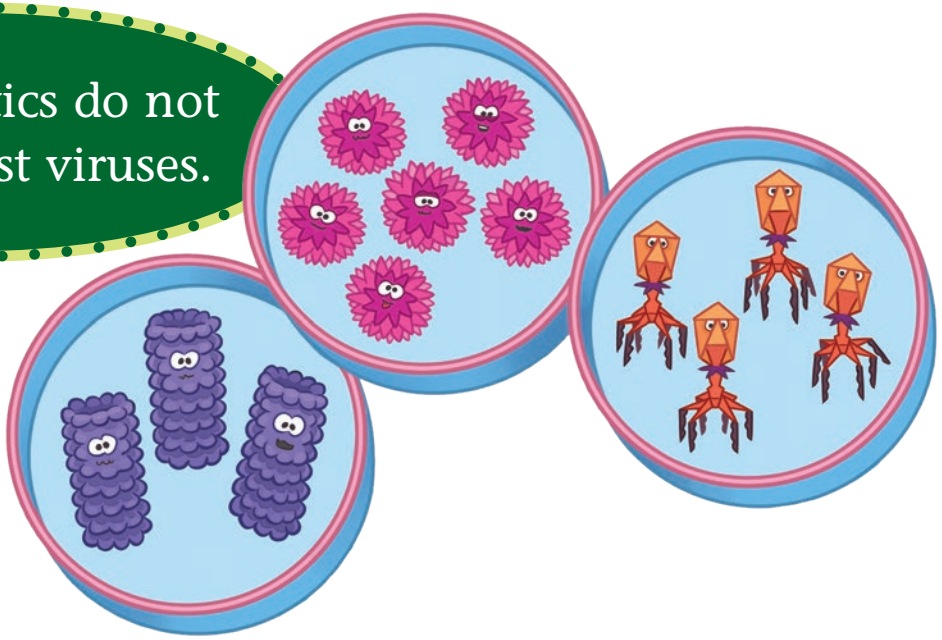


Whatever their shape, bacteria can grow and split into two identical copies—fast! If bad bacteria get inside you, it doesn't take long for you to feel sick. Your body can fight back, but it takes time. Luckily, medicines called antibiotics can kill bacteria, so you get well quickly.

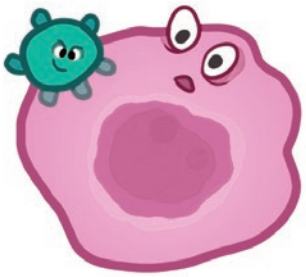


In just hours, what started as one can become millions of bacteria!

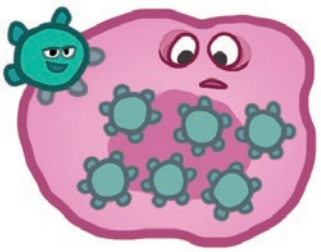
But antibiotics do not work against viruses.

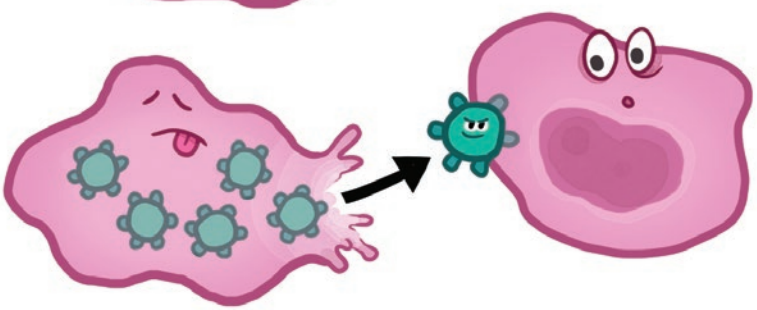


Many scientists do not think viruses are alive. A virus cannot grow or move by itself. And to make copies of itself, it has to be inside a living creature, called a host.



Once it is inside a host, the virus invades a cell and forces it to make more viruses. The new viruses burst out of the cell, leaving it dead or very weak. Each new virus then invades another cell.





If you're the host, millions of viruses soon spread through your body, making you feel sick. Antibiotics won't help. Medicines called vaccines can—but only if you get them *before* you get ill.

Seasonal Flu

VS

Pandemic Flu

What is it?

Influenza (flu) is a contagious respiratory illness caused by flu A and B viruses that infect the human respiratory tract. Annual flu epidemics occur among people worldwide.

A **flu pandemic** is a global outbreak of a new flu A virus in people that is very different from current and recently circulating seasonal flu A viruses.

How often does it occur?

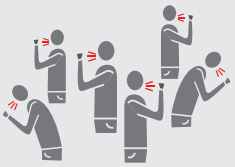
Epidemics of seasonal flu happen **every year**. Fall and winter is the time for flu in the United States.

Flu pandemics happen **rarely**. Four flu pandemics have happened in the past 100 years, but experts agree another one is inevitable.

How is it spread?

Flu viruses are thought to spread mainly from **person to person** through droplets made when someone with flu coughs, sneezes, or talks near a person (within 6 feet).

Pandemic flu viruses would spread in the **same way as seasonal flu**, but a pandemic virus will likely infect more people because few people have immunity to the pandemic flu virus.

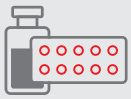


Is there a vaccine?

Seasonal flu vaccines are **made each year** to vaccinate people against seasonal flu. Everyone 6 months and older should get a vaccine every year. For most people, only one dose of vaccine is needed.

Although the U.S. government maintains a limited stockpile of some pre-pandemic flu vaccines, vaccine **may not be widely available in the early stages** of a pandemic. Two doses of pandemic flu vaccine will likely be needed.

Are there medicines?



Prescription medications called **antiviral drugs** can treat seasonal flu. During a severe flu season, there can be spot shortages of these drugs.

Flu antiviral medications may be used to treat pandemic flu if the virus is susceptible to these drugs. While a limited amount of flu antiviral drugs are stockpiled for use during a pandemic, **supplies may not be enough** to meet demand during a pandemic.

Who has the highest risk?

Young children, people 65 years and older, pregnant women, and people with certain long-term medical conditions are more likely to have serious flu complications.

Because this is a new virus not previously circulating in humans, **it's not possible to predict who would be most at risk** of severe complications in a future pandemic. In some past pandemics, healthy young adults were at high risk for developing severe flu complications.

source: cdc.gov

Epic Epidemics

by Marcia Amidon Lusted

They crept up stealthily and struck suddenly. They took hundreds of thousands of lives. And sometimes they affected the course of history. Historic disease epidemics have impacted wars, panicked the population, and motivated people in the field of science to develop treatments and cures sooner than they otherwise might have.

Yellow Fever's Reach

When French refugees from the Caribbean arrived in Philadelphia, Pennsylvania, in the summer of 1793, they brought with them a disease. Showing symptoms of fever, chills, and black vomit, citizens of the city began to fall sick at alarming rates. As "yellow fever" spread and 75 to 100 people died per day, President George Washington, his Cabinet members, and thousands more left the nation's capital to avoid infection. They did not return until November, when the deadly epidemic showed signs of easing.

The epidemic may have ended, but doctors in Philadelphia had no idea what had caused it. Some believed that yellow fever was contagious and spread person-to-person through close contact. More than 100 years passed before its real cause was revealed—that yellow fever is carried by a parasite that lives in mosquitoes and is transmitted to

FAST FACT

THE DISEASE IS CALLED "YELLOW FEVER" DUE TO THE YELLOWISH COLOR THAT AN INFECTED PERSON'S SKIN SOMETIMES TURNS FROM JAUNDICE.

After soldiers began dying at alarming rates during the Spanish–American War, medical personnel under the leadership of Dr. Walter Reed experimented with inoculation.

Cities could not function without certain critical employees, so these policemen took precautions against catching the flu in 1918.

humans when they are bitten by an infected mosquito.

The men who figured this out in 1900 were Dr. Walter Reed and Dr. Carlos Finlay while they were in Cuba during the Spanish–American War (1898). Yellow fever and dysentery were killing more soldiers than bullets in that conflict. Once it was determined that mosquitoes were spreading the disease, steps were taken to destroy mosquito breeding grounds. A decade later, this same method of eliminating mosquitoes was used to control yellow fever epidemics among crews constructing the Panama Canal.

Today, a vaccination is available for yellow fever. In places such as Africa and Latin America, however, supplies of vaccines are not available, which puts about 900 million people at risk of contracting the disease.

Fast-Acting Flu

One of the most frightening international epidemics was the Influenza Pandemic of 1918–1919 (also referred to as the Spanish flu). This virus came in three waves, the second two of which moved so quickly that medical personnel were overwhelmed and coffin-makers could not keep up with the demand for their services. When it was over, historians believe that an estimated 50 million people died worldwide. That's almost three times the number of lives that were claimed during World War I (1914–1918).

The illness spread person-to-person through the air, and the first Americans affected were soldiers in U.S. Army camps in March 1918. By October, some camps were reporting that one soldier died

every hour. Soon, nonmilitary Americans began contracting the flu. Health officials urged people to stay inside and avoid crowds and even banned public meetings. Churches, saloons, and theaters closed down. People began wearing masks in public. Still, one in every four Americans fell sick, and 550,000 Americans died before the pandemic slowed down in November 1918.

The particularly disturbing thing about the Spanish flu was that in addition to infecting the usual targets of the very young and the very old, this flu took a toll on the healthiest members of the population—young adults between 20 and 40 years old. Scientists have since determined that most influenza pandemics in the 20th and 21st centuries can trace their roots to the Spanish flu. This includes the H1N1 flu that surfaced in the United States in 2009.

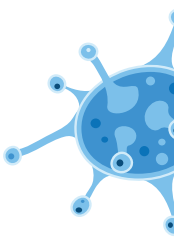
A War Against Malaria

During World War II (1939–1945), the American military did not just fight battles against enemy soldiers. It also fought to control the devastating effect of malaria on its soldiers. Like yellow fever, malaria gets passed to humans through the bite of an infected mosquito. Its symptoms are fever, chills, and vomiting. Even when a patient recovers from an initial infection, relapses often occur and malaria symptoms return.

For example, in mid-1943, when pivotal battles were being waged in Sicily, Italy, more soldiers were in the hospital with malaria than were injured in battle. During the early military engagements in the Pacific, malaria killed or injured four times as many soldiers as Japanese weapons did. Military campaigns had such limited success due to the shortage of soldiers that the U.S. Army was forced to address the issue.

Not only did the army develop antimalarial drugs, as well as better insecticides for controlling mosquitoes by destroying them and their breeding areas, but it made the fight against malaria a military problem. The army trained and educated officers to understand how malaria is transmitted and how it could be prevented.

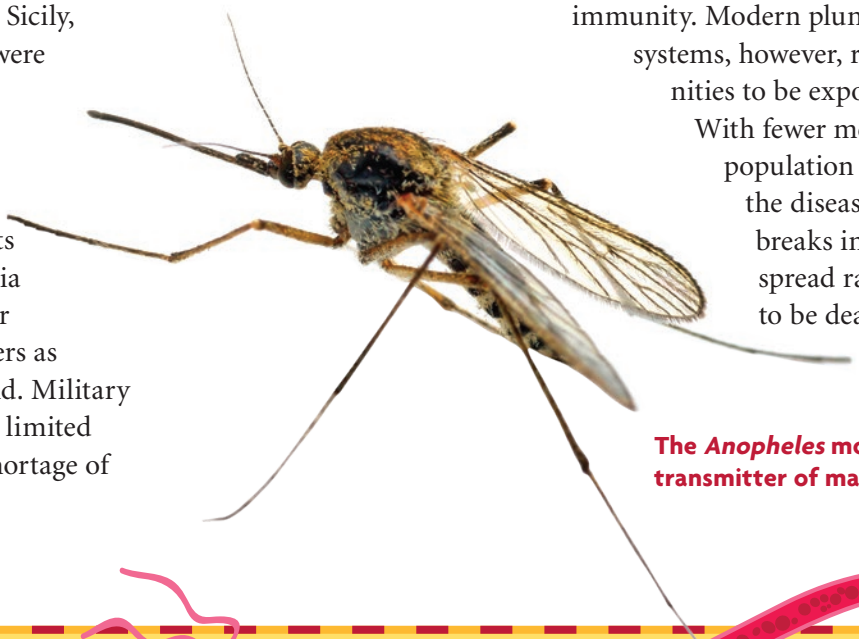
Scary Summers



Any inexplicable outbreak of disease can be terrifying, but those that target children are particularly devastating. Poliomyelitis, also known as "infantile paralysis" or "polio," is one such disease. It was one of the most dreaded childhood diseases of the 20th century.

Polio is caused by a virus that inflames the gray matter of the spinal cord and can affect the central nervous system. After initially developing mild cold symptoms and fever, those infected sometimes experience paralysis of the limbs. In some cases, the disease affects the lungs, which "forget" how to breathe. While the symptoms can be temporary, in some cases people are disabled for life.

Polio spreads person-to-person through exposure to fecal matter or saliva containing the virus. Scientists believe that the virus has been around for centuries and that most babies in the past were exposed to mild cases that then gave them immunity. Modern plumbing and sewer systems, however, reduced opportunities to be exposed to the virus. With fewer members of the population protected against the disease, sudden outbreaks in the 20th century spread rapidly and proved to be deadly.



The *Anopheles* mosquito, transmitter of malaria

A young victim of polio donates her bank full of pennies to help find a cure.

By the mid-1900s, the disease was appearing regularly in the United States during the summer months. Polio epidemics occurred in the United States in 1916, 1931, and then annually from 1942 to 1953. The 1952 epidemic peaked at 60,000 cases. Panicked parents were told to keep their children away from public places, such as pools, libraries, movie theaters, and summer camps.

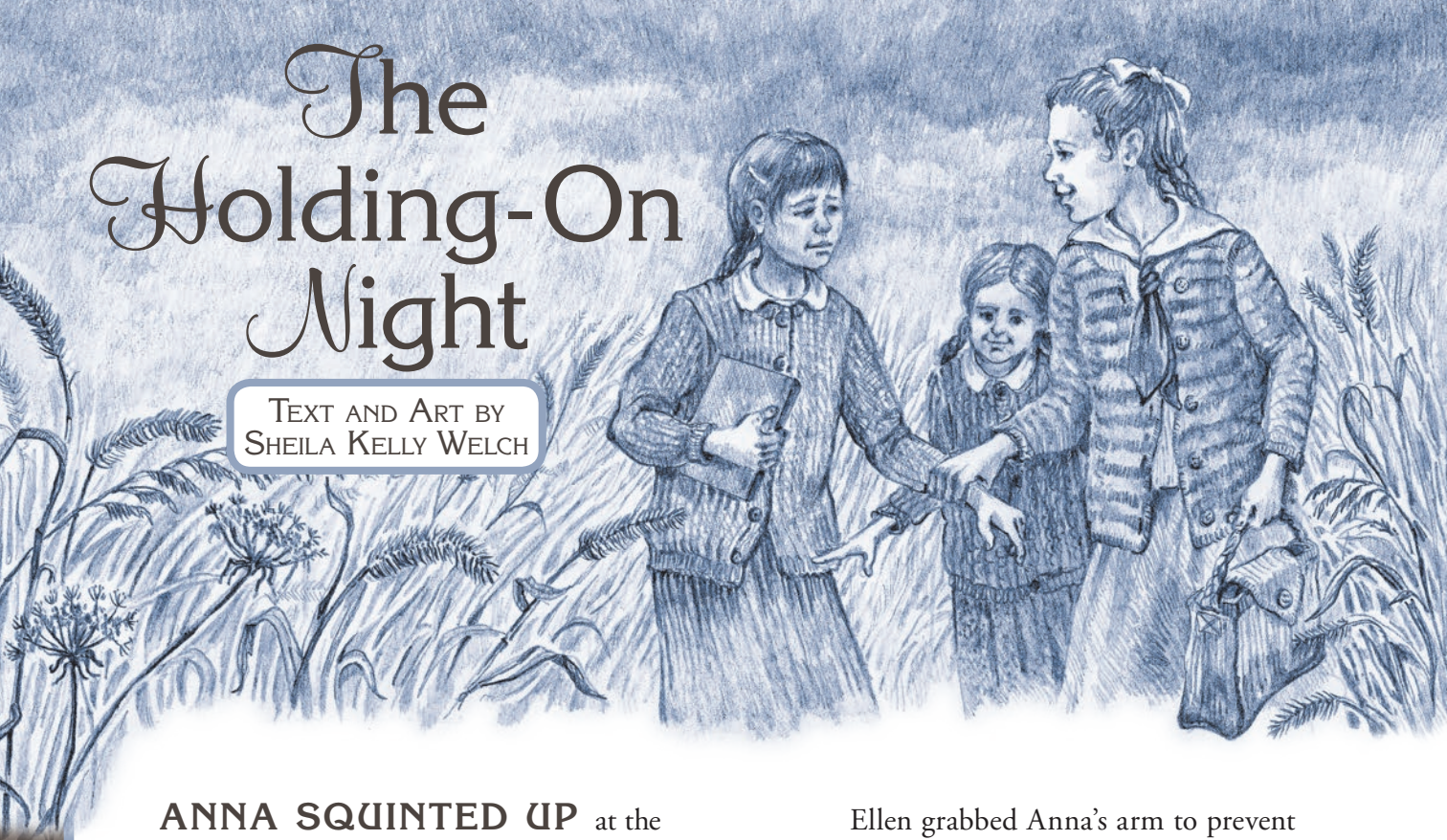
Americans were desperate for a vaccine that would prevent polio. After years of research and testing, Dr. Jonas Salk developed one. He tested his "killed" polio virus on himself and his family, then on select groups until the vaccine was approved for the general public in 1955. Polio soon was vanquished in the United States.

With the exception of the constantly mutating flu, many diseases that once were so devastating are almost unknown in the United States today. Better understanding of what causes diseases and the development of better sanitation and effective vaccinations have made this possible.

Marcia Amidon Lusted never had polio, but she did have measles, mumps, and chicken pox as a child.

The Holding-On Night

Text and Art by
Sheila Kelly Welch



ANNA SQUINTED UP at the stern clouds in the October sky. A sharp breeze skimmed across the field, whispering a threat of winter through the dried grasses. She shivered.

With an ugly twist of fear inside, Anna remembered the tense words of their teacher just before they'd been dismissed early from school. "All of you go straight home," said Miss Jacobs. "Don't go anywhere else. This flu is dreadfully contagious. Watch the newspapers to learn when school will be back in session."

Anna's older sister, Ellen, walked beside her on the narrow path. "It's going to rain, Anna," she said. "I can feel it."

"Beeeeep!" yelled nine-year-old Peggie. She was trying—unsuccessfully—to imitate the blaring horns of the Model T Fords that sometimes chugged past their house.

Ellen grabbed Anna's arm to prevent Peggie from squeezing between them. The grin on Ellen's face made her look younger than her almost-thirteen years. Any other time, Anna would have enjoyed teasing one of their little sisters. But today, she pulled free of Ellen's grasp and stepped into the high weeds to allow Peggie to slip by.

"Path hog!" yelled Ellen as Peggie skipped ahead of them.

"Daddy made the path just for *me!*" shouted Peggie.

"Did not!" Ellen replied. The path was for all the McNaughton school-age children. Their father had gotten permission from the farmer who owned the field and spent all of a weekend hacking through the weeds to create a shortcut to school. Yet Anna could understand Peggie's claim. Anna often wished their father would do something just for her.

In such a large family, it was hard to be noticed, easy to feel nearly invisible.

"I'm going to get the first slice of raisin bread," Peggie called back.

Every Friday, Mother baked bread. Today, Anna didn't feel her mouth watering the way it usually did at the thought of warm, yeasty, fresh-out-of-the-oven bread.

"Wait for me!" A small voice came from behind them. It was raven-haired Maria, another younger sister, always a slowpoke.

Ellen turned to walk backward a few steps. "Maria! Anna! Let's race Peggie to the road!"

Anna did not feel like racing. She watched her three sisters sprinting ahead of her, Ellen dragging little Maria. Their braids swung back and forth across their narrow backs. They all looked too thin, almost shrunken, inside their hand-knit sweaters.

Now Ellen and Maria had stopped at the road. Peggie had already dashed across and was running toward their house, third one from the corner. Ellen was insisting that Maria hold her hand, even though there were no wagons or noisy automobiles out and about with the deadly influenza stalking the country.

Anna had thought the Great War inflicted all the pain and suffering the world could bear. Every night she said a special prayer for the men and boys fighting for freedom off in Europe. But she hadn't started to pray for people with the flu until it was too late. Influenza came without warning, without newspaper photos of marching soldiers or bombed-out houses. The flu slipped in everywhere—unseen and unheard—like a deadly gas.

Anna had heard Mother whispering to Daddy about it at first. "Samuel has the flu."

"No! Not *Samuel.*"

Anna had known Samuel all her life. He was the handsome teenage son of the veterinarian who lived down the block. Samuel had been sick with tuberculosis for a long time, and his father had built him a tiny, screened-in house to help him get better. But air and sunshine didn't cure the flu. He was the first on the block to die.

Next was Mrs. Graferty.

She'd been mother of five and "expecting number six," as she'd told Mother one day last August. Anna had been in the pantry, quietly searching for a cookie. Through the open doorway she could feel the heat of the kitchen and smell the slightly sickening odor of diapers boiling, being sterilized on the wood stove. She listened intently, pleased to be privy to an adult conversation. Mrs. Graferty said, "Do you think God will see fit to send me a sweet girl this time?"

Anna could hear the smile in her mother's voice. "Yes, Alice, surely God will reward you for putting up with Michael, Mark, Matthew, Martin, and Mathias!"

Then the two women had laughed together. Anna had grinned to herself, happy to have stolen this moment of shared intimacy with her mother and the neighbor.

But now, Anna thought bitterly, Mrs. Graferty is dead, and so is her hoped-for baby girl. She trudged across the dusty road and along the cracked sidewalk. Just as she started up the sagging wooden steps onto

the front porch of their home, the door burst open. Peggie stomped out. "There's no bread!"

Ellen appeared in the doorway. "Back inside, young lady!" Her voice was as authoritative as their mother's.

With apprehension knotting her stomach, Anna entered the house. In the kitchen, she found their mother rocking, her dark head bent over baby Clara's damp blond one. Back and forth went the walnut rocker, and neither of them looked up even when Peggie began to whine.

"Be quiet," said Ellen sharply.

Anna stared at Mother and Clara. "Is she . . . sick?" Fear scratched at her throat.

Anthony and Joseph, the little boys of the family, came racing into the room. But their footsteps slowed and their expressions changed to solemn when the rocking chair suddenly stopped. Their mother looked up, pale eyes staring at each of the six children.

"Our baby may have a touch of the flu." Mother's voice grew firm as she continued. "It's nothing we can't lick. We're a strong lot, the McNaughtons, and we'll pull through."

"Where's John?" asked Maria. Although their fifteen-year-old brother could be a tease and no end of trouble, sweet Maria always wanted to say hello to everyone when she arrived home from school. At only seven years of age, she didn't comprehend the danger of the flu.

"He's . . . working," said Mother. "You little ones go play in the living room. I'll not have you disturbing the baby." When the younger children had left the kitchen, Mother told Ellen and Anna what sort of work their older brother was doing. "Helping to collect the dead," she whispered as she smoothed a damp cloth on baby Clara's forehead. Suddenly Anna wanted to cover her ears. She felt too young to hear the truth.

Later that night, with the oil lamp flickering on the kitchen table and all the little ones tucked into bed, John described in hushed tones the day he'd had. "The horses pull the wagon up and down the streets. People come to their doors. I call out, 'How many?' and they say, 'One large and two small.'"

Coffins. That's what the people were requesting, and Anna was thankful she had eaten almost no supper; otherwise, she was sure it would have come right back up.

The next day, there was no doubt that baby Clara had influenza—the flu. Mother moved onto the well-worn couch in the living room, the sick infant cradled in her arms. Ellen washed and boiled the heap of dirty diapers, and Anna helped her hang them on the gray clothesline behind the house. The wet diapers were icy cold and whipped her face as if in anger.

"I'm glad Daddy's home," Anna said, gritting her chattering teeth to keep from screaming at the wind. She loved her father with all her heart, although it was hard to know if he had time to love her back.

"He says the city is like a ghost town, with nearly no one outside," Ellen said, and Anna pictured the ghosts of those who'd died, drifting along the empty streets.

The house was too warm; their father had fed the potbellied stove so much wood, it glowed—as if fire could drive away the flu like a wild beast.

With everyone home, there were ten people crowded into the small rooms downstairs. Anna tried to convince the little boys to go outside to play, but when three-year-old Anthony complained that his head hurt, she was too frightened to say another word.

By Monday, most of the McNaughtons were sick, Anna included. Their father dragged the mattresses off their beds and down into the living room, transforming it into a makeshift hospital ward.

Anna lay still, trying not to roll into Peggie or Maria, who tossed and whimpered on either side of her. She ached all over. Her eyes felt like hot coals.

The room took on a grainy, grayish tone, like a silent movie, but minus the skilled piano player to fill her ears with entertaining music. Instead she heard the prone bodies moaning. She was vaguely aware that John had gone to work and Ellen was still moving around, helping to care for the others. She heard Mother's hoarse voice occasionally, crooning to baby Clara, whispering to Anthony or Joseph. Daddy was still up, coaxing broth into Maria, who complained that it burned her throat.

Days and nights blurred into one as the fever raged through Anna's body. Daddy had brought down several chamber pots, and he helped the little ones to use them. The stench was all around, and Anna lay, barely breathing. As her strength ebbed away, sucked down a stinking, dark hole, she was certain that she was dying.

And she was too weak to care.

It was night when Anna woke, her head on fire, wet stickiness covering her face. She tried to scream, but only a weird croaking sound came from her parched throat.

"Daddy?" she managed to whisper after several attempts. As if by some miracle, he was there, bending over her, holding a candle in one hand.

"Mother of God," he whispered. "It's blood. . . ."

Anna tried to sit up, terror gripping her body in a violent spasm. Blood! She felt her face with one hand and knew the blood was coming from her nose. Her father was gone for a moment and then came back with a wet cloth to mop up her face. Maria mumbled and flopped an arm over Anna's stomach.

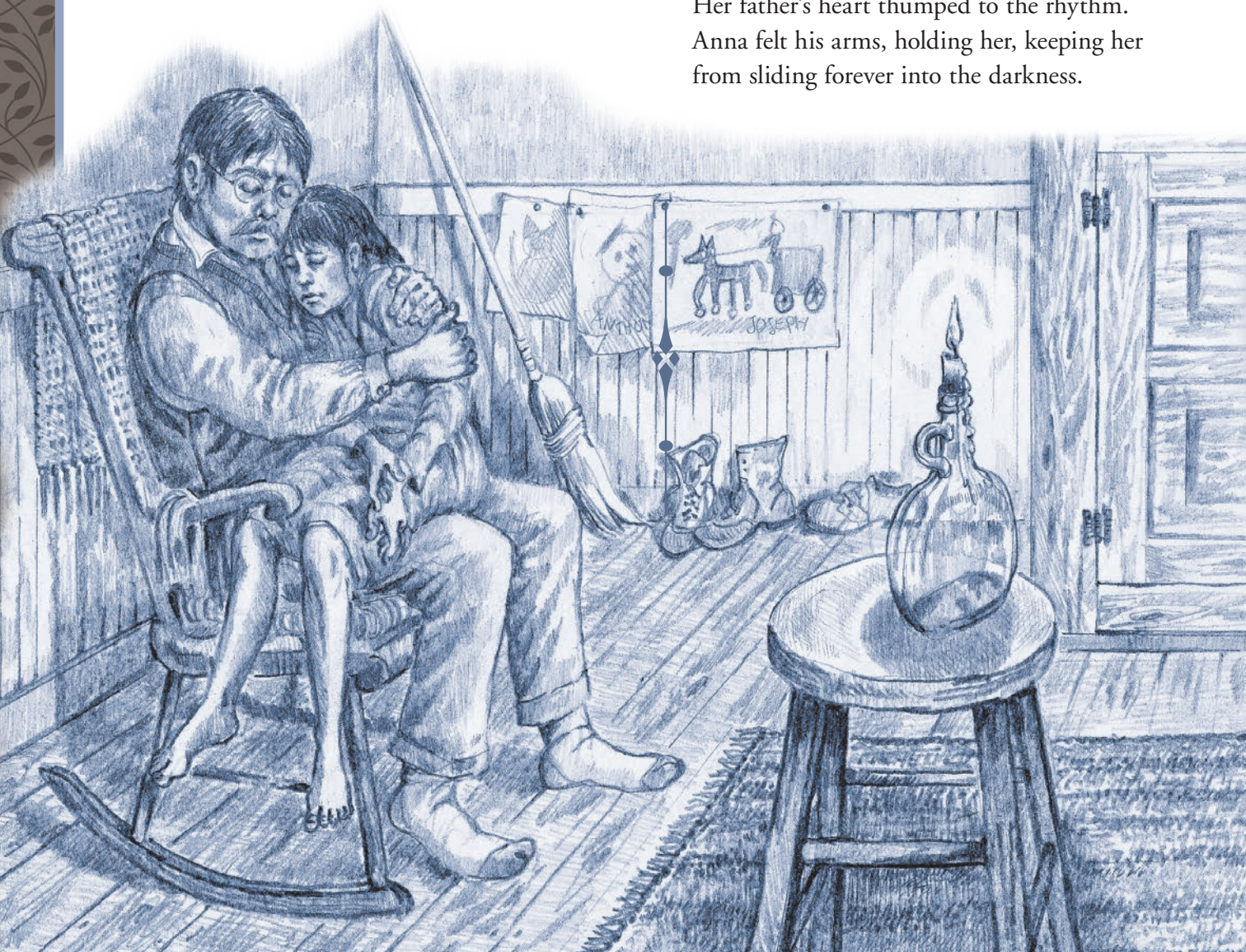
"Move over, wee one," whispered Daddy. And then he was gently pulling Anna off the mattress, extricating her from between her sisters. He carried her as if she were small. Anna had no strength to cling to him, but somehow he managed to thread his way through the maze of bodies and mattresses into the kitchen. There he sat in the walnut rocker, Anna draped awkwardly in his arms. She laid her aching head against his chest and heard the steady *thump-thump* of his heart.

Daddy held the cloth to her nose, but she was too exhausted to know if the blood had stopped flowing.

"We can't lose you," Daddy was murmuring. "Not our Anna. Oh, dear God help us, please."

Our Anna.

The rocker moved gently back and forth. Her father's heart thumped to the rhythm. Anna felt his arms, holding her, keeping her from sliding forever into the darkness.



Slowly, as the earth revolved through that long night, she felt the searing heat leave her body, and she knew that she was going to live. Yet her father, arms locked about her, kept rocking and holding on.

Anna knew she should tell him that she was feeling better. The other children, her mother, needed him. But there in the quiet kitchen, she let him hold her, this last time, as if she were a baby. It was a selfish, childish thing to do, she often thought later.

EARLY IN THE morning, as the first light seeped into the kitchen, Anna climbed from her father's arms. He had fallen asleep only moments before, but he barely stirred. She leaned over, ignoring a wave of dizziness, and kissed the top of his head. He looked up then and whispered, "Good morning, daughter."

"Go back to sleep, Daddy," Anna said. She could feel the warmth of his smile as she walked unsteadily into the living room.

"Ellen," she whispered. Her sister sat up on the mattress and stared at Anna.

"Oh, Anna. I thought . . . And if you . . . didn't make it, I didn't think any of the others could."

"I'm better," Anna said softly. "Today maybe I can help you. Remember what Mother said. We're a strong lot."

Ellen struggled up from the mattress. Suddenly, her gaunt face brightened. "Yes," she said, repeating their mother's prediction, one that would turn out to be right, "and we'll all pull through."

AUTHOR'S NOTE No one has been able to explain entirely why the 1918 flu was so deadly. Experts estimate that, during a six-month period, between 20 and 100 million people around the world died from the illness. The average fatality rate for those who contracted the flu was only about 3 percent, yet so many people got sick, the number of deaths was staggering. No other disease has ever killed as many people in such a short period of time.

Usually influenza is most lethal to the very young and the very old. In 1918, however, healthy young adults were also vulnerable. World War I military camps became places of horror as recruits died in droves. There were villages in Alaska that lost nearly all their inhabitants. In Philadelphia, 759 people died from influenza on one day in October, and in one month, the death toll was nearly 11,000. The city morgue was crammed with bodies, stacked three and four deep.

My grandfather worked in Philadelphia, and my mother's family lived on the outskirts of the city. The names have been changed in my story, but the characters all existed, including the neighbors who died. My mother's older brother did ride the wagon loaded with coffins through the streets of Philadelphia, calling out, "How many?" He was the last in the family to fall ill and he came the closest to death. My aunt Hester (Ellen) was the only one who never got sick, and all the others in the family recovered. Whenever my mother told me the story, she explained how guilty she felt about her behavior during that long night when she was reluctant to leave the comfort of her father's arms.

Such a pandemic seems impossible in today's world of modern medicine. Yet whenever a case of avian or bird flu is diagnosed, scientists and doctors are concerned that it might mutate and become contagious between humans. If that occurs, it is the haunting specter of the virus of the past that will spur a massive effort to prevent another deadly influenza from spreading around the world.

One Dreadful Record

WHAT'S GOING ON WITH EBOLA?

by Ivy Marr

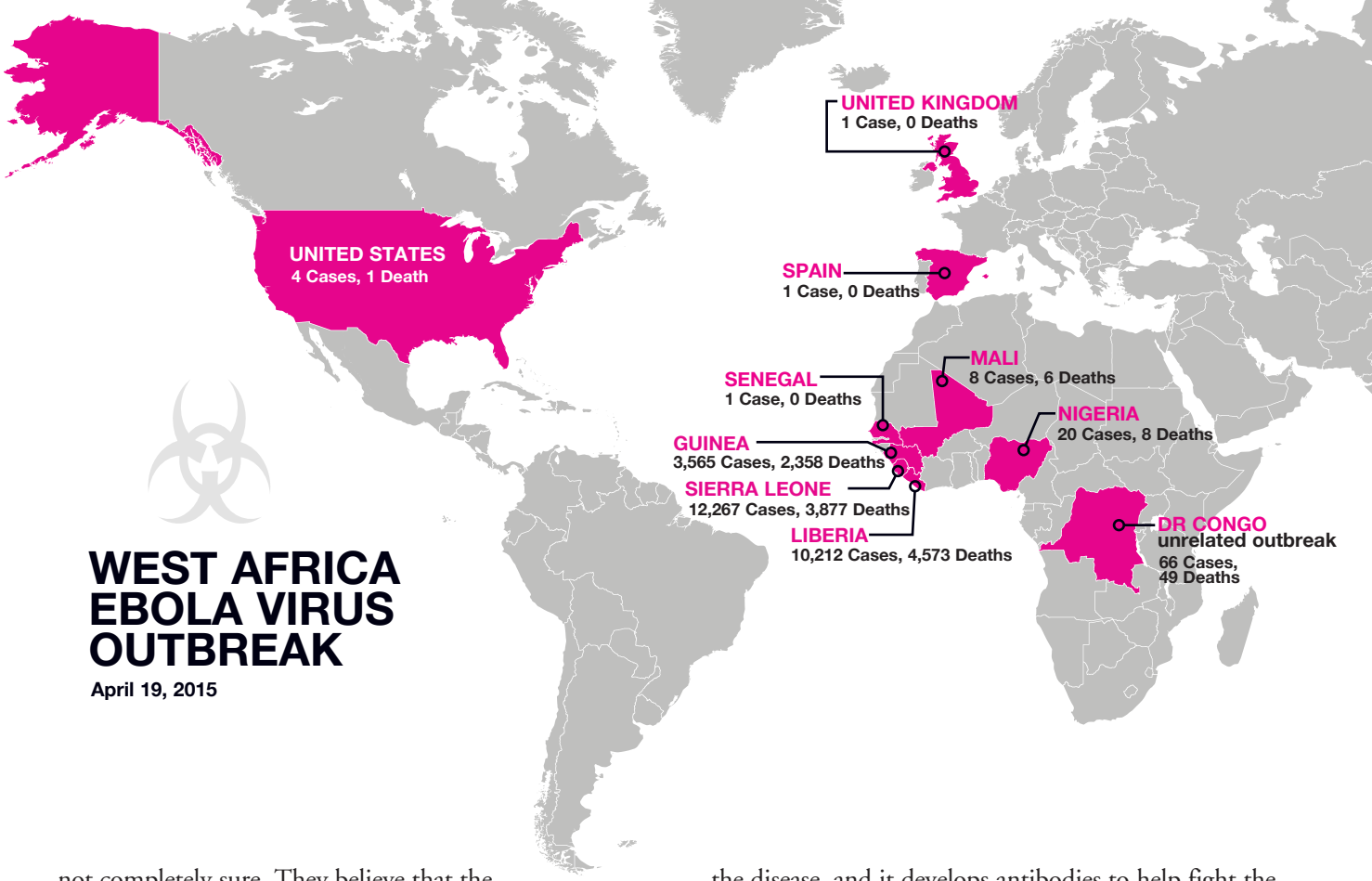
In December 2013, in a village in Guinea, West Africa, a toddler got sick. His family didn't know what was causing his fever, diarrhea, and vomiting. Most likely, they held him in their arms as they tried to nurse him back to health. Sadly, the toddler died of his mysterious illness. By the end of December, several of his family members had also died.

People traveled from across the country to go to the funerals, where they touched the bodies to say goodbye. After paying their respects, the mourners returned to their homes. In cities and villages across Guinea, the mysterious disease began popping up. Little by little, it spread to the neighboring countries of Liberia and Sierra Leone. By the time doctors realized that they were dealing with the Ebola virus, hundreds of people had contracted the disease.

A Virus that Looks like Spaghetti

Ebola first emerged in the Democratic Republic of the Congo in 1976. In the middle of the rain forest, pregnant Congolese women were experiencing fevers and severe diarrhea and vomiting. Scientists from Belgium and the United States flew in to investigate. With careful detective work, they discovered that the sick women had all been injected with the same dirty needles. The mysterious disease was being spread from person to person through bodily fluids, primarily blood. Using a powerful microscope, scientists were able to see the pathogen—a tiny, spaghetti-like virus called a filovirus. They named this particular virus Ebola, after a nearby river. But where had this new virus come from?

Scientists didn't know at the time, and they're still



not completely sure. They believe that the fruit bat is Ebola's natural reservoir—the place where Ebola hides between outbreaks. People can catch Ebola directly from bats or from eating "bushmeat"—the meat of wild animals. Chimpanzees and gorillas can also catch Ebola, and people desperate for food sometimes eat these animals, not knowing they are infected with Ebola virus.

Viruses are very difficult to treat. Antibiotics, which kill bacteria, don't kill viruses. This is why doctors won't give you antibiotics when you have a cold or flu; they tell you that you have to wait for your body to fight off the sickness. You've likely had vaccines to help prevent the flu, chicken pox, polio, and other viral diseases. These vaccines introduce dead or weakened viruses into your body. Your immune system learns how to fight the disease, and it develops antibodies to help fight the disease in the future, should you be exposed to it again.

What to Do?

Meanwhile, people were contracting Ebola and dying. As of May 2015, there were almost 15,000 confirmed cases and 11,000 more possible cases. The majority of these cases were in West Africa. (A few cases of Ebola have been brought to the United States and Europe, but Ebola barely spread in either place.) Since there was no cure, doctors and nurses did their best to keep patients comfortable while their bodies fought the disease. Unfortunately, roughly half of the patients didn't survive.

A few experimental treatments were tried. One involved exposing mice to Ebola proteins and then harvesting the mouse antibodies. These antibodies were "humanized" and inserted into tobacco plants. As the plants grew, they produced more antibodies, which researchers hoped would prove useful in treating Ebola in humans. Another experimental treatment was to inject blood from people who had recovered from Ebola into people currently suffering from the disease to transfer antibodies. However, this was not easy to do in remote field hospitals in Africa.

Since no Ebola vaccine was available, health-care workers focused on educating people about Ebola prevention. It's actually simple: wash your hands with soap and water, and don't touch sick people or those who have died. Ebola is not very contagious. It can't spread through the air like the flu can, and it's not spread by mosquitoes. Being in the same room as an Ebola patient is not very dangerous—as long as you stay a few feet away and don't touch him or her. Since doctors and nurses need to touch their patients, they wear special protective gear that covers all their skin and their eyes, noses, and mouths. They remove their contaminated gear very carefully and then wash with chlorine. People can use similar measures to stay safe when preparing the remains of someone who died of the disease. Most health-care workers did not catch Ebola.

African fruit bats [left] are reservoirs for the Ebola virus. Vaccines were tested in modified tobacco plants [right].

Hope for the Future

If it's easy to prevent Ebola, why did so many people get sick? Many people took care of their loved ones at home without protective gear. Hospitals were overcrowded, and people hesitated to send family members to hospitals where so many patients were dying. Because in West African cultures it's typical to say goodbye to those who die by touching their bodies, many people got Ebola at funerals. Another issue? Some didn't believe that Ebola was real and didn't listen to warnings.

Liberia's Ministry of Health put up posters like this one to help people protect themselves from Ebola.

Little by little, as people understood the disease better and as health workers from other countries went to help, transmission slowed. In January 2016, the World Health Organization officially declared Liberia Ebola-free.

Meanwhile, researchers all over the world worked on a vaccine. In the 1990s scientists had discovered an existing livestock virus that effectively delivered a vaccine. The livestock virus would infect humans but not sicken them, and another virus could be added to it. By 2005 an Ebola vaccine had proved effective in trials with mice, but years of work remained before the vaccine was allowed to be tested during the 2015 outbreak. The European Commission and the US Food and Drug Administration approved the vaccine, known as Ervebo, in 2019.

Where did Ebola come from in the first place? And how did the Guinean toddler become "Patient Zero" for the largest Ebola outbreak in history? Had he been playing in a tree filled with bats, as his friends remember? Did he actually catch Ebola from another person whose death was not recorded? We may never know the answers to these questions, but we learn more about Ebola every day.

As a young girl, Ivy Marr was fascinated by books on the Black Death. Now she's studying infectious diseases through the London School of Hygiene and Tropical Medicine. Her hobbies include traveling to exotic places, walking long distances, and doing chemistry experiments.

IN 140 CHARACTERS OR LESS

fiction by Marcus Griswold, illustrated by Lisa Fields

Alex jumps out of bed, ready for her first day at Disease Detective Camp. Ever since hearing about the Ebola outbreaks last fall, she's wondered if Ebola could make it to her town. And she's curious how experts track these invisible bugs.

At the Centers for Disease Control and Prevention, or CDC for short, campers wear badges with their photos and names. Hers reads: Alex, Disease Detective in Training.

Passing one of the labs, Alex overhears that there's been a new outbreak of Ebola! Her heart thuds. A CDC scientist pops out of the lab and briefs the campers. "We've got a case of Ebola on our hands. The first step in stopping an outbreak is to understand how the disease spreads."

Alex and her campmates are whisked into a room with wall-to-wall video screens. "This is our ready room," says the scientist. "We'll stay in close communication with experts and people on the ground to keep the disease under control."

One screen shows Dr. John Brownstein, a Harvard professor and founder of HealthMap.org (or, as Brownstein calls it, "Weather.com for disease tracking"). HealthMap.org appears on an adjacent screen. "This tool scours hundreds of thousands of social media posts from Twitter and Facebook, as well as local newspaper articles," Brownstein's voice booms from the video screen. "Recently, HealthMap found Ebola three days faster than traditional methods."

This tool sounds like a disease in itself—a computer virus that reads private posts, thinks Alex. At least those hours spent on Twitter and Instagram will come in handy.

A map pops up on another screen. "This is how the outbreak has spread over the last two weeks," Brownstein says. Alex watches, amazed, as colored dots appear across parts of Africa—slow at first and then faster.

"The first dots you see are where the computer program predicted Ebola cases would appear. Suspected cases show up when people mention the first symptoms of Ebola—high fever or body aches, for example," Brownstein says.

The CDC scientist asks Alex to open the Travel Map. Dots move slowly on the map, spanning the globe. The scientist says, "These are the movements of everyone who has been in the outbreak area in the last month, the incubation time for Ebola."

Alex gasps. "These dots are everywhere! How can you track all of these people?"

"That's why technology and social media are so important," says Brownstein with a smile. "We need more people like you out there, figuring out how to do this better. Social media is now our early warning system."

Alex turns to another screen, more chaotic than the last. Caged bats and monkeys screech and flap in the background. Wildlife experts and veterinarians come into view, faces covered with dirt. Flies buzz around them.

One of the scientists onscreen introduces himself as Dr. Zander. "Once a potential disease is identified, we first track down the infection host—in this case, bats or monkeys. These animals are common soup ingredients around here. We call diseases that can be passed between animals and humans 'zoonotic diseases.' We've just captured a few bats and monkeys suspected to live near the outbreak's site of origin."

Someone whispers, "Imagine eating bat-and-monkey soup!" A collective "Eww!" rises from the campers.

Dr. Zander continues, "Scientists also analyze genetic material, or DNA, from the stomachs of blowflies. That can help locate areas where the flies might have fed on dead, infected monkeys."

Another scientist jumps in front of the camera, hair flopping into her face. She's Dr. Gaia, a wildlife expert trying to protect the endangered monkey populations. Sweating profusely and out of breath, she yells, "This outbreak is so large because people here have cut down all the forests and built houses close together, increasing the chances of infection. Technology tracking is now key in these highly populated areas!" She signs off.

Alex and the other campers sit around a big table, their heads spinning as they debate how to pinpoint the outbreak's exact origin. After a few minutes, the CDC scientist comes over. "What do you guys think? Want to become real disease detectives?"

"Yeah!" many say. Alex's phone buzzes. It's a text from her mom, but it gets her thinking: how else could we fight epidemics by following posts and updates?

Marcus Griswold is a scientist interested in the interface between human activities and environmental conservation. He enjoys traipsing through swamps and forests in search of bugs. Much to his wife's frustration, he has been known to identify the species of mosquito biting her instead of swatting it away.

Real-Life Disease Detective Camp

Some kids really travel to the CDC in Atlanta, Georgia, for a free week-long camp held every summer. They take on the role of a CDC Epidemic Intelligence Service (EIS) officer, tasked with tracking down disease scenarios modeled after actual outbreaks. Campers meet CDC scientists, interview patients, and take on the role of reporters as they follow disease outbreaks from start to finish.

OUCH!

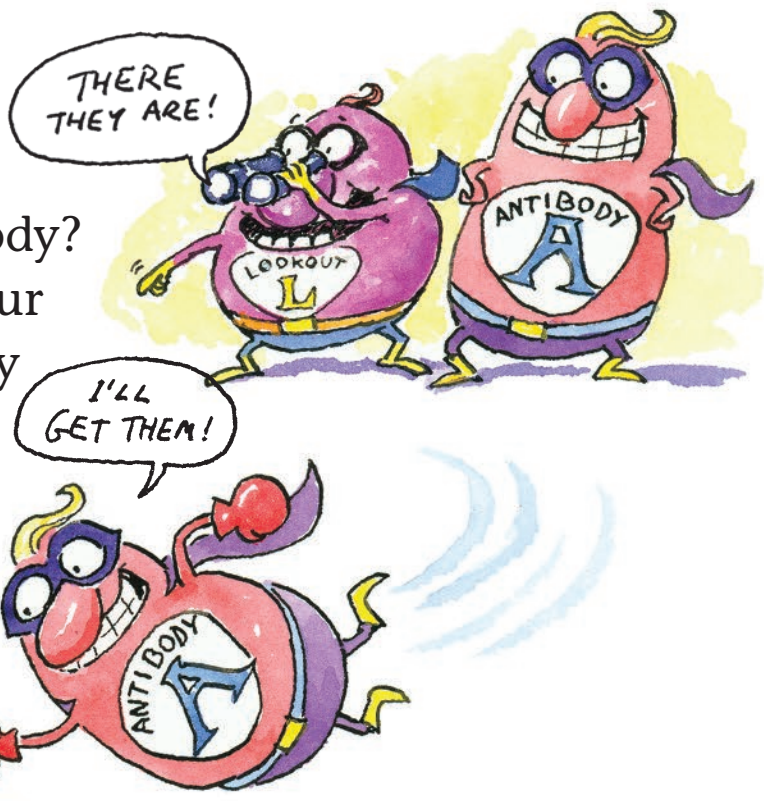
by Rachel Young

art by Thor Wickstrom

No one likes to get a shot. But shots are important.

The stuff inside the needle helps your body fight off germs that can make you sick. It's called a vaccine.

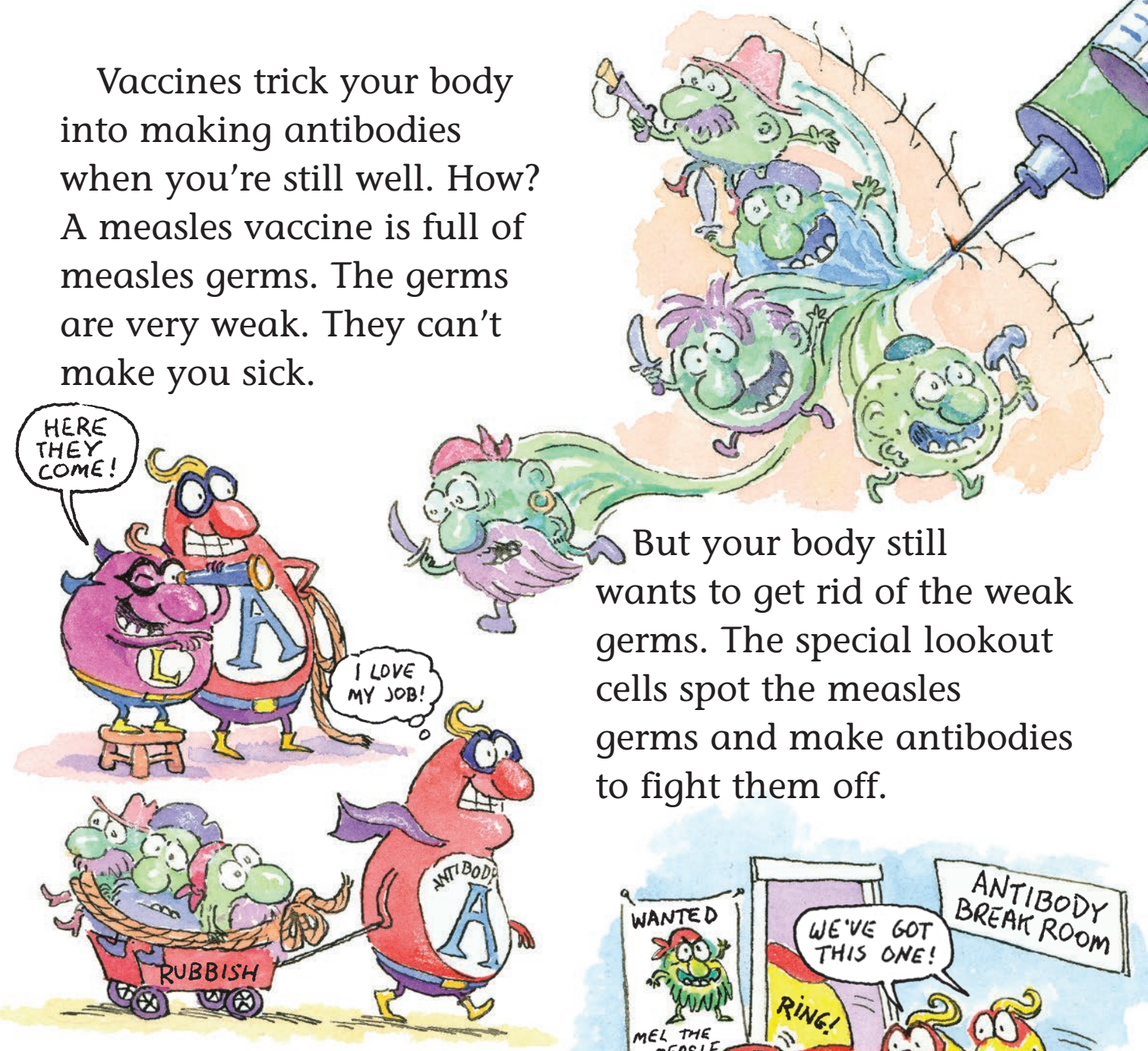
What happens when the germs that give you measles get inside your body? Special lookout cells in your blood spot the germs. They make germ fighters called antibodies that attack the measles germs.



You can get really sick before the antibodies kill all the measles germs. But once you're well, the antibodies stand guard so measles germs can't make you sick again.

If new measles germs get into your body now, the antibodies recognize and destroy them before you get sick.

Vaccines trick your body into making antibodies when you're still well. How? A measles vaccine is full of measles germs. The germs are very weak. They can't make you sick.



But your body still wants to get rid of the weak germs. The special lookout cells spot the measles germs and make antibodies to fight them off.

Now your body knows how to fight measles germs. If new measles germs get into your body, the antibodies are ready. They destroy the germs.

A long time ago, we didn't have vaccines. When your grandparents were your age, they might have been sick with mumps or measles or whooping cough or polio. Some kids got just a little sick, and some got very sick.

But because you've had your shots, those germs won't make you sick.

Got Germs?

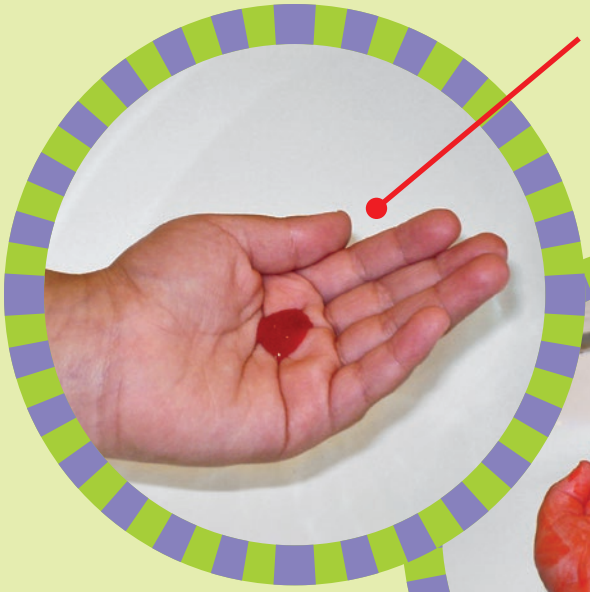
Why are people always telling you to wash your hands and cover your mouth when you sneeze? To stop germs from spreading!

When you sneeze, germs come flying out of your nose and mouth. And they can travel far. How far?

Go outside and pour a little pile of glitter onto your hand. Hold your hand flat, up by your face. Pretend to sneeze. *Achoo!*

How far did the glitter go? A real sneeze can send germs 20 feet away. That's as far as 24 *Click* magazines lying end to end!

Scrubbing your hands with soap and water loosens germs and rinses them away. You can't see germs. How do you know if you washed them all away?



Squeeze a small blob of washable paint onto your dry hand.

Rub your hands together to spread the paint around. Let the paint dry.

Wash your hands the way you usually do.

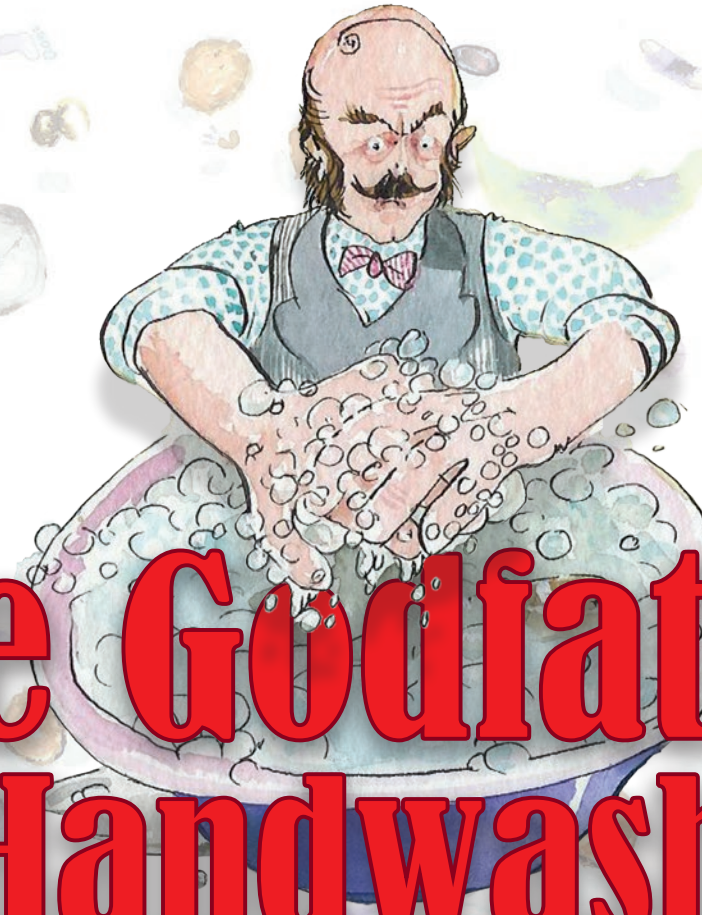
Is there still paint on your hands? Most people don't wash long enough to get rid of all the paint. Or all the germs.

To see how long you need to wash, make sure your hands are dry and try again.

Spread more paint on your dry hands, and let the paint dry.

Wash your hands with soap while you sing your ABC's.

All the paint should be gone! It takes a whole song's worth of scrubbing to send germs down the drain. So when you're washing your hands, slow down and sing.



The Godfather of Handwashing

Thanks, Ignaz Semmelweis!

by Leanne Longwill, illustrations by Roland Harvey

Your mom tells you to wash your hands a hundred times a day. Or maybe your teacher tackles you on your way to the cafeteria, trying to get a squirt of sanitizer on your hands. Everyone knows now that dirty hands spread germs and diseases. But back in the mid-1800s, Dr. Ignaz Semmelweis made this groundbreaking discovery at a hospital in Vienna, Austria. And everyone thought he was crazy!

What's Going On Here?

Semmelweis was an obstetrician who was puzzled by the number of women dying from "childbed fever" in his hospital just days after giving birth. Since it was a teaching hospital, he and his colleagues performed autopsies on the women who died to try to determine the cause. Often they had to leave the autopsy room and rush to the maternity ward to assist another woman giving birth. It's unthinkable now, but back then they didn't wear rubber gloves and they didn't wash their hands before delivering babies. Eww!

Two Clues

The hospital had two delivery wards; doctors delivered babies in the first ward and midwives delivered them in the second. Mothers were admitted randomly to either ward. Semmelweis's first clue to the cause of the fever was that statistics showed fewer women died from fever in the midwives' ward than in the doctors' ward. So, what was different? Aha! Midwives didn't do autopsies!

His second clue came when one of his best friends, Dr. Jakob Kolletschka, was accidentally stabbed with a scalpel during an autopsy of a woman who'd died after childbirth. Kolletschka died a few days later, after showing symptoms similar to childbed fever. Semmelweis theorized that the scalpel had been contaminated with some kind of "invisible cadaver particles" that caused Kolletschka's sickness. This scientific observation led Semmelweis to conclude that three things were needed to spread this disease: infected tissue (from a cadaver), a means of transporting the infected tissue (a hand or scalpel), and contact with healthy tissue (a woman giving birth or unlucky Kolletschka).

You Want Us to Do What?

Semmelweis then insisted that doctors wash their hands in chlorine solution when going from autopsy to bedside. He also insisted that bed sheets must be changed in between patients (yeah, they didn't do that before, either). He became obsessed with cleanliness, and his daily rants in the hospital made his colleagues treat him more like a madman than a hero.

The scorn of his peers and the realization that he, personally, had been responsible for the deaths of many mothers deeply saddened him. He worked around the clock and eventually alienated both family and friends. In 1865, at age 47, Semmelweis died a broken man, without recognition for his contribution to science and medicine. Perhaps now's a good time to express our belated thanks.

Leanne Longwill is a freelance writer in Pittsburgh, Pennsylvania. She likes to read and write about science, but right now she's washing her hands.

STOP the Spread!

by Andrew Matthews

Let's see if you know how to keep your germs to yourself and be healthy. Here's the situation: You have a common cold, but it's a bad case. You're sneezing and coughing, and your nose won't stop running. How would you handle these scenarios? Answers on page 1.

1. A group of your friends is getting together for a sleepover. The plan is to stay up all night and watch scary movies. You

a. immediately pack your bag and beg your mom to drive you to your friend's house.

b. suggest that everyone come to your house instead because you're sick and your mother doesn't want you to go out.

c. politely say no and explain that you're not feeling well and need to get a good night's sleep.

2. Your aunt brings over her six-week-old baby girl to introduce her to the family. Between sneezes you

a. beg to hold her.

b. keep your distance because you know that the baby's immune system is not fully developed and she might catch your cold.

c. poke your fingers around the baby's face in the hope she will try to grab onto one.

3. Your super-runny nose requires you to walk around with a box of tissues. You

a. make sure you immediately throw out the used tissues.

b. use your sleeves to wipe your nose anyway.

c. leave the used tissues all over the house for your mother to pick up.

4. You realize you suddenly have an appetite. You take this as a sign to

a. inhale two bags of potato chips and an ice cream sundae.

b. order a pizza supreme with extra cheese and sausage.

c. eat a broth soup and whole grain bread.

5. During your periodic coughing fits, you make sure to

a. leave your mouth uncovered and cough loudly so people know you are sick.

b. cough into the crook of your arm so that you don't spread your germs.

c. use the house phone to call all your friends to get sympathy.

6. Your father reminds you that it's important to wash your hands with soap when you're sick, so you make sure to

a. ignore his advice because you want everyone to be as miserable as you are.

b. ignore his advice because he also told you that Brussels sprouts are delicious and you think he is not telling the truth again.

c. wash your hands often, particularly after blowing your nose, coughing, or sneezing.

7. You feel so rotten that your parents let you stay home from school. You promptly

a. go back to bed to get the rest your body needs.

b. play an exhausting, two-hour game of Wii.

c. work up a good sweat practicing on your drums for three hours.

8. Your sister reminds you to stay hydrated. You take this to mean that you should

a. drink all the soda in the house.

b. look up the word "hydrated" because you have no clue what she is talking about.

c. drink water to flush out your system.

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