# PANDEMICS!

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ISBN 9781943431878

Noyce, Pendred
Pandemics! / Pendred Noyce - 1st ed
1. Children - Fiction 2. Science Fiction 3. Mystery

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September, 2023

# PANDEMICS!

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Tumblehome, Inc.

## CHAPTER 1

# WHAT IS AN OUTBREAK?

**MASSACHUSETTS, FEBRUARY 10, 2020**
**KNOX COUNTY, OHIO, JUNE, 2014**

Clinton Chang looked up with his mouth full of taco to see three eighth-grade boys jostle around a girl who sat alone at the end of the next table. A boy with low-slung jeans yanked a brown lunch bag out of the girl's hands. She was a small girl who had just joined Clinton's math class. Her name was June, she wore her glossy black hair in two pigtails with pink ribbons, and she had recently moved with her family from China.

"Whatchoo got in here?" demanded Brandon, the boy who had taken June's lunch. He peered inside the bag. "You

Chinese'll eat anything, won't you? What is it? Snakes? Rats? Cockroaches? Bats, right?"

He tore the brown bag open, spilling a box of noodles onto the floor.

"Oh, dear," sang out the tallest boy, whose name was George. "Looky, he spilled your worms."

Clinton climbed free of his bench. *Uh-oh, what am I doing?* he thought. But he felt the cool round disk of the G.A.S. medal against his chest. Clinton was no hero, but he had caught a thief once, and the Galactic Academy of Science had named him a trainee and awarded him a medal. The medal made him feel like he had to do the right thing. He crossed over to June's table.

George, the taller kid, leaned down and practically spat in June's face. "We don't need any filthy germs here, you understand?"

"Yeah, you should be wearing a mask," Brandon said.

"Or better yet, stay home," the third boy, a kid with curly hair, chimed in.

Clinton approached. "Hey, guys," he said. "Come on, now."

Brandon turned to him. "Oh, yeah? What do you want, punk?"

Clinton felt his courage melt. He stared at the floor.

"They're just noodles."

"Yeah, don't you know anything, buddy? The Yellow Peril? Haven't you heard about that new Chinese virus that's killing people? That comes from them eating weird

stuff and then coughing all over?"

Clinton wished he'd paid more attention to something he'd vaguely heard on the news. "Well, I'm sure June doesn't have any disease," he said, staring at June's feet, which were in shiny, black, patent leather shoes and white, silky socks. Her feet looked like a little girl's.

"June, eh?" Brandon asked. "A good friend of yours, is she? Your girlfriend? You Chinese like two chopsticks stuck together?"

Clinton gave him a fierce look. "I'm an American, same as you."

Brandon snickered. "Yeah, you look it."

"Korean American," Clinton said. For a moment he felt ashamed, as if he'd backed down. "I was born here," he added.

Just then, Clinton heard feet pound the floor beside him, and at his elbow appeared Mae Jemison Harris, who was his fellow G.A.S. trainee and also sort of his friend. She wasn't very big either, and Brandon was sneering at her too, but she crossed her arms and said clearly, "And I'm African American, and everyone knows we don't have bullying in this school. So get lost."

*Wow,* Clinton thought. He looked back. Around Mae, their arms folded, stood a semi-circle of middle school girls, all thrusting out their lower lips and looking mad.

"Need girls to save you, huh?" Brandon muttered, but then he stomped on the spilled noodles and walked away, with his two buddies hulking after him. Two noodles trailed along, stuck to Brandon's shoe.

June sat on the bench, not turning around, her shoulders shaking in her blue jacket. Clinton threw a desperate look at Mae, who smoothly slid into the chair beside the smaller girl. A couple of Mae's friends went around and sat on the opposite side.

"Don't worry," Mae said. "We'll get you something else for lunch."

June looked up at her. "Why they hate me? What I do?"

"They're just ignorant," Mae said, patting June on the shoulder.

But Clinton thought he could see steam coming out of Mae's ears.

Clinton caught hold of Mae's arm in the hallway on the way to science class. "What was that all about?"

"Coronavirus panic," Mae said.

"What?"

"Don't you pay attention to anything but video games and basketball?" Mae asked. "It's that pneumonia epidemic in China. It's spreading."

Clinton hitched up his backpack and matched his pace to Mae's. "I can't help it if my mother's not a nurse."

Mae stopped and glared at him. "You're the one who didn't even want to let your sister get vaccinated," she said. "I bet people would love a vaccine for this new disease."

"I just don't know that much about it," Clinton said. He tried to look humble. "You already convinced me about vaccines. But how do we stop those eighth-graders from

picking on June?"

Mae shook her head. "I don't know. I guess our country just likes to pick on foreigners these days. It makes me so mad."

Clinton was surprised to see tears shining in Mae's eyes. He drew her into a corner just as the warning bell rang for class. "What's going on?"

"You know my mom sometimes works as a nurse on cruise ships? Now she's stuck on one in a port in Japan and lots of people are getting sick. I'm staying with Grandma, and she's freaking me out with bad news and rumors. I don't know if they'll even let my mom come home." She gulped, swallowing a sob.

"Wow," Clinton said. "I'm sorry. I didn't know. Maybe we can do something. Maybe we can ask Selectra for help."

Selectra Volt was their teenage guide from the Galactic Academy of Science, a secret society to protect scientific integrity and the search for truth. She had already sent them on more than one science detection adventure. Though sometimes a bit ditzy, she was cool. And she came from the future.

Mae shook her head, crying more openly now. "We can't just call her. It's not like we have her phone number or anything."

A second bell rang, but Mae just stood there crying. Clinton wasn't sure what to do. Mae was never late to class—she must be really upset. He took her arm. "Selectra's not going to come visit us in a school hallway, that's for sure," he said, and he drew Mae down the hallway and into a janitor's closet. He pulled the door shut behind them,

except for a crack. At least this way, passing kids wouldn't see Mae crying. "Come on, Selectra," Clinton said in the darkness.

He didn't really expect their guide to answer. But all at once the closet began to shimmer with pink and green sparkles, revealing a mop and bucket and shelves full of unused science supplies. Selectra Volt materialized, as outlandish as ever in her green minidress, with pink pom-poms hanging around her neck and her short, straight hair sporting stripes of green and pink. Clinton supposed this was the fashion of the future. Selectra carried a purse of some transparent material hanging nearly to the floor.

"I was just thinking of you two," Selectra said, looking around. "But why do we have to meet in a closet?"

"Because we're in school, Selectra," Clinton said. "You know how we're supposed to keep you secret?"

"Oh, that," Selectra said, as if secrecy had suddenly become unimportant. "But listen, I may have a special mission for you."

Mae wiped her eyes and put her hands on her hips. “Were you eavesdropping?”

“We don’t do that!” Selectra said in a shocked voice. “But we do notice that some people in your school, in your country, are getting nervous, or as people in your time say, whacked out, about this new epidemic, COVID-19.”

“COVID-19?” Clinton asked. “Are you sure you’re talking about the right disease?”

“Oops,” Selectra said. “Haven’t they named it yet? Anyway, we don’t want foolish reactions the way we saw with Ebola or the Filovirus Frenzy of ’38.”

“The what frenzy?” Mae said.

Selectra bit her lip. “Uh, whoops, that one’s in the future, I think. That’s it, actually. We need some agents to be prepared for that worldwide… um… you know I can’t tell you about the future.”

“I think you just did,” Clinton said. “Anyway, we get to go on an epidemic mission? Cool!”

“Precisely,” Selectra said, hauling on the long cord handle of the purse until she could reach it. “Here are your supplies. These are special masks, which will protect you against airborne pathogens.”

“Against what?” Clinton asked.

“Germs in the air,” Mae told him, wiping her eyes.

“And you can wear these.” Selectra said. She handed them the masks, which felt light and rubbery, sort of like wet rice paper for making Vietnamese spring rolls. Looking doubtful, Mae plastered hers against her face, where to Clinton’s surprise, it seemed to disappear.

"I can breathe and talk just fine," Mae said, her voice sounding totally normal.

"Just don't try eating through it," Selectra said.

Clinton put on his own mask. It felt cool and damp as it melded onto his face, and then he hardly felt it. "Is this what you use in the future?" he asked.

"You know I can't tell you anything about the future," Selectra said. "And here's your X-PA." She handed Clinton the Expedition Personal Assistant, which looked like a modified smartphone.

Clinton took the X-PA and nodded at Selectra's bag. "What's that still in there?"

"Oh," Selectra said. "Those are your full-body protection suits, but you only need that if you're going to see the Ebola virus, which I don't think you really need to do. At least not yet."

Clinton perked up. "Isn't that the one where people spurt blood from their ears and everything? I want to see that!"

"They do not!" said Mae, who kept track of such things through her mother the research nurse. "And if they did, you would not like it!"

Selectra wrinkled her nose. "One problem with the body masks is that they get kind of … hot."

"I don't care," Clinton said. He exchanged glances with Mae, who gave a little shrug. Clinton accepted the two thin, rubbery, translucent suits from Selectra and stuffed them

into his backpack. “Okay, what’s the mission? Are we catching bad guys?”

Selectra formed a “No” with her mouth and shook her head. “You’ll be meeting a lot of good guys. Just learn, and come home to be the voice of reason.”

“Clinton, the voice of reason?” Mae sounded incredulous, but Selectra was already twinkling and fading away.

Mae crowded close to Clinton to look at the face of the X-PA. “Does it say we can visit my mom?”

The X-PA in Clinton’s hand had a dial for languages and a drop-down list of places and people to visit. It was much more limited than usual, and the places were numbered. Japan was fourth on the list. It was written in faced letters, and when Clinton tried to press it, nothing happened.

Instead, the first place lit up: “**Miller Farm, Knox County, Ohio, 2014.**”

Mae took the X-PA and scrolled through the destinations, but then she sighed and handed it back to Clinton. “Okay, let’s go.”

Clinton held the X-PA in the air, looped it in a figure eight around them, and pressed the button.

Clinton’s head whirled, and he steadied himself on his feet. He and Mae stood on a dirt driveway in front of a neat wooden house with a tall barn beside it.

“Look, a buggy,” Mae said, pointing. In front of the barn stood a black, wheeled carriage that looked big enough to carry four people.

Mae said, “I think it means we’re in Amish country.” When Clinton looked blank, she added, “They don’t like cars or other modern stuff, and they’re very religious. I bet they have a horse.”

“We could check the barn,” Clinton suggested. Somehow, he was reluctant to knock on the door of a house full of very religious people who didn’t like modern things.

“I don’t think—” Mae began.

But at that moment they heard a car coming up the driveway. A red Prius pulled up and stopped in front of them. The window rolled down, and a friendly-looking middle-aged woman whose blonde hair was beginning to gray looked out at them.

“Not to be rude, but you don’t look Amish,” the woman said.

Mae stepped closer. “We’re students,” she said, with that serious manner that always seemed to impress adults. “We’re on a project studying epidemics.”

“You are, are you?” The lady turned off the car and got out. She put on a white coat that had a stethoscope sticking out of its pocket, and took a clipboard out of the back seat.

“Have you had your MMR vaccines?” she asked. “Up to date on your baby shots?”

While Clinton tried to remember, Mae answered confidently, “Yes, we have. We have to get them to go to school, and besides, my mother’s a nurse.”

“Oh, really? So am I, a public health nurse.” She looked them up and down, and then said, “Right, then you can

come with me. I'm investigating the measles outbreak here among the Amish. Counting cases, checking on people's health, tracing contacts, the usual."

"Tracing contacts?" Clinton asked.

"Yes, certainly. When we find someone with measles we have to figure out where they've been, who else has been there, how the infection may be spreading. Usually that means a lot of time on the phone, but—" she shrugged—"the Amish don't use phones."

And with that, she strode up to the door and knocked.

Mae and Clinton followed and stood at her sides.

Footsteps echoed inside, and the door opened a few inches. A man with a chinstrap beard peered out. *"Ja, wie is hier? We hebben de mazelen in huis."*

"That's why I'm here, to see about measles," the nurse said. She stuck out her hand. "Janet Woodley, public health nurse for this district, and these are my trainees. May we come in?"

The door opened, and the three visitors entered a dark kitchen with a wooden plank floor. Around the table sat the man's family, eating a lunch of potatoes and sausage. But none of them looked that hungry. The man's wife, Mrs. Miller, wearing a long dress and a kerchief over her hair, scraped at her plate. Three boys sat in a row, slumping, their eyes glassy. A girl who looked less than two years old sat crying in her high-chair.

"We are trying to feed them," Mr. Miller said. "But they all have fever and the light hurts their eyes."

Ms. Woodley got right to work. She asked the boys to

open their shirts and summoned her "trainees" over to see the scattered red blotches of measles on their skin. She shone a penlight into their reddened eyes and saw them flinch from the light. Then she handed the clipboard to Mae. "Take notes," she directed, and she began to ask the family their ages and who else they had seen over the past two weeks, whether they had attended the Lunder wedding.

"How do I spell these names?" Mae muttered, scribbling as fast as she could.

Ms. Woodley pulled out her stethoscope and listened to the family's lungs. When she got to the last one, the angry toddler Lise, she frowned and kept moving her stethoscope around.

"Mrs. Miller," she said, her voice turning gentle, "I'm afraid Lise may have pneumonia, infection in the lungs. I'm sorry, Mrs. Miller, but I think she will need to go to the hospital."

The mother gave a little moan of distress.

"Will you come with me in the car?" Ms. Woodley asked. "To hold the baby and comfort her? Or should I send the ambulance?"

Mrs. Miller stood up. *"Ikzalkomen,"* she said. She rested her hand on the head of her eldest son and spoke to him in her language, which the X-PA told Clinton was called Pennsylvania Dutch. It wasn't too hard to understand, even without the X-PA's translator function. She told him to help his father and care for his brothers. *"Help je vaderenzorgvoor je broers."*

The boy ran out of the room and came back with a blan-

ket and change of clothes for the baby, which Mrs. Miller placed in a bag. Her husband gave her a hug and kissed the baby. "Stay at home," Ms. Woodley told him. "Rest and drink lots of fluids, all of you. We'll be sure to send word about Lise, but please stay home. It is important not to see people who have not been vaccinated."

"We will do," Mr. Miller said, bowing his head.

As they left the house, Clinton tugged on Ms. Woodley's sleeve. "Will the baby be all right?"

"I hope so," said the nurse. "We don't have medicine for the measles, but they can watch her breathing and keep her hydrated." She shook her head. "This outbreak started with a preacher who came back from the Philippines, which is having an epidemic. And some of the people in this community avoid vaccination because a few years ago, a couple of kids got sick after their vaccine. Of course, kids get sick all the time, so why not after a vaccine? But the MMR got a bad reputation, and people think of it as too modern anyway." She turned to Mae. "My notes?"

Mae handed over the clipboard, and asked, "Is the measles spreading fast?"

"Very fast," the nurse answered. "We have 292 cases already in this community. Ten in the hospital. Measles has an R-naught of about fourteen, you know. Now, I'm sorry I can't take you on more visits, but we have to get to the hospital."

She opened the back door of the red car, and Clinton saw that a baby car seat was already buckled into the middle of the back seat.

As Ms. Woodley helped the baby's mother put her into

the car seat, Clinton and Mae backed away. A horse whinnied from the pasture, and the X-PA vibrated in Clinton's hand. He looked down at it. The face read, "Return to base." He showed it to Mae.

"What?" she demanded. "Only one trip? What about going to see my mom?"

Clinton made a face and shrugged to show he didn't know. Then he pressed the button that read, "**Home**."

## CHAPTER 2

# WHO'S WATCHING THE NUMBERS? THE 1918 "SPANISH" FLU

### MASSACHUSETTS, FEBRUARY 12, 2020
### PITTSBURGH, OCTOBER 19, 1918

"Have you heard of the 1918 flu?" Selectra asked. "Some people in your time call it the Spanish flu, which is backward, because we think it started in Kansas."

They were meeting in the janitor's closet again, after lunch and before science class.

Mae saw Clinton looking at her confidently, as if he was sure she would know. She shook her head.

"Oh, ameboid," Selectra groaned. "So I have to play

teacher? History was my worst subject. But you must know this at least, right? It was the last year of World War I." Selectra stared into the distance for a moment. "Don't you think it's inept I got this job? Me, handling the past? What were they thinking?" She shook her head and brought her attention back to the kids. "A third of the world infected, maybe 50 million dead around the world. Do you know how many that is? No, of course you don't. Who knows what 50 million means?"

She seemed more scattered than usual. Mae put a hand on Selectra's arm and asked, "Our assignment?"

"Oh, it's on there." Selectra nodded at the X-PA in Clinton's hand. Sure enough, the second destination was lit up, "**Pittsburgh, October 19, 1918. Dick Lawrence, journalist.**"

"Any special instructions?" Clinton asked.

"Wear your masks. But if someone offers you a mask, wear that too. You don't want to seem rude by refusing."

Mae challenged Selectra, "When are you going to let us visit my mother?"

"We'll see," Selectra said, just like any ordinary adult. And with that, she nodded, and Clinton pushed the button on the X-PA.

They stood in the corner of a room crowded with desks and people talking on clunky, black, non-mobile phones. One man stood over a machine that seemed to be tapping out marks on a running strip of paper. The only woman wore her gray hair in a bun and pushed a cart holding a teapot and sandwiches. She stopped in front of them and asked in a stern voice, "Yes? Advertisements and funeral

announcements should be left at the window outside. No children in the newsroom."

Mae said, "We have an appointment to see Dick Lawrence."

The woman rolled her eyes. "That one. Wouldn't you know. Down there, last desk."

Mae and Clinton made their way down the row of desks to the last one, where a young man with mussed-up brown hair was leaning and squinting at a row of figures. "Doesn't make sense," he said. "Have to check these out myself."

"Excuse us, Mr. Lawrence," Mae said. "We're students, here to learn about the epidemic."

He squinted up at them and shifted in his chair. Mae noticed then that one of his shirtsleeves was empty and pinned across his chest. *World War I*, she thought.

"To learn?" He narrowed his eyes at them. "Or to tell me I'm unpatriotic to write about this when there's a war going on? To ask if I'm trying to undermine the spirits of our brave boys overseas with gloomy words from home?"

Clinton surprised Mae by speaking up. "Looks like you were pretty brave yourself, sir."

Dick Lawrence winced and looked down at his empty sleeve. "Not brave, just unlucky. Or maybe lucky. I'm home, and my buddies are in France." He lifted his head again and looked Clinton straight in the eye. "But I'll tell you this, when I was over there, what I wanted from home was the truth, not some sugar-coated cheery news."

"Yes, sir," Clinton said.

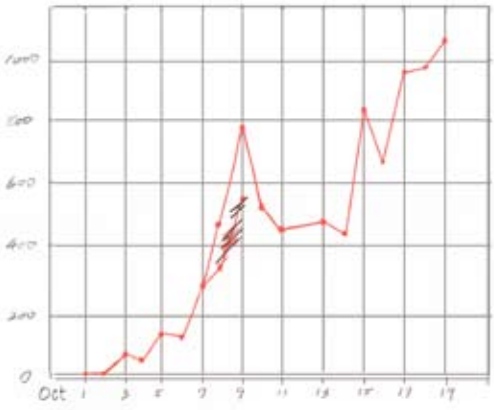
"And don't call me *sir*. I'm not an officer."

Clinton gulped. “No. Ah… okay.”

Mae said, “Tell us about the epidemic.”

Dick Lawrence lifted a sheaf of papers. “Numbers. I’m trying to get the numbers straight. If I can really see the real numbers of how many cases we have—if I can show people how it’s growing, maybe I can convince them—at least the mayor’s taking it seriously now. Not at first. ‘Oh, it’s just a few cases, it will go away.’ ‘Oh, it’s just at the military camps, we don’t have to worry.’ ‘Oh, we can’t ask people to stay away from saloons, how will they relax after a long week? And what about business?’”

He shook his head. “If we had acted faster… Now we’re seeing a hundred new cases a day, 400, 600, more. And forty people dying a day. Young people, mothers, doctors, workingmen. All in this one city! How do we know when it’s going to stop? And we don’t know what’s going on in other places. Some people are saying today will be the peak. The highest number, and everything will be roses from here on out. How do they know? What makes them think they know? I’m able to get little bits of information from other cities, but the numbers, who’s watching the numbers, making sure they’re accurate? What about New York, Chicago, San Francisco? What’s happening in Alabama? Mexico? China?”



He was talking faster and faster, his one arm flailing.

"Um," said Clinton. "Why do the numbers matter so much? You already know it's a lot."

"I want to chart it out," Lawrence said. "Look here." He showed them a jagged line that was trending upward, steeply. "I want to figure out where it's going, what's going to happen. That would help us now, but—" He shook his head.

"We expected so much of medical science, you know. We thought this was the century we would conquer disease. But what can we do against this bacterium? Quinine, castor oil. You should see the letters we get: 'Red peppers twice a day.' 'Chloroform and alcohol, burned by the patient's face.'"

Mae said gently, "It's a virus, you know. Antibiotics don't work. Flu is caused by a virus."

He jerked his head up and stared at her. "What are antibiotics? And a virus, what's that?"

Mae stumbled a bit. "Viruses are smaller than bacteria are. And they're not really alive. They're sort of half-alive, just packets of protein and DNA and—"

"DN what?"

Mae remembered that she wasn't supposed to tell people they visited anything about the future. *When did scientists learn about DNA, anyway?* she wondered.*

Clinton spoke slowly, as if an idea was just sinking into him. "Mr.

*James Watson and Francis Crick, with the help of Rosalind Franklin and Maurice Wilkins, figured out the structure of DNA in 1953.

Lawrence, wouldn't it be cool if you could get all those numbers you needed every day, all at once, from all over the world?"

Mae poked him, but Lawrence replied, "Yes, then we could get a handle on it, wouldn't we? And cities could compare what they're doing and see what works. And we could get a sense of when it's going to get better, when the numbers will start going down again."

He jumped up from his seat. "But that's just a dream, isn't it? Right now, we're just trying to tell the true story. And to help the historians. Want to come with me, see how it's done? Do you have masks?"

Clinton started to say yes, but Mae poked him again. "Um, no."

"Well, we'll go there first. But first, my salt and soda gargle." He spooned a large spoonful of salt and one of another white powder into a mug, then added steaming water from the teapot sitting beside him. "Salt and soda, doctor-recommended." He threw back his head and gargled loudly. "Want some?"

The kids shook their heads, and Lawrence took off through the newsroom with such long, fast strides that they had to half-run to catch up with him. "Where are we going?" Mae asked at his elbow.

"Red Cross, YWCA, Volunteers of America," he said. "All working on making masks, hospital suits, sheets, even. Thank God for the women. Do you know that the first thing the Red Cross did was send all our nurses to work in Philadelphia? That was two weeks ago, when the only people saying things were going to get hot here at home were me

and Dr. Armstrong, head of the hospital."

On the street outside, old-fashioned, squarish cars that looked like they could hardly drive competed for space with horse-drawn streetcars and darting children. "Look around," Lawrence said. "Streetcars with their windows down so the passengers can be saved by fresh air, not so helpful when it rains and the wind is blowing. And all these youngsters. It's not just the working kids, it's schoolkids too. The schools announced that any pupil with a cough or sneeze had to go home. A lot of pepper made its way around the classrooms."

Clinton snickered. "I bet. Wish *we* could get out of school that easy."

"Maybe we *will* get out soon," Mae said.

Lawrence wove quickly through the crowd, with Mae and Clinton scrambling to keep up. They climbed the front steps of a stone building with an arched entranceway. Inside, the main room was crowded with tables where women sat sewing. There were society ladies in fancy dresses and women who looked as if they could use a good meal and a good dress. Some sewed with sewing machines which they ran by pumping a pedal on the floor. Others bent over needle and thread.

"Mrs. Armstrong," Lawrence said, and a large, plump woman stood up to greet him.

"How many masks today?" the newspaperman asked.

"Hundreds," she said. "Maybe five hundred by day's end. But we have orders for seven thousand masks and three thousand sheets. And blankets." She looked at the kids. "Where am I going to find blankets? Are you here to

volunteer?"

Lawrence shook his head. "These are cub reporters, learning the trade."

Mrs. Armstrong said, "Children, you are learning from the best. The first one to warn us that this plague was coming, that it was real and big. The one who called out for volunteers, who helped convince the mayor to shut down the saloons and picture houses, who is urging them to close the schools and church services so we can wait out this plague while we let people like my husband find a cure."

"And Mrs. Armstrong is helping to organize food delivery to the poor and sick," Lawrence said. "They should put up a statue to you, ma'am."

"Not to me, to all these women," Mrs. Armstrong said, waving an arm to indicate the teams of seamstresses. "But what can I do for you?"

"Two more masks," Lawrence said, looking apologetic. "For the cubs on a hospital visit."

"Done," she said, taking two clean, white, cloth masks from a sack beside her and handing them over. "Now go along, and if you encounter my husband, tell him his supper will be waiting." She bit her lip. "Tell him to please be careful. And, oh, why not have your cubs deliver today's haul of masks?"

She lifted the sack, and Clinton took it, while Mae said their thank-yous and good-byes.

Then, still hurrying, Dick Lawrence ushered them back out to the street.

"A great lady," Lawrence said, as he led them along the

sidewalk with his long strides. “You see, for the numbers, I could wait for the city health department to issue them. But I find they miss a lot, and they’re slow. All doctors are required to report their numbers, but sometimes they’re too busy. I double-check by going straight to the hospitals. I ask the duty nurse, who has to write down the names of everyone who comes in and takes up a bed, and then record who goes out on their own two feet or with a sheet pulled over them. Though I still miss some that way, you know. Some healthy men drop dead right on the sidewalk. So I check the morgues too, but I’m not taking you there, not your first day on the job.”

They were approaching what looked like a large collection of carnival tents, and for a crazy minute Mae wondered if he was going to stop and buy them some popcorn or something. But Clinton was the one who spoke up. “I thought you were taking us to the hospital.”

Lawrence quickened his pace. “All our other hospitals are full. This one just went up a few days ago… a field hospital like the ones we had behind the battle front in Europe.” He stopped and looked at them. “Which is where half our doctors and nurses are, by the way. In France, patching up men who have been trying to kill one another instead of here protecting the civilians we thought we were fighting for.” He shook his head. “But never mind. Take a look inside.”

He pulled back the flap of the tent and ushered his cub reporters within. A portly, grizzled man with large sideburns stood talking to an earnest young man in an army uniform. Both wore masks. “Dr. Armstrong,” Lawrence said. “I bring masks and greetings from your wife, who implores you to take care.”

"Lawrence?" The doctor raised his bushy eyebrows. "And who are your pack mules?"

"Students out of school," Lawrence said.

The doctor frowned at Clinton and Mae. "You are right to stay home from school, but wrong to come mix yourselves among the sick, mask or no mask," he said. "Look at them. We build a hospital with three hundred beds, and it fills up." He waved a hand across the rows and rows of cots, each one occupied by a bundle that was a human being. Some of them sat hunched over, coughing. "And then there are the others, the ones we urge to go home unless they are really ill, and to stay away from other people."

"How many today?" Lawrence asked.

"Well, let's see here," the doctor said. "In this hospital, 164 admitted, 88 sent home to wait it out. You'll have to check at the other hospitals; I hear it's high. And we've had 12 deaths here today."

Lawrence scribbled on a pad of paper and turned to go, but caught himself.

"These students aren't from Pittsburgh, "he told the doctor. "And they have the oddest notion. They say this illness is caused by a virus, which is very small and not truly alive, and which they say is like a little packet of poison. Have you ever heard of such a thing?"

Dr. Armstrong's bushy eyebrows pushed together. "I haven't seen anything new under the microscope."

Mae said softly, "Viruses are too small to see under regular microscopes."

"Intriguing," the doctor said. "There is a Russian, a Dr.

Ivanovsky, who studied plant diseases. He found a disease of the tobacco plant which he can spread by crushing the leaves of an infected plant, squeezing out the juice, and filtering it through a filter with holes so small not even bacteria could pass. And that filtered fluid, applied to leaves of another plant, causes it to get the disease. Now, is the agent of infection a fluid or a particle so tiny it can pass through the holes?"

"Um," said Mae.

The doctor continued. "Now, how could we test your theory that this is a virus, whatever that is? We could take the infected blood of one of these poor patients. We would filter out all impurities, all bacteria, and inject it in a healthy person. But that would be unethical, of course. It's not a thing we could do."*

*Just a week earlier, in France, on October 8, a doctor named Dujarric de la Rivière persuaded a fellow scientist to inject him with filtered fluid from the blood of a soldier infected with influenza. Three days later, Dujarric fell suddenly ill with headache and fever, followed by sweats and fatigue, and finally by chest pains and shortness of breath. Luckily, after more than a week of symptoms, he recovered. He even tried to re-infect himself by swabbing his own throat with material coughed up by a patient, but he found he was immune.

"Oh, yeah, I mean no, I really wouldn't do it if I were you," Clinton said, shaking his head.

"Most intriguing as a thought, though," Dr. Armstrong said. "But now, alas, I must get back to my patients and you must get back to your rounds."

He shook their hands as if they were scientific colleagues and thanked them for delivering the masks.

Back outside the tent, Dick Lawrence shook his head. "You two sure have some crazy ideas. But now you should probably go home to your dinners while I go on to the other hospitals and the morgue. Will I see you again tomorrow?"

Mae said politely, "Probably not."

Lawrence grinned, shaking his head. "Thought not." He strode away, his legs swinging rapidly.

"Okayy," Clinton said, and he pressed the button that would take them home.

## CHAPTER 3

# PLAGUE SHIPS

### MASSACHUSETTS, FEBRUARY 12 & 14, 2020
### VENICE, 1348

Selectra Volt stood waiting for them in the closet, casting a pinkish glow on the brooms and buckets around her. “Welcome back,” she said. “You still have time to scurry off to class.”

“But we should keep going,” Mae said. “We have to keep going so we can get to visit my mom.”

“Patience is a virtue,” Selectra said primly. “It takes time and thinking to learn about pandemics.”

“Pan what?” Clinton asked.

"Demics. Epidemic: a disease breakout in a certain area. Pandemic: a disease outbreak around the world, or at least affecting two continents."

"Wait a minute," Mae said. "Are you saying this pneumonia thing is going to go around the whole world?"

Selectra clicked her tongue and shook her head slowly. "You know I can't tell you about the future."

Mae demanded, "How could it spread? By ship? The ship my mom's on is being held in Japan, and all the people on it are basically prisoners. They're all in quarantine, which means they can't even get off the ship."

Selectra looked impressed. "Quarantine, good word, Mae. How about visiting the place that word comes from?"

"Yes," Mae said. "Now, before class."

"Not yet," Selectra said. "You can go Friday. February 14, Valentine's Day!"

Without meaning to, Clinton took a half-step away from Mae. At the same time, Mae took a half-step away from him. Selectra smirked. "Friday morning, put on your safety suits. Meet up at lunchtime, and go on your mission. Clinton, you carry the X-PA."

"Me?" Clinton asked. "Mae's the responsible one."

"Could be you this time," Selectra said, with a sparkle.

Clinton shrugged and held out his hand for the X-PA. Selectra passed it to him.

"Where are you sending us?" he asked.

"Venice, 1348," Selectra said.

When Clinton didn't respond, she added, "Plague, you

know. The Black Death."

**1348 Venice**

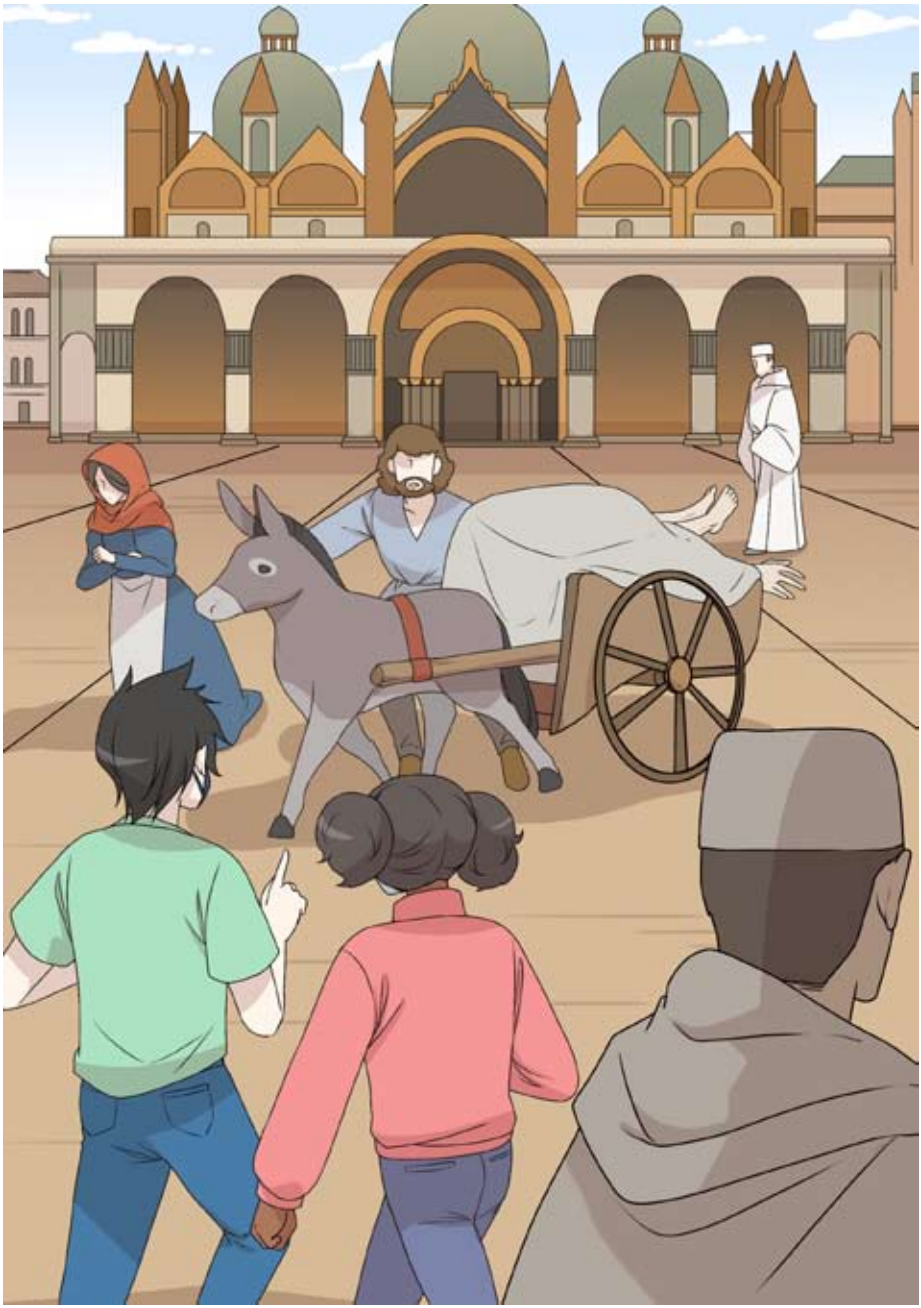
Two days later, Mae and Clinton landed in a large square paved with stones. They wore the protection suit-sover their clothes but under their shoes. Clinton could hardly feel his.

A few feet in front of them, water lapped at the edge of the square. A waterway opened into a lagoon dotted with islands and beyond them, the ocean. Low, narrow black boats with high curved ends moved along the lagoon, each propelled by a man at the back sweeping one long oar.

Clinton turned around to look at the square. It was almost deserted. At the far end loomed a massive building that looked like a church. It had one high marble archway and two smaller arches on each side. Its roof was a series of domes of different sizes, each one covered by a golden cross. Four huge bronze horses stood above the first arch.

"Wow!" Mae kept her voice low. "It's amazing. But where is everybody?"

Clinton pointed. "I see a few." He started walking across the stones. Mae followed, looking around at the rows of lower buildings that lined the sides of the square. Here and there she saw people. She approached a young woman with a shawl carrying a basket, but the woman ducked her head and hurried in the other direction. A man in a tunic and leggings led a mule and cart across the square, but when Clinton called out a hello, he glowered and waved them away. As the cart passed, Clinton caught a foul smell and turned to look at it. In the cart, a blanket covered a lumpy



pile of—what? An icy feeling slid down Clinton's spine.

In the midst of all this unfriendliness, it was a relief to see the church door wide open. The two travelers stepped inside. In the half light, the interior walls and ceiling sparkled. Scenes made up of tiny tiles glinted in colors of turquoise, magenta, and mostly gold. Statues looked down from high corners. A solemn, slow, almost tuneless singing sounded from the depths of the church. By an altar in front, there seemed to be a religious service going on, with a priest chanting and swinging a pot that gave off smoke. In front of him, three forms, one adult-sized and two child-sized, lay covered in sheets, while a man in dark clothes stood nearby, weeping.

Mae watched.

Clinton touched her arm. "I think it's a funeral."

She snorted. "You think?" She shook him off and turned to exit the church.

Clinton shrugged and followed. But as they stepped out into the square, a man wearing a rough tunic and carrying a thick stick stepped in front of them.

"I saw you go in there," he growled.

"We were just looking for some information," Mae said in her most polite voice. "Maybe you can help us."

The man shook his stick. "I'm the watch," he said. "Look at you, you're not from here. What are you doing here?"

"We're students," Mae said, giving Clinton a worried look.

"How long have you been here?"

"Not long," Mae said. "We just arrived."

"Is that right? And how did you get here, girl?"

"We… we…" Mae's voice trembled. She wasn't used to hostile greetings on their missions.

Clinton spoke up. "By ship. We came by ship."

"Oh, you did, did you?" The watchman twisted his hand into Clinton's collar and yanked him off his feet. "Bringing more plague? I'll chuck you in the canal!"

"But we just—" Clinton's voice choked off as the watchman dragged him back across the square. Mae followed, trying to catch the man's arm.

When they were about halfway across the square, a figure in a black, hooded robe crossed to intercept them. For an instant, Mae thought, *That's Death!*—but then the hood fell back, and she saw the tired face of a regular man. A monk, maybe.

"What have these youngsters done?" the monk asked.

"Snuck off a ship to bring us pestilence!" the watchman said, giving Clinton's feet a kick so he struggled again against the collar. "Which shall it be? The lagoon or the prison?"

"How about just sending them back to their ship?" the monk asked mildly. "I can take them, I'm going that way."

The watchman stuck out his lip and glared at the monk, who just nodded in an encouraging way. The watchman set Clinton back on his feet with a snort. "Take them. But don't let them get away." Shaking his head and grumbling, he stalked off.

When he was out of hearing range, the monk laid a hand on each child's shoulder. "Don't be frightened. He's just trying to protect the people of the city. Stay by me, and no one will question you again." He started walking, and Mae and Clinton hurried to keep close to him. "I am Brother Lorenzo," he said. "And you?"

They told Brother Lorenzo their names, and then he asked, "And what ship do I take you back to? For, as surely you know, each newly arrived ship must wait in harbor 40 days before anyone may come ashore."

"Er..." Clinton said. He liked the idea of getting aboard a ship, but he wasn't too sure they'd be welcomed aboard.

Mae spoke up. "First, we'd like to learn more about the plague. Maybe we can help somehow."

*I guess she really has confidence in these suits of ours,* Clinton thought.

Brother Lorenzo looked down at them doubtfully. "Some of the sick come to the monastery, out on the island," he said. "Few of them last long, but they do need care."

He led them to one of the long boats tied to a post along the shore. Instead of a bare-armed boatman, another monk in black robes stood at the oar. The boat was packed with bags that bulged with some sort of vegetable and grain. Brother Lorenzo waved to the travelers to sit themselves among the bags. To the other monk he said, "Runaways from a ship, but they offer to help us serve the sick."

The boatman monk harrumphed. Brother Lorenzo untied the gondola and settled in the bow, facing backward. The boatman monk said, "Did you find those you were seeking?"

Brother Lorenzo said quietly, “I found them.” He turned to Mae and Clinton. “My sister and her daughter caught the pestilence six days ago. By the time I heard, they were already gone. My brother-in-law is locked in his house, but he told me where to find their graves.”

“I’m so sorry!” Mae blurted.

Brother Lorenzo swallowed and blinked back tears. When he spoke, his voice was calm again. “My sister was a pious woman who loved to laugh. Who can predict when the Lord may summon us home? Some say these are the end times. Whether the sickness lingers until all of us are dead, or whether it departs as it came—”

“—On ships from the East!” put in the boatman monk, with a dark look at Clinton.

“Either way,” said Brother Lorenzo, “now is the time to treat our fellow beings with heavenly love and service. I grieve to see how friend turns from friend, no one dares visit the sick, anger rises against foreigners among us. Some want to blame the Jews, some the bad air, some the sinful times, some want to blame God himself. But our job is to live as Christ did, loving our neighbors as ourselves.” His brown eyes gazed at Clinton, seeming to bore into his soul. Clinton squirmed.

“What is the illness like?” Mae asked, polite as ever. The boatman monk stood behind her, weaving his oar in a figure eight shape, propelling the gondola forward, out into the waterway, past buildings crouching close to the shore. Ahead, islands interrupted the view of open water.

“Lumps or tumors appear in the armpits or groin. Some are as large as chicken eggs, some larger. After a few days

these may break down and leak out blood and pus. There is a high fever and terrible pains in the abdomen. Blotches appear on the skin. The sick person babbles and cries out. He vomits or has the bloody flux. Usually he dies, usually alone, sometimes in three days, sometimes a week."

"That sounds terrible!" Mae said. "How can you help them?"

The monk sighed. "We give them a bed to lie on. We walk among them and pray over them to keep them from being alone. We spoon broth into their mouths and lightly wash their burning bodies."

"But aren't you afraid you'll get the sickness too?"

The monk looked at Mae. "Would that be so terrible? To join my sister, my niece, so many of my brothers? But I wear this." He pulled out from under his robe a mask like a bird's head with a giant beak. "I stuff the beak with fragrant herbs, as the wisest physicians do. We burn other herbs around the room to keep the evil air away. So far, it has kept me safe."

The land slid by them on their left, and small waves slapped against the side of their vessel. Ahead, a low island came into view. Mae asked, "And how do you know where the sickness came from?"

"Stories from travelers. Two years ago it raged in the East, in trading ports. It spread from Kaffa in the Black Sea. Sailors bring stories, and then they fall sick and we know they have brought the pestilence itself. That is why we require all ships to anchor out beyond the island and wait for forty days, quarantagiorni, in quarantine. If the plague does not touch them in that time, then they are safe

to come ashore."

Now the boat swept slowly along the shore of the island. Beyond it, Mae and Clinton saw the masts and high hulls of anchored ships. On the island itself, one long, stone building stood back from the shore. "Our monastery," Brother Lorenzo said. "We have given over one end of it to the sick who come from the ships or sometimes from the mainland. You may stay as guests in the other end, where some of the sailors stay as they wait out their time."

Their gondola approached a low wooden dock and nestled its way in between others like it. Ashore, a few burly men rolled barrels or carried bundles from the dock up toward the building.

"We can help bring up the food, Clinton suggested, and the monk nodded.

Clinton lifted a sack and made his way along the narrow bow of the gondola, which rocked under his weight. Hurriedly he tossed the sack up on the dock, then clambered after it.

He turned around and said to Mae, "I think it's better if you hand me stuff."

So she did, as Clinton looked around at the clear blue sky and clear blue water. It was hard to believe there was sickness here, but then he heard a cry from the long building and shivered again.

"Shall I show you where you can stay?" Brother Lorenzo asked, stepping ashore. He led them toward a door in the right half of the building. But as he stepped across the threshold, a large, black rat slithered across his sandaled feet.

Mae cried out and jumped back.

Brother Lorenzo didn't seem to notice. "I will give you the cell of a man who died of the pestilence," he said, "but we swept it out and filled it with sweet smoke to purify it, and the blanket is clean."

Mae said, "You need to keep the rats out!"

Clinton gave her a worried look. He vaguely remembered something about rats and the plague, but he knew G.A.S. trainees like them were never supposed to mention future knowledge to someone in the past.

Brother Lorenzo shrugged. "The rats suffer also. We find so many of them dead."

Mae hesitated, lifted her foot as if to enter, and then abruptly put it down again. She said to the monk, "We can see the room later. First, we would like to start work."

Mae wiped her hands on her clothes and said, "We would like to start work."

Clinton glared at her, but Brother Lorenzo bowed his head, stuck his hands into his sleeves, and led them around the building to another entrance. They reached a large, wooden door with an iron ring. Brother Lorenzo offered Mae his bird's head mask, but she shook her head, and Clinton did too. *We have body suits and he doesn't,* he thought, *even though wearing a crow's head would be cool.*

Brother Lorenzo lifted the ring and set his shoulder to the door. It opened into a smoky room with straw-filled mattresses lining the walls. The mattresses were covered with people of all ages. Some sat with their head in their hands, some lay curled in a ball, some thrashed and cried out. Some wore dirty rags, some wore fine clothes half

ripped away.

Brother Lorenzo led the way between the mattresses, lifting his feet over puddles of vomit. “They should lie in clean places, don’t you think?” he said. “And be helped into clean tunics?” He nodded to an end of the room where a pile of woolen garments lay on a table. “Are you certain you are brave enough to start?”

“I’ll bring water,” Clinton said quickly.

Clinton grabbed a couple of wooden buckets and ran outside. For a moment he stood gasping in the clean salt air. He didn’t see a well anywhere, but surely seawater would be better than nothing for washing floors. He dipped the buckets and lugged them back up to the monastery door. Inside, Mae was kneeling beside a woman, wiping her face as she tossed her head and moaned. Clinton’s legs weakened and he sank to the floor.

“We can’t do this,” he said. “I’m sure we’re not meant to be doing this. We don’t have any medicine, we can’t help them.”

Mae looked up at him. “My mother wouldn’t just leave them. She’s probably doing this right now, aboard that ship, the Diamond Princess.”

“She’s a trained nurse,” Clinton said.

“I wish I could see her,” Mae said, and she began to cry.

Clinton looked across the room to see Brother Lorenzo kneeling beside one of the sick people, praying. The wet rag hung from Mae’s hand. Gritting his teeth, Clinton plucked it from her. He dabbed at the woman’s sunken, yellow face. Her eyes were dull. Clinton tried to wash her face without

looking at her. Mae groaned and moved on to the next bed.

Clinton picked up one bucket of salt water and poured it over a particularly filthy area of the floor. Then he went to look for a broom. There was one standing beside Brother Lorenzo, but when Clinton reached for it, the monk said, "This is not a good place for you two. Go and sit by the sea."

*Maybe he thinks we're weak,* Clinton thought. *Maybe he thinks we just need a break*. He took Mae by the arm and led her out around the back of the building. The lagoon lay in front of them, aquamarine and peaceful, the way it might look if there were no people left in the world.

Clinton took the X-PA, looped it around them, and pressed the button for Home.

Sitting with his family at their meal that night, Clinton looked back and forth between his parents and his little sister. He wanted to get up and hug them all, one after the other, which would be weird. He couldn't get the plague out of his head. So after dinner he went to his computer and started doing some research. His social studies teacher was threatening to give him a D, which would bar him from sports, but now he had a chance to impress her with something that really interested him. He set to work.

Clinton's essay:

The Black Death is the name for a plague pandemic, which is an epidemic that spread around the world. The plague came from central Asia to Europe in the middle 1300s, and some people say it killed one-third of all the population in Europe. It was probably brought by rats and fleas on ships.

Plague is caused by a bacterium called Yersinia pestis that is spread by lice, which are small biting insects. Lice bite an infected mammal and suck in some blood. If the Yersinia is in that blood, it will multiply in the lice guts. The lice get so full that the next time they bite someone they vomit up bacteria into the bite hole. Then the bacteria grow like crazy in the new host.

Symptoms of plague are terrible. You get gross swollen lymph nodes that break down and ooze blood and pus. You have high fevers and headaches and bad diarrhea and you vomit a lot. Then you die, usually. At least you did in the 1300s, because they didn't have any medicines for it. Now most people can be saved by antibiotics.

Plague pandemics came and went in waves for hundreds of years. Now the main place with lots of plague is Madagascar, which is an island off the southeastern coast of Africa. People can even get plague in Arizona or New Mexico, though not often. Yersinia infects prairie dogs and other rodents, not just humans. In fact, to prevent plague

from spreading, people spray prairie dog towns with insecticide or try to leave out anti-plague vaccines for prairie dogs to eat. Maybe that's why in the U.S. only three or four humans catch the plague every year.

- Clinton Chang for extra credit

## CHAPTER 4

# LIFE IN A PETRI DISH - ABOARD THE DIAMOND PRINCESS

### MASSACHUSETTS, FEBRUARY 16, 2020
### YOKOHAMA, JAPAN, FEBRUARY 16, 2020

"You say that cute boy invited you over?" Mae's grandma asked.

Mae rolled her eyes. "He's not cute. It's just a school project. Besides, his parents will be with us the whole time." Mae almost bit her tongue, surprised at how easily the fibs rolled off it.

"Well, you be home before too long, hear? I already have my daughter lost and in danger halfway around the world, I don't need my only granddaughter way across town. Besides, I need help with this puzzle." Mae's grandmother loved jigsaw puzzles, and right now she was doing one about all the different frogs and

salamanders in the world.

Mae slipped out the back door and unchained her bike. As she pedaled her way to Clinton's house, her heart beat hard. What did Clinton mean, Selectra had called?

At Clinton's house, she blew right past Clinton's mom, almost forgetting to say hi, and hurried up to his room. She burst through the door and saw Selectra right there, conversing with Clinton, who sat on his bed surrounded by half-constructed Lego projects.

"There you are, moonshine," Selectra said. "I waited for you in the broom closet."

Clinton said, "I told her it's Sunday and we don't have school."

"I don't see the point of this seven-day cycle," Selectra said. "Why not ten days, to make counting weeks easier? Why not 27 days to match your moon? We go to school every day, everywhere, except for holidays marking real milestones, like the first colony on—never mind, I'm doing it again, aren't I?"

"Selectra!" Mae said crossly. "Pay attention! Why did you come?"

Selectra gazed at her reproachfully. "I got special permission, just for you. And him too, of course." She waved dismissively at Clinton. "To visit your mom. Today, now. But of course it will be night there. You have to wear your full-body suit. And I have to spray you with this." She held up a lavender-colored spray bottle.

"Oh, wow, thank you!" Mae cried. Clinton took off his backpack and reached inside to pull out the two suits. "Nice and clean," he said. "My mom about fainted when she saw me doing the laundry."

They struggled into the suits. “What’s in the spray?” Mae asked, as Selectra began to spray her lightly, head to toe.

Clinton backed away. “No perfume for me, thanks!”

Selectra sprayed him anyway. “It’s lavender, to help your mother think she’s still dreaming. You must not betray the real existence of the Galactic Academy of Science. It will be night there, as I said, if you leave right now. Look for cabin C348, sixth floor. Nowhere else. This is a visit just to reassure you, Mae, so no poking around, please.”

“Does that mean my mom is okay?” Mae asked, but Selectra was already twinkling and fading away.

Clinton turned to Mae, shrugged, looped the X-PA around them both, and pushed the button.

They landed on the upper deck of a cruise ship much larger than the one they had visited when they solved the mystery of the cooking contest. It was night, and deck lamps lit the flooring under their feet. The ship lay against a pier, with no apparent movement from the waves. A few lighted ship windows cast yellow rectangles on the stones of the pier.

“I thought she’d put us right inside the room,” Clinton said. “Now we have to find our way.” He turned on a flashlight in the X-PA, and Mae followed him toward a structure that housed an elevator. He summoned it.

Inside, Clinton checked the buttons. “Look at this! Sports Deck, Sun Deck, Lido Deck—What do you suppose that is? Don’t you think we should explore a little?”

Mae just reached past him and pushed number six. When the doors opened, she entered the corridor. Everything was quiet, all

the people asleep behind closed doors, no sounds of laughter or partying. Mae followed signs to cabin C348. Once there, she hesitated, looked at Clinton, and then knocked.

"Yes, who is it?" came a sleepy voice from within.

"It's us," Mae said in a small voice, suddenly realizing how strange her mother would find it to see her daughter here, half the world away from where they'd last seen each other. "We came to check on you, Mom."

The door opened slowly. Mae's mother was in her favorite orange bathrobe with her hair still pinned up as if she were wearing her nurse's cap. "Mae, how sweet of you! And you brought your sweetheart Clinton."

"Mom!" Mae said, shocked.

Her mother sniffed the air. "What a lovely scent you're wearing. Oh, don't fuss, honey, of course I would never call him that in real life, but we're just dreaming, aren't we? Do come in."

Choked with embarrassment, Mae went at once to sit on the bed. But grinned and said, "Hello, Mrs. Harris. We thought you could tell us how things are going on the ship and how you're doing."

"Just a minute. I can't really converse with you in my bathrobe, can I? And I'll be back on duty in a few hours anyway." Mae's mom disappeared into her bathroom, emerging a few minutes later in her nurse's uniform with her hat pinned securely in place. "Much better," she said, and she sat beside Mae on the bed while Clinton sat on a chair at her desk.

Mae's mom fixed Clinton with a serious look and said, "We're living in a Petri dish, that's how it is, Clinton."

"A Petri dish?"

"Those are plastic disks that we cover with agar to grow bacteria and cells on. Here we feel like we're an experiment: what happens when you lock three thousand people in with a raging, contagious virus that maybe spreads by touch, maybe spreads through the air?"

"Er," Clinton said. "Yeah, that sounds kind of bad. What happened?"

"This was a pleasant cruise at first," Mrs. Harris said. "I helped out in the clinic, checking blood pressures and pulses, and we saw some sprained ankles and asthma. Then two weeks ago we got word that a patient who had left the ship in Hong Kong was sick with the new coronavirus, the one they're calling COVID-19. We weren't too worried: he'd already been on land for six days by the time he got sick. But we paid special attention to anyone with a cough."

"And I bet you saw some," Clinton said. "Sick people, I mean."

Mrs. Harris nodded. "By the time we reached the port here in Yokohama four days later, we had a few people with fevers and coughs. We asked them to stay in their cabins or in the infirmary so they wouldn't infect other people, and when we got to port the Japanese Ministry of Health sent people aboard to test them. Ten positive that first day."

"Uh-oh," said Clinton.

"But when are they going to let you come home?" Mae demanded.

Mrs. Harris held up a hand. "Let me continue. The Coast Guard took those ten people ashore to the hospital, but the rest of us had to stay aboard."

"That's not fair," Clinton said. "They were like keeping you locked up just because other people were sick."

"Well, what would you do?" Mae's mother asked him. "Let almost 3000 people out to wander around your city and your country if they might be carrying the virus? Or keep those people in quarantine until you knew for sure they had no disease?"

"Well, couldn't you just separate out the sick ones?" Mae asked. "Wouldn't they all have fevers or something?"

"We weren't quite sure. Could someone have the virus, not have any symptoms yet, and still get other people sick? That's what we call asymptomatic transmission. Nobody knew for certain. For example, what if right now I'm carrying COVID-19 and can pass it on to you? That's why if this wasn't a dream I'd kick you out of here so fast…!"

Mae wanted to tell her mother that they were not a dream, but that they were protected by their body suits. Then she wondered if Selectra already knew her mother was sick and that was why she had made them put on the suits. She shook her head to make that thought go away, and asked, "So what happened?"

"All the guests were told to stay in their rooms. Food is delivered to them, and they have internet, and they can go out on their balconies if they wear a mask. That was on February 4. By February 6, 41 had tested positive. By Feb 9, there were 66 more."

"It's just like the flu in Pittsburgh!" Clinton said. "The number keeps going up and up. What's the R0? It's going to get everybody in the end!"

"Clinton!" Mae clenched a fist, but her mother laid a hand on her daughter's arm.

"We think the R0 for COVID is between 2 and 3," she said.* "But we don't think it will get everyone."

"Why?" Clinton asked.

*Calculating R0 for COVID has proved very difficult. By July, 2020, epidemiologists in various countries were saying it was between 1.4 and 5.7—a pretty broad range.

"Because they're taking the sick people off the ship, stupid," Mae said. "And people are staying in their cabins."

"There's no need to call names, Mae." Mrs. Harris's voice remained calm and dreamy. "It's good to see you two questioning and debating."

"Then why does it keep getting more people?" Clinton asked. "Maybe it's spreading through the vents!"

"These are questions we're asking, and the Japanese authorities are asking too," Mrs. Harris answered. "One reason might be that the passengers were still mixing and dining together even after the first couple of people started getting sick. Some of the infections that started then could just be showing up now. And even though the crew are being very careful, wearing gloves and masks as they deliver our meals, there's some fear they could be spreading the infection too."

"Where did this come from in the first place?" Clinton asked.

"Well, the first patients were in Wuhan, China. It seems that most of them worked at or shopped at the wet market. Do you know what that is, Clinton?"

He shook his head.

"It's a huge, open market that goes on for blocks. People sell seafood, fresh meat, and even live animals, including exotic ones, not just chickens, but wild geese and civet cats and I don't know what."

"Snakes?" Clinton asked. "Mongooses? Kangaroos? Bats?"

Mrs. Harris shook her head. “I’m not really sure. But sometimes a virus that lives inside one species as its host can jump to another species, where all of a sudden it causes disease. So for now, China has closed down all its wet markets. Locking the barn door after the horse is stolen, so to speak.”

Somehow a horse trotting off into the night did not remind Mae of this infection. So she asked, “But at least you’re not sick, right, Mom?”

“I tested negative last week. They tested me so I can help nurse people who fall ill until they can be evacuated to the hospital.”

“Is that safe?”

“We wear full PPE—gown, double gloves, masks, face shields, hats…”

“And the sickness, what’s it like?”

“Fevers, sweats, chills. Dry cough. Muscle aches, fatigue. People feel miserable. And then some go on to get lung problems and have a lot of trouble breathing. We give them oxygen here, but in the hospital, if they get exhausted trying to breathe for themselves, the doctors can sedate them and put a tube down their breathing tube, their trachea. Then a machine, a ventilator, pumps the high-oxygen air in and out of their lungs, and they get to rest.”

“Do they die?” Mae asked, clutching one hand in the other.

“Very few of them. One or two percent. The Japanese have very good medical care. But the big problem is, how do we get all the passengers home? We decided on 14 days of quarantine, 14 days of being shut up in our rooms. Can you think why we chose that length of time?”

Mae shook her head, but Clinton guessed, “Because you think

that's how long it takes for the disease to show up?"

"Exactly right," Mrs. Harris said. "I always knew you were smart, in spite of what Mae says about you."

Mae groaned and looked at her feet.

Mrs. Harris continued, "We call that the incubation period, the time between exposure to the disease and the first symptoms. We think it's between two and 14 days. Of course, it's not the same in everyone, and some people never have symptoms, but in those who do, the average seems to be about five days."

"You've all been locked in your cabins since February 4," Mae said. "Doesn't that mean you can all go home now?"

"Some countries have been evacuating their citizens already," her mom said. "Now, finally, the U.S. is ready also, but sick people have to stay in Japanese hospitals, and the rest of us have to go into quarantine again once we get back to the States."

"At home?"

"No, at an army base. I'm sorry, Mae, but it will be at least two weeks before I see you again. That's why it's so nice of you to visit me in a dream like this!"

Mae stood with her lip trembling. Then silent tears began to well in her eyes, and she threw herself into her mother's arms.

"There, there," her mother said, in her most motherly voice. "It will be all right. It won't be long, really. And my, how nice to get such a good hug in a dream, though your skin does feel sort of… rubbery. Now, honey, off you go. Mama needs some real sleep. Clinton, you take care of her, hear? And Mae, be good for grandma!"

Clinton beckoned to Mae, and they stepped out onto the balcony. The lights of the city twinkled not far away, and a few-

boats chugged around the harbor, their white wakes visible in the moonlight.

"I wonder which lights are the hospital," Mae said.

"How would I know?" Clinton said. "I'm the stupid one, remember?" And he pushed the button to take them home.

**Saturday, March 14**

Four weeks later, Mae pulled Clinton aside in the school lunchroom. "Look, I want to show you something. I got some graph paper from the math department and I've been working on these graphs."

Clinton groaned when he saw how many sheets of paper she wanted to show him. He had been avoiding Mae for the past few weeks, partly because she had called him stupid and partly because she was going around with a vertical line between her eyebrows as if the world was about to end. But then he leaned closer over the careful, penciled hills he saw on the paper. "Wait a minute, you did all these *by hand*? Shouldn't you use a computer? Where'd you get the data?"

Mae sounded almost apologetic. "I found this website that updates the numbers of infections in all these countries every day. And I just started graphing them because… well, I like using different colors and I need something to do to keep me from being anxious while my mom is gone."

"You mean she's still gone? We saw her weeks ago!"

Mae nodded. "Three weeks. They let her come off the ship, but she's still in quarantine on an army base. She tested positive."

"She *what?* You didn't tell me. Is she okay?"

"You didn't ask, and so far, it's just kind of like a bad flu. But look at these."

Clinton studied Mae, whose brown eyes looked moist and whose lips were set in a stubborn, brave line. Suddenly he wondered why he'd been holding a grudge. Who cared what she called him? He really *was* stupid sometimes; maybe everyone was. So he bent to look at the graphs.

"Okay, I get it, these are some different countries. You've got time along the bottom, the x-axis, and number of infections along the side, the y-axis. And all of them show these hills going up—"

"—With different scales," Mae pointed out.

"Okay. So the total number of infected people in all these countries is going up—except here's China. The hill has kind of flattened out. Doesn't that mean there aren't any new infections?"

"Yep," Mae said, thrusting a second pile of paper into his hands. "This one shows the number of new infections every day. And you just add the new ones to the total from the day before and—"

Clinton said hastily, "I get it."

"But don't you see the whole point?" Mae asked.

"Um…" Clinton squinted at the papers. "The curves are all the same shape? Italy and Iran are really messed up?"

"But so is the U.S.," Mae said. "Look at the x-axis. We're just a week or two behind them, and the graphs of total infections just keep going up faster and faster!"

"Oh," Clinton said, looking at the sheets of paper. "Maybe we'll just flatten out, like China."

"But in China, they're locking everyone in their houses. The army is delivering food. A whole part of the country is just like the *Diamond Princess!* You think we're going to do that *here*?"

Clinton put a hand to his stomach. "Ugh. I have a bad feeling about this."

## CHAPTER 5

# BATS IN THE DATE PALM

### MASSACHUSETTS, MARCH 17, 2020
### BANGLADESH, TANGHAIL DISTRICT, FEBRUARY 2005

(Note: This chapter owes a great deal to the book *Spillover* by David Quammen, published in 2012—a gripping book about how infections spread from animals to humans.)

Mae showed up at Clinton's door at 10:30 am. It was Tuesday, March 17, the first day all the schools in Massachusetts were closed.

"Do you still have the X-PA?" Mae asked, as soon as Clinton let her into the kitchen.

"Yeah, in my room," Clinton said. "But Selectra hasn't been in touch. How's your mom?"

"Getting better," Mae said. "But before they let her go home, she has to have no symptoms for fourteen days and

test negative two times."

"Wow."

"But this whole thing isn't over, Clinton. Lots of people are getting sick, and hospitals are filling up, and schools and stores are closing, and—"

"I know. Pretty soon you won't even be able to come over and bug me."

Mae glared at him. "I want to know more. Where did this come from, when will it be over?"

"It came from China," Clinton said. "And I've heard some people say it will go away when the weather gets warm."

"You don't know that for sure," Mae said. "And how did it start, really? Suddenly there's this new virus spreading all over the world that didn't even exist a few months ago."

"Yeah, that's true," Clinton said. "But hey, at least we don't have school. Want to… um… play video games?" Get your mind off COVID, he thought.

"What I want," Mae said, "is to check the X-PA. Maybe Selectra's added some new destinations."

And there, to Clinton's amazement, as they stood by his desk gazing down at the X-PA, they read the words, "**Bangladesh, Tanghail District, February 2005**." And below it, in bright red letters, "Drink only bottled water." And in smaller letters, "Mask unnecessary."

"Um, okay," Clinton said, and he handed the X-PA to Mae as he ran downstairs for a bottle of water. It was hard to find one; his mother didn't believe in plastic water bottles. When he got back upstairs to his room, Mae was al-

ready standing with her finger hovering over the button. She was so impatient. She looped the X-PA around them and pressed the button.

It was night, with a half moon lending a silvery light to a green landscape. Warm, humid air rose in a mist around them, and Clinton smelled vegetation and ripening fruit and animal dung. Puddles of water gleamed in the nearby fields, scattered shadows of houses crouched in the distance, and a young boy about their age came quickly along a path between two watery fields. He wore only a turban and a kind of long skirt tied around his waist. His skin was dark in the faint light, and then he flashed a bright white smile at them. He called out a greeting, and Clinton fumbled with the Translator dial on the X-PA. What language did they speak in Bangladesh? "Bangla, Bengali," he found, and he heard the boy say again, "Who are you? Where do you come from? I am Suresh."

"I'm Clinton."

"And I'm Mae. We're visitors from America."

"But why are you visiting our village before dawn?"

"Um," Clinton said. "We, um… to be honest, I don't know."

Suresh laughed. "Foreigners are so funny."

Mae asked, "Has anyone around here had any strange new illness lately? Maybe with fever, and coughing, and trouble breathing?"

Suresh examined her with interest. "Oh, are you with that team of health inspectors? I've heard about you, but I didn't think you'd be so young." He shook his head. "Nobody in our village has been sick, but in the next village

over, twelve people got sick and eleven died. Not here, thanks be to God."

"Hmm," Mae said. She thought for a moment. "Have you seen the rest of our team?"

Suresh shrugged. "No. Some people said you were coming today, but I didn't expect you so early. But now I have to work." He grinned at Clinton. "You want to help, American boy?"

"Uh, sure," Clinton said, looking around him. Would he be mucking out a stall, weeding some crops?

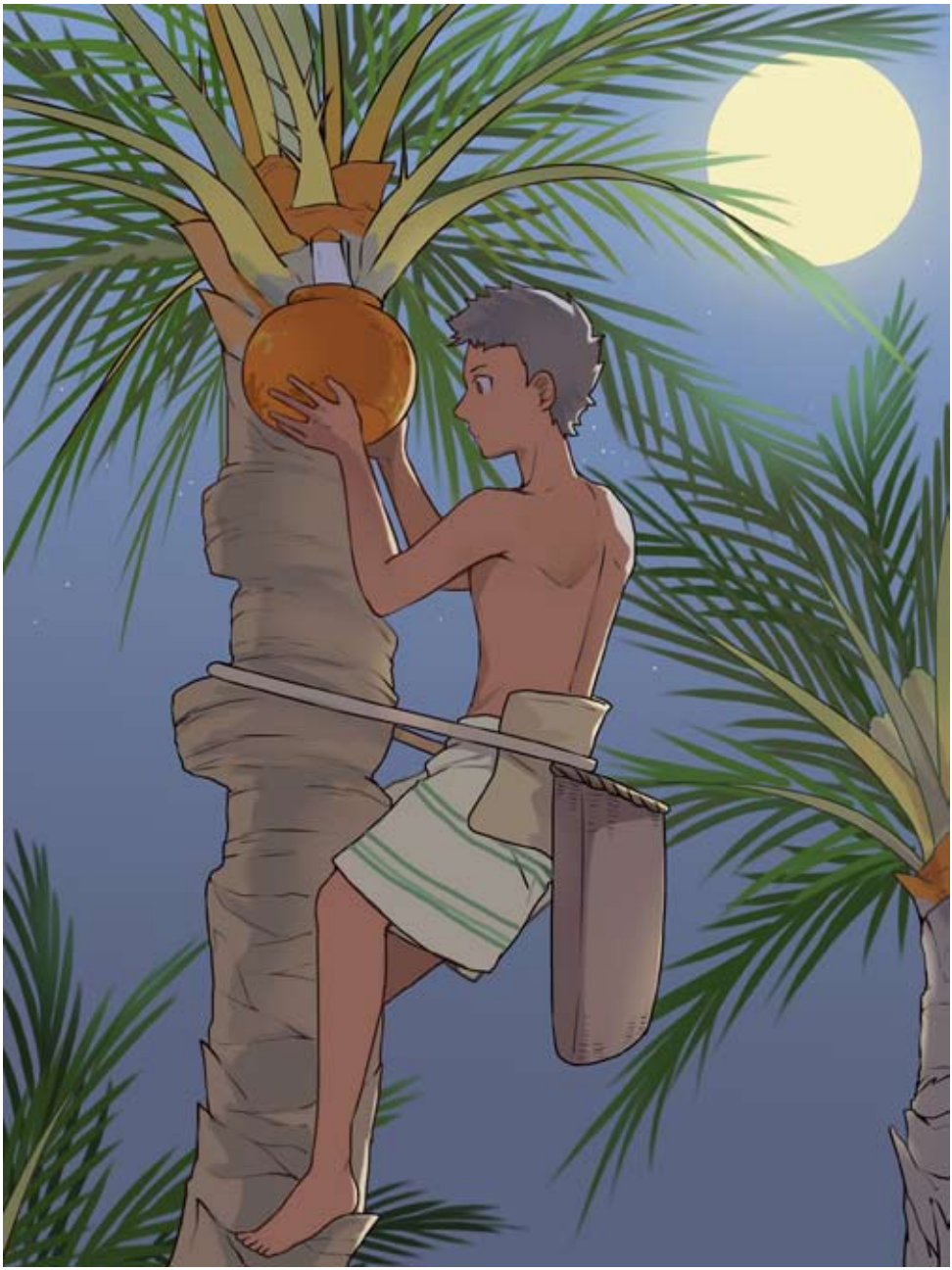
"Here we are," Suresh said, gesturing to the row of trees behind them. "Eight of the juiciest date palms in all the district. And I am the one who gets to tap them." He tied his skirt between his legs, making it look like something between shorts and bloomers. Then he unslung two straps from around his shoulder and handed one to Clinton. He approached the first tree and tied his strap in a loop between his waist and the trunk. He nodded at Clinton, laughing a little. "You take the next one."

With that, he grabbed the trunk of the date palm and began to shinny up it with bare hands and feet. Each time he hoisted himself farther, he slipped the strap a few inches up the trunk, leaned out against it, and shifted his knees higher.

*What are we doing?* Clinton thought. *I don't like this at all.* He tied his strap loosely around the next palm trunk and grabbed the trunk in a bear hug.

"You can do it," Mae said helpfully. "It's like climbing a rope in gym."

Clinton gave a little jump and managed to pull himself



up about a foot. The palm trunk was rough against his hands.

"Now toss the strap up a bit," Mae suggested.

Clinton tossed the strap up, but it fell back again. He shinnied up another foot, and then the strap held him back. His arms were getting tired.

"Come on!" Suresh called. "We have the best date sap!"

Clinton tilted his head back and saw Suresh almost at the top of his tree, just under the foliage. A huge, furry bat swooped overhead as Suresh detached a small clay pot from a spout driven into a V that had been cut into the tree trunk. Suresh grasped the handle of the pot in his mouth and began to descend.

Clinton gritted his teeth and hoisted himself up two more times. But then he lost his grip and fell, scraping his chest and face against the trunk as his strap slid in a skittering fall down the tree.

"No, no, my friend!" Suresh cried. He loosed his own strap and came sliding down his tree as easily as if it was the pole in a fire station. He joined Mae, who crouched beside Clinton, dabbing at the scrapes on his face with a bit of their bottled water and the hem of his torn t-shirt.

"I am so sorry, I thought you could do it," Suresh said, his face anxious. "Being an American and so strong and fat." He squeezed Clinton's biceps. "But you haven't learned, so I am sorry, and I will give you some of the most delicious date sap in all the district, free." He cradled Clinton's head in one arm and tipped the clay pot toward his lips with the other.

"NO!" cried Mae, startling both boys.

Suresh turned toward her with wide, hurt eyes.

"We, um, we took a vow," Mae said. "No food or drink but water for three days."

*Great,* thought Clinton. *Now we'll starve.* But then he remembered the warning on the X-PA: "Drink nothing but bottled water." But didn't it just mean no *water* but bottled water? It didn't really mean *nothing*, did it?

Suresh gently let Clinton's head down to the earth, stood up, and bowed. "I will not interfere with a religious vow," he said. "But now I must return to my trees, because date palm sap must be sold before ten in the morning or it will spoil, and see, dawn comes already."

Sure enough, as Clinton sat up and then gingerly got to his feet, the sky in one direction was turning a pinkish purple, and it was easier to make out shapes around them. "We'll guard this pot for you," he said.

Suresh drew a large, aluminum container out of the grasses that edged the path among the trees. "I pour them in here," he said. Mae took over that job, patiently emptying one small pot after the other into the large one. The date palm sap was dark red and syrupy. Its surface was dotted with bits of bark and other impurities, but it smelled so sweet Clinton had to fight the urge to dip his finger into it for a taste. Suresh scrambled quickly up and down the trees as the mild light of morning washed over the fields. Mae used a leaf to try and skim some of the dirt from the surface of the sap.

Beyond the house, a bit of traffic started along the dirt road: people walking, swaying with baskets on their heads;

a bicycle loaded with one man and three small children; a man pulling a cart.

"Quick, quick," Suresh said, and he picked up the large container and darted around the house. Mae and Clinton followed him out toward the street, where he squatted by the ditch and called out, "Sweetest date palm sap! Fresh date palm sap, only three *takas* for a cup!" Mae glanced at Clinton, shrugged, and sat down cross-legged beside Suresh.

They had only been sitting for five minutes when a jeep pulled to a stop beside them. Out of the driver's seat jumped a man who looked American. He had broad shoulders, brown hair in a crewcut and a blue baseball cap. He leaned down and spoke in awkward Bengali to Suresh. "How much you want for all your sap here?"

"Twenty-four *takas*," Suresh replied without blinking. "Okay," the man said. "But only if you do this. Listen to my partner Atif here." He nodded back at his Bangladeshi partner, a small, muscular man who looked like he could climb trees even faster than Suresh.

Atif carried what looked like a collection of placemats woven out of bamboo. "Friend," he said, "in God's name I can help you. Do bats get into your sap?"

Suresh said proudly, "Bats like my sap as much as people do. They hover over the pots and drink. I do not mind sharing a small bit of my good luck with these animals."

Atif shook his head sadly. "Ah, but, my friend, the bats are sharing with you too." He picked up a stick and stirred Atif's container of red sap. "You see these bits floating? Bat feces. And their urine is all mixed in here too."

Suresh's face turned red. "That is nonsense, my bats are polite!"

Atif continued. "There are viruses in the bat urine, and when people drink them down, they can get very sick with a disease called Nipah, which in your neighbor village—"

"That's what's causing them to die?" Suresh wailed, his eyes growing wide. "But what can I do? Without my date sap, how can I bring money to my mother? Must I leave school now? Maybe my bats are clean!" he protested again.

Atif shook his head. "We know you need the money," he said. "We can't tell you not to sell your sap. But we have brought you these." He held up his little string of bamboo shelters. "If you attach one of these over each V and tap hole you make, covering every collection pot, the bats will not be able to get in. This little roof will keep the urine and feces out of the pot. That way you will keep your neighbors safe. Do you agree?"

"Yes," Suresh said, looking very serious. "This is very good. Pure, clear sap will sell for more money, and besides, I don't want people in my village to get sick."

The American driver nodded. “Good, then. Here is your money, and we will take your sap.” He carried it to the back of the jeep, where he exchanged it for a new aluminum bucket, which he handed to Suresh. “For your new start,” he said.

Then, for the first time, the American looked at Mae and Clinton. “And who are these?”

Suresh smiled. “They are Americans. They helped me, but they are clumsy. And they belong to you.”

“They do?” The American lifted his eyebrows in surprise. In English, he asked the kids, “What does he mean? And who are you?”

“Clinton Chang and Mae Harris,” Clinton said quickly. “We’re very glad to see you. We were sent here to find out how diseases get started.”

“Are you reporters, or what?” The American didn’t look too pleased.

“School project,” Mae said, nudging Clinton so the X-PA moved closer to the man. *I don’t know why,* she thought, *but the X-PA always seems to make people… more welcoming.*

Sure enough, the American’s shoulders relaxed, and he held out a hand. “Well, pleased to meet you. Name’s Jon. And this is Atif. Hop in, and we’ll go see about some bats.”

He opened the back door of the jeep, and Clinton and Mae, after exchanging a glance, scooted inside. Jon took the front passenger seat and turned to chat with them while Atif drove.

“You didn’t drink any of that palm sap, I hope,” Jon said in a pleasant voice.

"Um, no," Clinton said. "Too sticky."

"Why shouldn't we?" Mae asked.

"Have you heard of Nipah virus?" Jon asked. "I've been chasing it across three countries now. Nasty virus. Fever, headaches, convulsions, coma, usually death."

Mae said, "Suresh told us twelve people in the next village got sick—"

"—And eleven died," Jon said. "That's why we're here."

"Handing out little placemats?" Clinton asked.

"It's mostly other teams doing that. We just thought, when we saw your friend, we couldn't pass by without doing anything. So… Nipah's a rare one, luckily. First showed up in pigs and pig sellers in Malaysia in 1998. At first we thought the people had a disease called Japanese encephalitis, which is carried by mosquitoes, and the authorities sprayed. But we had all these coughing pigs—that doesn't happen with Japanese encephalitis—and then two guys named Paul Chua and Abu Bakar Sazaly isolated a new virus from a patient who died. They called it Nipah virus. In the end, 283 people caught Nipah, and 108 died, but it was much worse for the pigs. The government sent out the army to cull all the pigs—a million pigs, slaughtered and buried."

"Ugh," Clinton said, while Mae said, "Poor pigs."

"Well, here we are," Jon said, as they pulled up next to some concrete buildings that looked abandoned, with their windows broken and fallen roof tiles. Mae and Clinton got out, and Jon led them over to an awning stretching from one part of the building. "Our field laboratory, where

we'll bleed the bats, and collect some of their urine too, of course."

"How do you collect urine from bats?" Clinton asked.

Before Jon could answer, Mae asked, "Why bats? What does this all have to do with bats?"

"I was getting to that," Jon said. He carried a box full of coveralls and gloves to the foot of a ladder leaning against the building. "Here, give me a hand getting these up to the roof." He started up the ladder, and Clinton came behind him, placing a steadying hand under the box. After looking back at Atif, who shrugged and pointed, Mae followed them up the ladder. The roof was not too steep, covered in tiles; it only had a few holes in it.

Jon settled himself near the peak of the roof. "So in Malaysia we went looking for bats, because some bats carry interesting RNA viruses like Nipah. There's Hendra, for example, and of course Ebola…"

"You're going too fast for us," Mae said.

"Oh, right. Sorry." Jon looked surprised.

"You looked for bats in Malaysia," Mae prompted.

"Do you know that one-quarter of all mammal species are bats?" Jon asked. "That's 25%. The smallest ones are the size of one finger joint and the biggest ones, the flying foxes or giant fruit bats, have a six-foot wing span."

"I think I saw one of those last night," Mae said. "Do they have pointed snouts?"

"Look over there." Jon pointed to a tree overhead. "Do you see, under the top branches?"

"Whoa," Clinton said. Mae just let her mouth drop open. Out of the corner of her eye, she had vaguely noticed something that looked like brown pods hanging from the branches. But now she saw hundreds of bats crowded together, their wings folded, hanging upside down.

"I'd close my mouth if I were you," Jon said. "Back to my story. We found giant fruit bats in Malaysia. And you know where we found them? Hanging out in fruit trees, not surprisingly. And a lot of these fruit trees, mangoes and water apples, grew over the places pigs lived. Two things happened. The bats would eat a piece of fruit, gum it up nicely and half finish it, and then drop it, where the happy pigs gobbled it up. And then, just for good measure, the bats, um, *excreted* all over the area."

"They what?" Clinton said.

"Pooped and peed," Mae said, and clamped her mouth shut.

"Exactly," Jon said. "A whole team of us worked together. We caught all kinds of bats, and we took their blood and their urine, and we tested them, and sure enough, we found Nipah virus in the giant fruit bat, the flying fox. See, the bats are the natural host. Nipah virus doesn't make them sick at all. They've probably been living happily together, bats and virus, for a hundred million years. We say the bats are a reservoir for the virus, because bats sort of store it, just like how a reservoir stores water. But when the virus crosses into pigs, it gives them a cough, so they cough it all over each other, spreading it like mad. And then people working with the pigs get it from them, and in humans the virus attacks the brain. So you see, viruses can spill over from animals to people."

"That's creepy," Clinton said. "But I haven't seen any pigs here."

"Yep, that's the interesting thing," Jon said. "And it took a whole lot of old-fashioned epidemiology to figure it out.

"There were outbreaks of Nipah in Bangladesh, but it's a Muslim country where no one eats pork, so they don't raise pigs. Health investigators went to every village where there had been an outbreak to see if we could find something people did, like owning monkeys or swimming in dirty water, that tied them all together. And finally we realized that the outbreaks were happening in the parts of the country and times of the year where people were harvesting date palm sap. It tastes like maple syrup, you know."

"Oh, boy," Clinton said.

"Yep. Date sap boys like your friend, what's his name—"

"Suresh," Clinton said.

"Yep. And their customers. They were the ones getting sick. These big bats, flying foxes like the ones you see roosting there, are fond of date palms. They hang out, they sip the sap, their droppings fall into it… Drinking raw sap is like sharing a glass with a flying fox."

"Worse," Clinton said. "It's like drinking from the flying fox's toilet." He made a face. "Will Suresh be okay?"

"I hope so," Jon said. "And now we're just putting in the last piece of the puzzle. Look, you two have traveled a long way. How about if you eat some sandwiches and take a siesta?"

"Oh, I don't think—" Mae said. She looked at Clinton, who held up the X-PA. Usually, a visit couldn't last much longer than this, but the power bar was still in the green, and a message flashed: Longer stay optional. "How long?" Mae asked.

"Oh, another twenty hours or so," Jon said. "I have some notes to write up. The bats will fly out around dusk, and when they come back just before dawn, we'll catch some in the mist nets. Then we'll collect our samples and let them go…." His forehead wrinkled. "Who do you kids belong to, anyway?"

Mae decided to ignore this question. Instead of answering, she asked, "Why can't we catch some bats on their way out?"

Jon looked surprised. "Well, it will be hard to work in the dark."

Mae put her hands on her hips. "Well, there's a moon, you know. And we can't stay all night."

Jon tilted his head to one side and gazed at her. "Why am I listening to you? But yes, maybe we can catch a couple of bats on their way out, since Atif and his pal Pachai were good enough to climb those trees and put the mist nets up first thing this morning. Now have some sandwiches and leave me in peace for a while."

He nodded to Atif, who nodded to Clinton and led him back down the ladder to the jeep. The two of them returned with a cooler which they set on the roof. Clinton opened it and passed a sandwich to Mae. "I'm starving, aren't you?" he whispered to Mae. "Good thing Suresh can't see us breaking our vow of fasting."

Mae examined the sandwich. Chicken, cole slaw, and—was that cream cheese? As she ate, she leaned back in the warm air, gazing up at the trees and the roosting bats with their bodies the size of a small dog's. How strange, she thought, to be chasing viruses in a far-off country. Eventually she lay back on the roof, spread a tablecloth over herself, and dozed, making sure to keep her mouth shut.

When she woke, the sun was sinking. Jon and Atif had pulled on coveralls and thick gloves, and even Clinton was climbing into a white coverall suit that was a couple of sizes too big for him.

"There you are," Jon said. "Guess you were tired from all your travel, eh? Your friend here's been plying me with questions."

"Wait," Mae said. "What have I missed?"

"If you want to help catch bats, you have to suit up," Jon said. "Remember, if a bat bites you we'll need to vaccinate for rabies. Of course, if he gives you Nipah, there's no vaccine and no treatment."

"Selectra!" Mae groaned under her breath. "What are you doing to us?"

Clinton, zipping up his coverall, said, "Look, I thought the same thing, but by the future they probably have a treatment for this, right? I mean, Selectra wouldn't just let us get a deadly infection, would she?"

"Okay," Mae said. "But why didn't you wake me up? What did you learn without me?"

"I found out that Ebola probably started in bats too. And SARS, which stands for Severe Acute Respiratory Syndrome, and made a lot of people sick a couple of years

ago—well, in 2003, which is a couple of years back from where we are right now—"

"But before we were born," Mae said.

"Yeah. Anyway, that virus came from bats too, but it passed through civets, which are sort of like wild cats, and they sell them in markets in China."

Clinton was about to continue, but a rustling overhead made them both put their heads back. In the tree above them, the bats were beginning to stir, then dropping, spreading their wings and swooping upward with a flapping of leathery wings.

"Let drop the net," Jon called, and he and Atif loosened two ropes tied to the roof. The rope ran through pulleys on poles above two trees, and the net fell, thin and hard to see in the darkening air.

"Hurry up," Clinton said.

Mae pulled the legs of the suit up over her pants and thrust her arms through the too-long sleeves. She zipped the suit up. Clinton laughed. "You look like you're wearing a wrinkled old sack," he said.

Mae stuck out her tongue at him. "Incoming!" shouted Jon.

The kids heard a thunk and looked up to see a furry body writhing in the net, then another, and another.

"Haul them in," Jon said. "That's enough for tonight. Come on, kids, give a hand."

Mae and Clinton took hold of the ropes Jon directed them to, and pulled when he told them to pull. They hauled the net down and toward them, while the three bats

thrashed.

"Take one of those sacks," Jon said. "You have your gloves on? Good, now hold it open." With that, he reached in and took hold of one of the bats, lacing its four ankles between his fingers and pulling it free of the net. "Ready?" he said to Mae. "This is the moment you've been waiting for. Hold tight, she's heavy." And he dropped the bat into the sack, where she flapped twice and then lay quiet.

"Knot up the top," Jon said.

Atif had already dumped another bat in Clinton's bag, and then Jon brought in the last one. Mae held open another sack for him. She felt the weight of the bat as it fell into the sack and briefly struggled. She looked up. Above her, giant bats swooped and soared, silhouetted against the purplish sky. "We did it," she said.

"No bites, no scratches?" Jon asked. "So far, so good. Now to the lab." He took two sacks, Atif took one, and they led the way down the ladder and into the tent set up against the outside wall.

Atif turned on a lantern and went to a bench where a set of syringes and tubes were laid out on a tray. Without a word, Jon opened a sack and lifted out one of the bats, letting it hang upside-down from his gloved hand. "Do your stuff," he told Atif, and to the kids he said, "Atif finds the brachial artery of a bat like no one else I know."

Sure enough, Atif took off one thick glove. He was wearing a surgical glove beneath it. He probed in the bat's armpit, and then quietly slipped the needle in and drew out a syringeful of bright red blood.

"Tube," Atif said. It was the first time Mae had heard

him speak in hours, and she handed him one of the glass tubes with red stoppers that lay on the bench. He transferred the blood to the tube and said, “On ice,” nodding at a cooler. Mae took the tube from him, almost fumbled it in the thick gloves, and managed to open the icebox and lay it on the ice inside.

Atif bled the two remaining bats, and soon the three tubes lay on ice. Jon wiped his brow. “Good work, team,” he said.

“Three samples to take back to Dhaka to check for virus. With luck, we’ll be able to prove these bats are the carriers, and then we’ll have tied the whole story together. Bats carry the virus. They infect the date palm sap, and people who drink it get Nipah. Because of your work here today, we’ll know more about how to control this disease and save lives.”

He smiled at them. “You may think Nipah isn’t an important virus,” he said, “because not that many people get it.”

Mae and Clinton both shook their heads, protesting, but Jon continued. “But think of this. This virus mutated enough to make pigs sick, and to make humans sick. And it spreads in pigs pretty easily. What if someday some new mutation happens—and RNA viruses are mutating all the time—what if it mutates so it can spread easily among humans, which it can’t do yet? Then we’ll really be in trouble.”

“That would be terrible,” Mae said, thinking to herself, *COVID spreads easily between humans. That’s what R0 means.* She said, “Does that mean Nipah has an R0 of zero?”

"Oh, very good," Jon said. "Good thinking. Yes, in humans, Nipah has an R0 of zero, so far. And now let's release our bats."

He and Atif brought the sacks outside, lifted the bats out and opened their hands. Each bat fell from their hands but caught itself in the air and swooped upward without hitting the ground. "Off they go to feast on fruit," Jon said, looking after them fondly. Then he turned back to the kids. "And now, what am I going to do with you?"

"Oh, don't worry," Mae said. "Our ride will be here soon. But can you tell us…"

"Yes?" John said.

"Do all viruses come from bats? All new ones?"

Jon shook his head. "No. Flu comes from wild waterfowl, and it passes first through domestic birds like ducks and chickens. And mosquitoes carry dengue and yellow fever. But bats have a lot of viruses, and when humans and their farms rub up against bats, well"—he spread his hands—"you see what can happen. So we'll need virus hunters for a long time, and tonight you guys made a great start."

Mae and Clinton thanked the two scientists. They removed their protective suits and gloves, assured the men that they didn't need a ride anywhere, and walked a couple of hundred yards down the road.

"Man, I'm exhausted," Clinton said. "How could you just drop off to sleep like that? I was afraid I'd roll off that roof. And besides, my scrapes from that date palm are killing me."

"But we learned a lot," Mae said.

“I guess,” Clinton grumbled, and he pulled the X-PA from his pocket and pressed the Home button.

# CHAPTER 6
# RING VACCINATION

## MASSACHUSETTS, APRIL 10, 2020
## BENI, KIVU DISTRICT, CONGO, MAY 2019

"Hey, Clinton," Mae said into the phone. Even to herself, her voice sounded glum. The school week was over, and online classes just weren't as much fun as in-person ones were. Her teachers often seemed to ignore her raised hand on Zoom. They didn't call on her as often as they used to when she strained in class to raise her hand the highest and wave it the most emphatically.

And besides, she missed her friends. Even Clinton. Sure, it was great that her mom was home and safe, only—

"Hey, Mae!" Clinton answered. He sounded way too cheerful.

"Um, any plans for the weekend?" Mae asked.

"Sure. Kick a soccer ball around the living room, see if I can hook my little sister's goldfish using cheese as bait, try to throw my muddy shoes just right to make footprints on the ceiling—except my mom won't let me do any of them. How's *your* mom? She make it home okay?"

"Yes," Mae said. "Only now since she's already had COVID she figures it's her duty to help other people as much as possible, so she's working at the hospital all the time. When she gets home she's too tired even to play Scrabble."

"Oh, too bad," said Clinton, in a voice that suggested he thought playing Scrabble was the most boring idea ever.

"She seems really discouraged too," Mae said, "even when I remind her how smallpox was completely conquered. She says it could be a long time before we have a vaccine, and even then we'll have to vaccinate the whole world. But whatever, you'll be happy, because we won't have school."

"No," Clinton said, sounding serious for once. "I hate it. I'm so bored. I can't stand being cooped up another minute. That's why I'm coming to see you."

"You are? I don't think my grandma—"

"Oh, is she still staying with you? But you're all alone up in your room, right?"

"Yes, but—"

"I'm bringing a friend!" Clinton said, and the next moment the air of Mae's room sparkled and Clinton appeared, grinning, with Selectra Volt by his side.

Selectra looked a little dizzy. “I hate this lateral travel,” she said. “It was so much easier when you were both together in the broom closet.”

“Selectra, I’m so glad to see you!” Mae said. “I thought you were done with us after smallpox, and we were just supposed to wait with all the rest of the world for a vaccine.”

Selectra put her head to one side. “Well, that would be a good idea. But Clinton kept trying to phone me or something with the X-PA—which is not a walkie-talkie, you know—to plead with me to send you someplace more … up-to date.”

Clinton was so excited he was jogging in place. “Turns out if I hold the X-PA close to my mouth and keep shouting, I can reach Selectra. That’s how I convinced her to send us to Ebola land!”

Mae’s stomach turned a couple of slow somersaults. “But didn’t you say that’s the one where people start bleeding from their ears and their nose and everything?”

“And it started in bats!” Clinton said, as if that should delight her.

“People really don’t bleed that much,” Selectra said. “They just get really hot and sick and vomit and get dehydrated and go into shock and stuff. And about half of them survive.”

“I don’t like this,” Mae said.

“It’ll be cool,” Clinton said. “Mae, we’ll get to visit Africa. And we’ll learn so much. Come on, I’ve been talking to Selectra about it. We don’t even have to really see sick people, we’ll just learn how they control the disease.”

"That's right," Selectra said. "Besides, you have your suits, so you'll be very safe. I think. Let's see, I have to program the X-PA." She took it from Clinton. "There have been two big recent outbreaks of Ebola, one from 2014 to 2017 in West Africa, which infected almost thirty thousand people, and then another that wasn't nearly so big in the Congo in 2018 and 2019. Now let's see…"

As she worked at the X-PA, Mae and Clinton pulled on their full-body protection suits.

"Just like the PPE Ebola doctors wear," Clinton said happily, "only pretty much invisible. And I get to wear dark glasses."

Selectra put a finger to her lips. "To repeat myself, two outbreaks. Which one is the safer one?"

"Must be the recent one," Clinton said. "Because it's smaller, right? And because it's more recent, and you told me they developed a vaccine. So even though 2014 would be more exciting, I think we should go for the Congo one, so Mae won't be worried." He flashed Mae a big grin. "Come on, Mae, we gotta do it. I'm going crazy stuck at home, aren't you?" He watched over Selectra's shoulder as she entered the time and destination on the screen: Beni, North Kivu, Congo, May 2019. Then he took the X-PA out of her hand.

"But what am I forgetting?" Selectra mused, as Clinton looped the X-PA around himself and Mae. "Isn't the 2018 outbreak the one that's in"—

As Clinton pushed the button and the room faded around them, Mae heard Selectra's voice trailing off—"a war zone?"

They landed on the sidewalk of a road just where it

was switching over from paved to packed, reddish dirt. On the opposite side of the road, men were working on a construction site. Bamboo scaffolding supported the men as they cemented concrete blocks in place.

Mae nudged Clinton and pointed to the building next to them, a one-story white building with a red tile roof. "I bet that's a clinic," she said.

A motorbike passed them and pulled up in front of the clinic. The driver, a young man, helped his pregnant passenger unload. Her head hung low, and her big brown eyes looked up at Mae from hollows in her face.

Mae stepped forward. "Can we help you? Is this your wife?"

The man said, "No," and waved his hand at them to signal that they should stay back. "We are fine. Do not come so close."

"But we're protected," Mae said. With that, she took the free arm of the pregnant woman, who was leaning on the shoulder of the motorcycle driver, and helped guide her to the clinic door.

Clinton followed. He had to admire how Mae stepped in, gentle and reassuring and less upset than she had been from the plague. *She must get that way of acting from watching her mother,* he thought.

Inside, Mae and the motorcycle driver helped the woman lie down on a low examining table with wheels. The motorcycle driver asked them, "Are you survivors too, then? Or just vaccinated?"

"Yes, we are safe from Ebola," Mae said. *At least half her statement is true,* Clinton thought. "Our names are Mae

and Clinton," she added.

"Are you from WHO?" asked the driver. He gave his head a shake. "I should be more polite. It's just I didn't know they were sending children now. Like child soldiers for health. My name is Nsii. And here is Jeanine."

A door opened beside them, and a woman dressed neatly in a colorful skirt and green blouse came to greet them.

"They are new helpers," Nsii told her. "They speak French, and like us, they are survivors and immune. Did you or Dr. Chalachala send for them?"

Jeanine smiled and shook her head. "Thank you for coming," she said. "So many are afraid to let other people know they have been infected, because then people will fear them or drive them away. But you are foreigners, so maybe you can go home at night to a nice hotel or guest house."

She turned to the patient and took her hand. "Sister," she said, "how long have you been ill?" She bent forward to hear the murmured answer, but then the woman gave a new, loud, groan.

"Ah, you waited a long time," Jeanine said. "We will give you fluids and care for you. How long have the birth pangs been coming?"

At that the woman writhed in an attempt to sit up, and her eyes looked wild. "You will not take my baby!" she cried. "In the village they say you will take my baby and give it to a foreigner. Maybe to her!" She pointed at Mae, who took a step backward in surprise.

"No, no, no," Jeanine said softly, patting the woman's

arm. “No, no, you have nothing to fear. We will help you have your baby. We will make sure the baby is healthy so it can go home with you when you go.”

“Don’t take me to the hospital,” the woman said. “All those brought to the city, brought to the hospital, die. Maybe the foreign doctors kill them.” She pointed at Nsii. “He promised not to take me to the hospital.”

Nsii looked guiltily at Jeanine. “Not to start at the hospital,” he said. “I said I would bring her to see a wise friend.”

Jeanine leaned close to the woman and stroked her hair. “Listen to me, sister,” she said. “When your driver Nsii went to the hospital with this sickness, the foreign doctors helped to save him. I went to the hospital dying, and our own doctors from right here, from Congo, doctors like our Dr. Chalachala at this clinic, saved me. All the doctors are working to save the people. But first, we must find out if you have Ebola.” She turned to Mae. “Hold her hand,” she said.

Mae stepped forward and once again took hold of the hot, dry hand, which clutched hold of hers.

Jeanine and Nsii wheeled the sick woman’s gurney into another room, while Mae squeezed through next to them, and Clinton was left in the waiting room. He picked up a newspaper and glanced at the headline. “Clinic Attacked.” Hastily, he put it down and began to pace around the empty room until Nsii emerged again.

“I need to pick up a schoolboy in a village not too far away,” Nsii said. “One of the health workers says his mother is hiding him sick under covers in their house. I think

maybe as another schoolboy you can tell him your story."

"Um," Clinton said. "Did you tell Mae?"

"I know that girl Mae is not your relative," Nsii said. "Is she your elder? Do you ask her for permission and obey her? Or did you come to volunteer?"

"Of course not," Clinton said, straightening. "Why should I sit here doing nothing while she helps with the pregnant lady? I'm coming with you." He followed Nsii out to the motorcycle and settled in beside him. As the motorcycle gave a cough and drove off the pavement onto the rougher dirt road, Clinton thought, *Uh-oh, I should have asked about helmets*. He thought guiltily about what his mother would say if she knew he was jouncing along a dirt road in the middle of Africa with no skull protection.

"Why is that mother so afraid of the hospital?" he asked in his driver's ear.

"People here have no trust in anything," Nsii answered. "They don't trust the government after so many years of civil war. Not only the militias steal and burn, so do the government troops when they are looking for rebels. And now foreigners come to say they must stop this terrible disease, but they do nothing about the measles and malaria that kill so many of us every year. They only care about diseases they think may spread to the West."

"I don't think that's true," Clinton said, just as the motor- bike hit a pothole. Bouncing high, he clutched at Nsii's shoulders. "Do you think you could slow this thing down a little?"

"Sorry," Nsii said. "But I ask you, does WHO send teams to investigate every case of measles? They send vaccine,

but half the time the cold chain gets broken. You know the cold chain?"

"Er," Clinton said. *I have to get better at saying 'I don't know,'* he thought.

"Vaccines have to stay cold," Nsii explained. "From the manufacturer all the way to the village. In coolers full of ice, in refrigerators. Sometimes the clinic refrigerator does not work. Sometimes the vaccine takes too long to reach the village, so all the ice melts and the vaccine is no good. So the people do not have trust in the health workers who do not save their children from measles, or in the government that lets this civil war drag on, or in the foreigners who come in their fancy white vans and stay at the best hotels. They think the foreigners come to make lots of money. What else can they think? They see you foreigners with fancy clothes, fancy cars and watches and phones like you have there, buying drinks all around…"

They were passing small houses now, with small green fields around them, an occasional banana tree or skinny cow. *Like Bangladesh but drier,* Clinton thought. He said, "I guess ordinary foreigners are mostly richer than ordinary people from here."

"When the people see this," Nsii continued, "some of them start to think that the foreigners invented this Ebola or imagined it. They say they make a big fuss just to come here and steal the people's money. They say if you go in the Ebola hospital you don't come out. That's why we don't have many white or Chinese people like you working here, because the people are too suspicious."

"Maybe I shouldn't have come out with you," Clinton said.

"No, you are different. You are just a boy, and you can tell them how you had Ebola and survived. How long were you in the hospital?"

"Er," Clinton said. "It's, um, so hard to remember. I was throwing up, bleeding..."

"Ah, you had a very bad case," Nsii said, turning off the road onto another, narrower track and splashing through a puddle. "And your vision, has it come back to normal?"

"Oh, yes, definitely normal," Clinton said. "But you saw Mae. She needs glasses now."

"And did they vaccinate everyone around you? Your family, your schoolmates? Or did all of them get sick also?"

Clinton fished in his mind for the right answer, but in the end he figured he couldn't make up more stories of sickness. "All my family and friends have had all their vaccines," he said, which was true.

"Good, good," Nsii said nodding. "So you know all about ring vaccination."

"Uh, no, I really don't," Clinton said.

Nsii pulled the motorbike to a stop. "Here is the village."

Nsii led Clinton along the track among the thatched houses. Clinton glanced at the X-PA and felt a needle of guilt. How would Mae be faring without the Translator? She didn't know French.

Nsii addressed a little boy in a language that was not French and nodded at the answer. He told Clinton, "I asked for the house of Chitemba Ibaka, and he told me it is that one under the three raffia palms."

The house they approached was rectangular and looked as if it was built of adobe, earth-brown with a thatched roof. Nsii paused at the doorway. "Our job," he told Clinton, "is to persuade the family to let us take the boy to the clinic and then the hospital. It will give him a better chance to live, but it will also give the family, and this whole village, a better chance to survive. In the end we will probably vaccinate everyone in the village. This is what we call ring vaccination. There are not enough vaccines to give to everyone in the whole country, so we do this work. We find the sick. We put them apart so they will not infect so many others. We vaccinate the family and ask them to wait at home to make sure they do not fall ill. Then we vaccinate anyone the family has touched or been with for the past weeks. We build a ring of vaccination and quarantine around each case of Ebola, and this is how we will defeat this outbreak."

Nsii knocked at the door. It opened a crack and a woman peered outside.

"Mama, I have come to check on your son Chitemba," Nsii said.

"I have no son," the woman said, backing away and shaking her head. "Oh, you are not taking him. Who has betrayed us? The foreigners will let him die all alone in a terrible place, and our own neighbors will cast us out of the village!"

"No, no, Mama," Nsii said, easing his way into the house. Clinton thought of the first house of sickness he had entered, the Amish farmhouse full of measles, and how mothers' fears are everywhere the same—separation, loss of a child.

"Listen, Mama," Nsii said. "If your boy is sick and stays home, he will surely die. If we take him to the clinic, he has a good chance to live."

"You are lying. You will take him to the hospital to die. Everyone who goes to the hospital dies. They go, and they do not come back."

"Not true, not true," Nsii said, wagging his head. "Tell her, Clinton."

Clinton stuttered at first, not sure how to tell a lie this big. *But I'm trying to save a life,* he thought. *And anyway, I can start off with true things.*

"Nsii recovered from this disease," he said. "He went to the hospital and they saved his life. And me too, with Western treatments from foreigners, I also survived."

The woman stared at him with wide eyes. "Even Chinese can get this Ebola? It is a real thing in China too?"

*Oh, boy,* thought Clinton. *Now what?*

"Not in China," Nsii said, and he looked expectantly at Clinton.

"I live in Congo," Clinton said. He hesitated a moment. "My parents are… teachers. They were very sad when I got sick, but they took me to the hospital, and after a while I got well."

"Is this true?" the woman asked them, looking back and forth between them.

Clinton squeezed his eyes shut and nodded. Nsii answered, "Mama, the hospital is the only place that can save your son."

"But I cannot call an ambulance," the woman said. "Everyone will know why it is, and they will drive us from this village."

"That is why we have come by motorbike," Nsii said. "You will say I am your cousin from the city, and I am taking your boy for a visit."

"Maybe it will work," the woman said doubtfully, and all at once Clinton wondered, *But then how do I get back?* He checked the X-PA, but it didn't offer to take him back to the clinic in Beni; the only destination was home. He couldn't go home and risk not being able to come back for Mae. What a mess!

Nsii, however, didn't seem worried. He let the woman lead them to a narrow bed under a window at the back of the house. In it lay a boy who looked about ten years old. A bucket beside him was full of vomit, and the blankets where he lay smelled bad.

"We will wash him and dress him in his best clothes," Nsii announced. "You must not help us, Mama. Do you have garbage bags for these blankets?"

The mother brought them a fresh bucket of water, soap, and a suit of clothes, but no bag. To his amazement, Clinton found himself helping Nsii bathe the boy, who had the same glassy-eyed, staring look of the pregnant woman in Beni. Clinton held the boy in his arms as Nsii peeled his clothes away and sponged his body clean.

Chitemba's mother handed them a pair of brown shorts. "All his other clothes are dirty," she said. "Even his school uniform."

Nsii pulled the shorts over Chitemba's legs and but-

toned them. “Do not come back to this part of the house,” he told the mother.

“A team will come to clean this place, and to give you a vaccine so you won’t get sick. They will ask you questions. Do you have other children? Who has visited you and the boy? These and many other questions. Do not be frightened. All of these questions are to protect you and the village. Do you understand?”

The mother nodded, backing away again, thanking them. “I know this is the right thing,” she said. “But I am so frightened.”

“We’ll take care of him,” Clinton promised. “Try not to be frightened.” *I’m frightened,* he thought. *How am I getting home?*

“Bring the motorbike right to the door,” Nsii told him. “Wait until no one is looking, and knock.”

Clinton went to the edge of the village. A trio of small children lingered around the motorbike, one of them touching its fender. “Scat!” he told them, and to his surprise they dropped their mouths open and scattered. When he was sure they were gone, Clinton wheeled the bike to the door and knocked.

Nsii stood with the sick boy in his arms. “You will have to lift him up behind me,” he said. Clinton readied himself for the boy’s weight as Nsii passed him over. Chitemba was as light as Clinton’s little sister Chelsea, and Clinton gazed down for a moment at the boy’s wide, expressionless eyes. Then he shifted him onto the seat behind Nsii, who helped arrange his legs.

“And now you,” Nsii said. “You will hold him up with

your arms reaching around my waist."

*Oh!* Clinton thought. He squeezed himself onto the seat behind the sick boy and rested his feet on the foot pegs. He clung to Nsii as the motorbike started, and the sick boy's head lolled back against his shoulder. What if the boy died before they reached the clinic? "Hurry," Clinton said.

They bumped along the road. Clinton's back hurt, his arms ached. *Try not to hunch your shoulders so much,* he told himself. *Just an hour, you just have to hold him for an hour.*

After forty minutes, the bike slowed. "Have we run out of gas?" Clinton asked.

"Hush," Nsii said. "Men in jeeps. Around the corner. I don't know which side they're on." He pulled the bike into the ditch, told Clinton to get off, and unloaded the boy Chitemba into the tall grass. The sick boy groaned. "Wait here," Nsii said. "Don't be seen."

As Clinton huddled in the ditch beside the sick boy, Nsii crept across the street and glided through the bushes. He was gone a long time, maybe ten minutes, maybe half an hour. The sick boy breathed with rasping breaths. His lips were cracked and dry. Then Nsii was back, sprinting across the road.

"It's very bad," he said. "They are planning to attack the clinic at nightfall."

"But why?" Clinton asked.

"Because they are militia, and ignorant," Nsii said, his face hardening. "There are so many different groups fighting here, twenty—more. All fighting for control of this area, for minerals, for riches, and they do not want any

Westerners to see what they do. They believe the stories their leaders tell them, that Ebola is a lie, that the government started Ebola, that doctors kill people."

"Oh," Clinton said. "But Mae is at the clinic. And Jeanine and the lady who's having a baby."

"And soon this boy Chitemba," Nsii said, "and no militia will make us abandon them. But Clinton, you must hold tight, because we will take a short cut. A long one."

He dragged the motorbike back onto the road, but facing the other way this time. Clinton helped him lift the sick boy back to his seat and climbed up behind the two of them. The bike coughed to life, just as Clinton heard shouting behind them and then, to his horror, gunshots.

"I didn't know this bike could go so fast," he said a few minutes later, when Nsii finally slowed and turned them onto another narrow track.

"That is not my bike going so fast, Clinton," Nsii said. "It's your heart. Now, hold tight."

Their way became even bumpier, with dips and sudden turns to avoid low branches. It was more a path than a road, but Nsii drove on, and Clinton clung hard, his arms aching. *I'm never going mountain biking again,* he thought, but at the same time he knew he would, in an attempt to re-live the excitement, the high, the terror of this ride. *I wanted to get out of my house in Massachusetts,* he reminded himself.

Clinton noticed the shadows of the trees growing longer. It was a race now to reach the clinic before the militia did. But then the motorcycle jounced through a ditch, and he almost lost hold of Chitemba. They were on the road

again, racing for the town. There were more houses, cars. Clinton's arms felt like fire. At last, Nsii pulled into a driveway.

Clinton tried to step off, stumbled, and fell with the boy Chitemba on top of him.

"Hurry," Nsii said, lifting the boy off of him.

Clinton scrambled to his feet and followed Nsii into the clinic, where Mae sat beside Jeanine, twisting her hands on her lap.

"You're back?" she cried. "Clinton, how could you—"

"We have a sick boy," Clinton said, even as Nsii laid the boy on another gurney and called for help. Dr. Chalachala emerged and with Jeanine's help inserted an IV line into the boy's vein.

"Fluid, quick," the doctor said, and then he turned to listen to Nsii telling him that a militia group was coming to attack.

"They are Mai Mai, I think," Nsii said. "I will go to the police now, and to the army station."

"God grant they come to protect us," the doctor said. To Jeanine he said, "I will hide you in the supplies closet."

"The militia will rob the cupboard," Jeanine said. "No, I will stand by you and our patients. I will tell the militia how you saved me. Maybe they will listen. But you"—she looked at Clinton and Mae—"you must run away, out the back door, back to your hotel, to your parents, to your fancy schools."

Clinton's heart beat hard and he felt a stone in the pit of his stomach. "We can't leave you," he said.

Mae took hold of his hand, something she would never do in normal times. “Listen, Clinton,” she said. “We can’t help. We’d only be two more people they had to protect.”

Clinton looked around. If there were only a gun somewhere. But no, this was a clinic. No guns. Mae was right. He gulped.

“Good-by, Jeanine,” Mae said. “Take good care of our baby. Don’t worry about us, we know the way home.” With that, she pulled Clinton toward the rear of the clinic.

“*Our* baby?” Clinton asked.

“I helped deliver a baby,” Mae said. “Look, there he is.” She drew Clinton into a room where a baby wrapped like a little sausage lay in a crib, sleeping. Mae lifted the baby and kissed its forehead, right along its hairline, then laid it back in the crib.

“You helped deliver a baby,” Clinton repeated in awe. He looked around. “Where’s the mother?”

“Dr. Chalachala says there are new treatments,” Mae said. “He thinks she will make it.” She gave Clinton a grave look. “You look exhausted. Come on, take us home.”

# CHAPTER 7
# IS IT FAIR?

## MASSACHUSETTS, MAY 26, 2020
## HISTORICAL DINÉ TERRITORY, MAY 4, 2020
## LOS ALAMOS NATIONAL LABORATORY, MAY 4, 2020

When Mae finished her homework, she came into the kitchen. At the table, her mother sat with her head in her hands. She always came home tired these days. She had already showered and changed out of the scrubs she wore at work, as she did every day, since she was taking care of patients on the COVID ward and didn't want to infect her family. Mae's grandmother stood at the stove stirring something that smelled of garlic and onions, so neither of them saw Mae enter.

"I'm so sad and worn out," Mae's mother was saying,

her words almost too soft to hear. “It hurts my heart, Mama. Most of our patients are Black or Hispanic. It’s hurting our people so much. And Ellen, you know my friend Ellen, her mother and stepfather are both in the hospital in Florida and her mom’s probably not going to make it.” She gave a gulp, and her shoulders shook. “It doesn’t seem fair.”

“Nobody told you it would be fair,” Mae’s grandmother said. “When’s it ever been fair? Everything hits Black folks harder.” She turned from the stove and walked over to give her daughter’s shoulders a squeeze. At the same time, she saw Mae. “Hush now, your baby’s listening,” she said.

Mae knew she should give her mother a hug too, but a rising bubble of something inside her chest made her turn around instead and run upstairs. Was it true? Were Black people getting COVID worse than white people? Why?

Mae turned her computer on and started scrolling through websites, looking for graphs that could show her what was going on. Then she hit Clinton’s number on quick-dial.

Clinton picked up on one ring. “Hey!” he said. “Wussh-up?”

“Are you talking with your mouth full?” Mae asked. But instead of sounding bossy to herself the way she usually did, she heard a tremble in her voice.

“Yup,” Clinton said. “Bulgogi on rice. But don’t worry, I can talk. What’s up?”

“I heard my mom—she was talking to my grandma and I think she was crying,” Mae said. That big bubble in her chest was rising again, and she tried to gulp it back down. “She said there’s so many Black people in the hospital and

I—I started looking and it's hard to find data but I think she's right it's hitting Black people harder and it's so unfair and I don't know why and—" Suddenly, to her horror, Mae let out a big sob. Tears dripped all over her phone.

"But you're okay," Clinton said. "I mean, aren't you? Oh, forget it, man, I'm sorry, look, I'm coming over."

The phone clicked off.

Mae sat on the bed, trying to stop the flow of tears. How could she explain to Clinton that it wasn't just about her own family? It was about everything, Trayvon Martin, Tamir Rice, and now George Floyd and this virus that kept them all at home so they hardly saw neighbors, much less cousins and aunts and uncles. How long was a person supposed to stay brave?

It felt good to cry. Mae flung herself down and cried until her pillow was sopping. Then she got up and went to the bathroom to put cold water on her face. In the mirror, her eyelids still looked swollen, but when the doorbell rang, she grabbed a mask, called out, "It's just Clinton!" and ran down to open the door.

Clinton was wearing a Boston Red Sox mask that clashed with his green shirt, and his eyebrows were drawn together in worry. Mae waved him in, shut the door, and led him up the stairs. "Stay six feet back," she ordered. "Six stairs."

"Okay, okay," Clinton said. "But I'm wearing one of those masks from the future Selectra gave us. We're safe. I just wear the regular mask on top so people won't freak out." Still, Mae opened the window too, just in case.

Clinton sat at Mae's desk while Mae sat on the bed.

"Okay," Clinton said. "Your mom is seeing a lot of Black COVID patients."

"And Hispanic people, Latino people," Mae said.

"So? Her hospital's in the city, right?" Clinton said. "I mean, isn't the neighborhood around it mostly people like, you know, people of color? Doesn't it make sense? The virus doesn't know what color skin people have. We know it's hitting all over the world."

"But what if it hits some people more?" Mae said. "I found this site—" She showed him the page on her laptop.

"Look, right here, it says 9,000 Black people in Massachusetts have had COVID, and 20,000 Latino people. And you should be upset too, because it says 18,000 Asian and Asian American people."

"Yeah, but look here," Clinton said. "It says there have been almost 36,000 white people. I mean, how can you tell it's not fair? It looks like more white people are getting sick than anyone else." He handed the laptop back to Mae. "We can't just bring everything back to race."

Mae slammed down the computer and leapt to her feet. "How can you say something so stupid and mean? Haven't you watched the news? You think being Black and white are just the same in this country?" The sobs rising in her chest again were bursting out in hot words like lava from a volcano.

"Whoa, whoa," Clinton said, holding his hands up as if to defend himself. "No, no, I just—I don't know what the numbers mean."

Mae breathed hard, as if steam were coming from her nostrils. Gradually her breaths slowed down as she stared

at the floor. “I’m sorry,” she said at last. “It’s just—I haven’t seen my mom cry since my dad’s funeral.”

Clinton stood up and took a step toward her with his arms open as if he was actually going to give her a hug, when there was a sound like a fuse shorting out and there, right between them, stood Selectra Volt, holding a small green book in her hand.

“Nix!” Selectra said as they each fell back a step. Clinton’s arms dropped to his side.

“Decelerate!” Selectra scolded.

“She means slow down,” Mae said.

“I wasn’t going to infect her,” Clinton said.

Selectra ignored him and addressed Mae instead. “No fighting with friends. No flying off the handhold!”

Mae looked puzzled, and Selectra continued. “I know it’s a pandemic side effect,” she said. “Look, it says so right here in the handbook. Sulks, tears, stomping feet, acting like a snapping turtle—”

“How do snapping turtles act?” Clinton asked.

“They bite people’s heads off. No, maybe just their fingers. The hands that feed them, that sort of thing. People trying to help them.”

“We already took care of it, Selectra,” Mae said.

“You took care of racial disparities in COVID?” Selectra asked.

Mae shook her head while Clinton said, “I’m confused. I just came over because Mae sounded so sad.”

“Because she doesn’t know why some groups of people

get COVID so much more often than other people," Selectra said. "And why they get sicker when they do get it."

"So I was right," Mae said. "Black people do get it worse. It's just, how do you tell? Because, like Clinton says, more white people are getting sick, but there just are more white people, so…"

"You look at percentages," Selectra told her.

Clinton said, "What, you mean what percent of all Black people get sick versus what percent of all white people? Do we even know those numbers?"

Selectra waved a hand. "You'll figure it out. The more interesting question is why. Which is what you need to explore. Because"—she held up the book again—"it says so right here. Top three cures for the COVID blues. Three, do something creative. Two, do something active. One, do something important and new and helpful."

"But how?" Mae asked.

"Exactly," Selectra answered, as she placed the X-PA in Mae's hand, twinkled green and pink, and disappeared.

Clinton said, "Have you ever noticed she's kind of like Tinker Bell? Only full size."

Mae shook her head at him. "I don't know if I'm up for a mission," she said. "Not even a mini-mission."

"Fine," Clinton said, holding out his hand. "Give me the X-PA and I'll go alone."

Mae gave him a dirty look. "No way. We go together. Huh, look at this."

Clinton twisted his head to try and see the print right

side up. “May 4, 2020. Three weeks ago. Navajo Nation. Cool! And we’re going to see a person named Betty Yazzie, a storytell…”

His words trailed off as Mae pushed the button. There was a swirling sensation, and then a landscape appeared around them. Flat, reddish land stretched off in all directions, and in the distance stood tall, flat-topped formations of red rock with sides that looked almost vertical. A smell of wood smoke and sage hung in the air, and the sky was wide and blue. They stood on a dirt road next to a flock of sheep that grazed on stubby bits of grass among the sagebrush. Riding toward them on a spotted pony came a child wearing a cowboy hat and a bandana over the lower part of his face.

“Whoa,” said the boy, pulling up beside them. He looked about seven years old. “Where did you come from?”

His pony pushed its nose toward Clinton. “Cool horse,” Clinton said, patting it. “Can I ride him?”

Mae said, “We’re looking for a storyteller named Betty Yazzie.”

“That’s my grandmother,” the boy said, backing his pony away a few steps. “We live over there about ten minutes farther.”

Clinton and Mae fell in step beside the boy as the pony ambled forward. Mae said, “You live with your grandma? So do I.”

The boy swayed easily in the saddle. “Just sometimes. Sometimes I live in Gallup with my mom and dad. But my grandmother is teaching me now. My name’s Billy, by the way.”

"I'm Clinton," Clinton said. "Billy, can I try riding for a minute?"

Billy frowned. "Are you a good rider?"

"Sure," Clinton said. "I've watched a lot of riding tricks in old movies."

Billy pulled the pony to a stop. "Okay, if you're sure," he said as he dismounted. "But be careful, Dasan likes to run home."

He handed the reins to Clinton, who shifted from one leg to another for a moment as if unsure which foot to put in the stirrup. Finally he decided on the left leg and swung himself up to the saddle. The pony stood there.

"Hi-ya!" Clinton cried, waving one arm and jamming his heels into Dasan's sides. The pony jolted into a fast trot down the road.

Billy and Mae took off at a run after him. "Pull on the reins," Billy shouted. "Whoa, Dasan, whoa!"

But Clinton had dropped the reins and was holding on to the saddle horn with both hands, bouncing higher and higher.

Dasan swerved around a pothole, turned onto a path, and broke into a gallop. Beyond him, a small roundish house appeared. Beside it stood a fenced-in corral, and in front of that, Dasan jerked to a stop, sending Clinton sailing over the fence with a cry. When Billy and Mae caught up to him, he lay curled on the ground inside the corral, groaning.

Mae climbed over the fence while Billy caught the pony by the reins. "Clinton!" Mae cried out. "Can you move? Did you break your back? Did you hit your head?"

"I landed on my hip," Clinton said. Slowly he rolled up to his hands and knees. "Riding's harder than it looks on TV."

"You idiot," Mae said. She helped him to his feet. "And look, you have horse manure all down your leg." She plucked up a handful of dry grass to scrape it away.

Billy, meanwhile, opened the corral gate and led the pony inside. Without looking at the older kids, he took off the pony's saddle and bridle and began to brush its coat.

Clinton watched, rubbing his hip, and then turned his attention to the house. It was low, built of logs and earth, with eight sides and grass growing on the roof. "Look" he said. "That's a hogan, a Navajo house."

From inside, a woman's voice said, "*Yá-á-tééh? Hoodzaa, baa? Háíshàánít'į'?*"

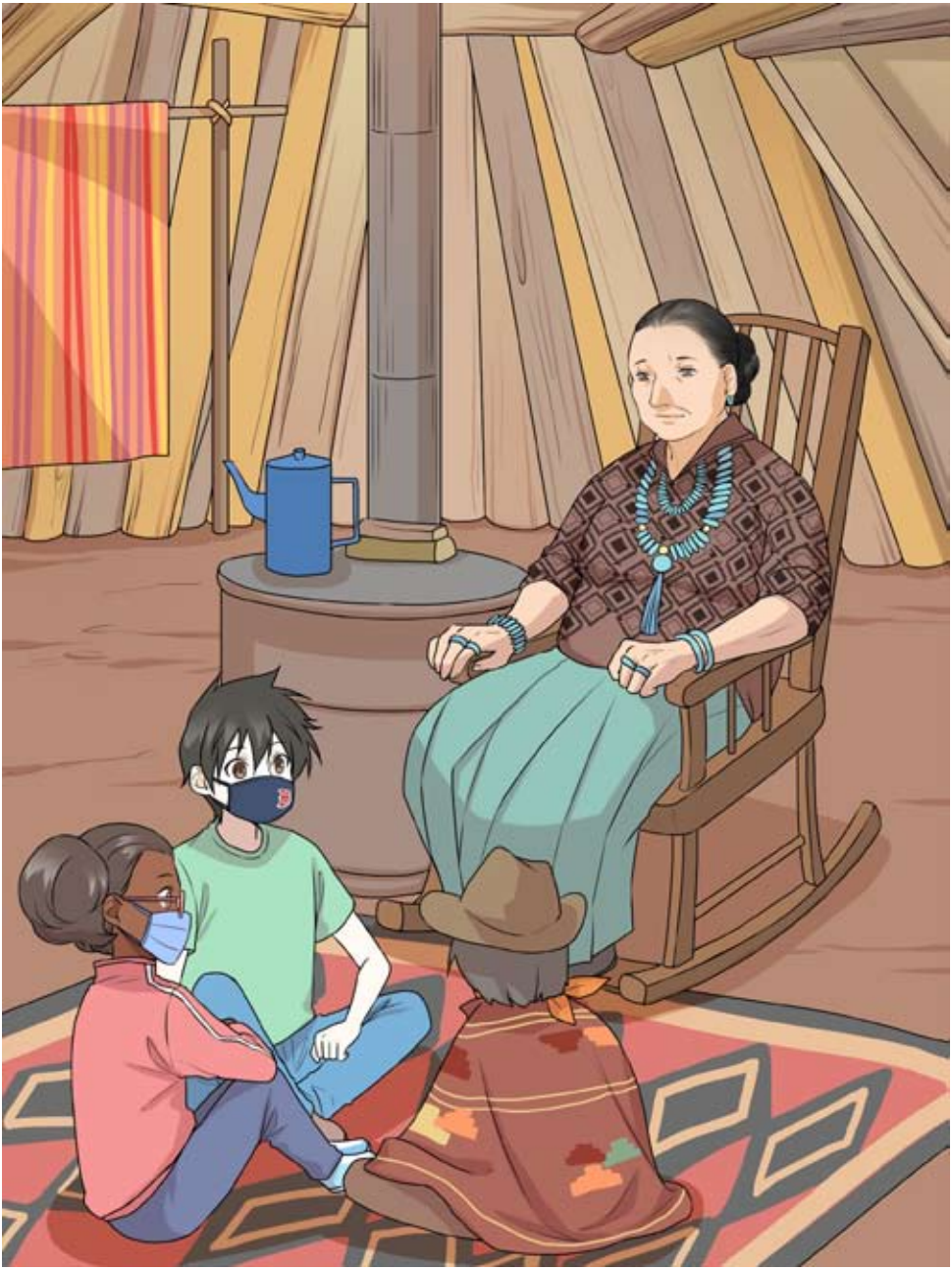
Billy slipped past them and opened the door.

"A boy fell, Grandmother," he said. "But he's okay. These two came to visit you."

Mae and Clinton exchanged a glance, and then Mae hurried to scroll through the translator on the X-PA, but she couldn't find a setting labeled "Navajo." So she said in English, "We're students."

A woman came to stand next to Billy. Plump and no taller than Mae, she wore turquoise rings, and a heavy necklace of turquoise and silver hung around her neck. Her skirt was green, her blouse rust-colored with geometric designs standing out in black. Her neat black hair glistened, pulled back tight from her round face.

Billy said, "These are my friends."



Mae said, “Hello, Mrs. Yazzie.”

Billy’s grandmother looked surprised, but then she smiled and waved them inside. “Come in, but leave your shoes.”

Clinton and Mae stepped through the door into a large, round, single room. A bed and a cot stood at one end. A large bottle of water stood bottom up on a shelf beside a sink with no faucet, and kindling was stacked by a wood stove in the middle of the room. The floor beneath their socks was neatly swept earth, covered in one or two places by patterned rugs. Billy led them to one of the rugs, and all three of them sat down cross-legged. Betty Yazzie sat on a chair opposite them and waited.

Mae said, “We are students who heard you are a story-teller, Mrs. Yazzie. We came to hear from you about COVID in Navajo land.”

Betty Yazzie gazed at them, her face serious. “The virus has struck our people very fiercely,” she said. “So many of the people who have caught the virus here in Arizona and New Mexico are Native Americans. Already more than 300 of the Diné have died, and there are more every day.”

“The Diné?” Mae asked.

“We are the Diné, but the Spanish named us Navajo, which came from a Tewa word, back in the 1600s when they came north from Mexico in search of gold. With an order from the Pope, they tried to enslave our people and make us Catholic. Then came the Americans moving west. They tried to drive our people off this land and dragged our children off to government schools where they could only speak English.”

Mrs. Joe shook her head. “The young people lost their culture, but we kept this land. Then came the uranium mining that has poisoned our wells and given so many of our people cancer. And without their own culture, some of the people ate only fast food and drank too much, so our health is not the best. Many of us have ‘pre-existing conditions’ like diabetes or smoking or other problems. Many of us lack running water in our homes, so how can we constantly wash our hands?”

She gestured to the large bottle, nearly empty, beside the sink. “You see that? My nephew brings me water all the way from Gallup every few days. The wells closer to me are contaminated with uranium.”

“But how did COVID get to the Navajo way out here?” Clinton asked.

“It caught up with us early. There was a big church meeting in Gallup, and another big meeting at an alcohol rehab center. Both times, a few days later people all over the territory began to be sick. Not everyone has cars. Sometimes it takes hours for them to get to the clinic, and the Indian Health Service clinics are small. Then ambulances take the sickest ones to Gallup, but so many of our people died there that now some of us don’t want to leave our homes even if we’re sick.”

“I’m sorry, that’s so terrible,” Mae said. “What are people trying to do to stop the illness?”

“The governor of New Mexico closed the city of Gallup last weekend. Nobody in, nobody out, because too many people were rubbing shoulders and breathing on each other. They closed the schools. Now there are announcements in English and Diné everywhere telling us to stay

apart and wear masks and wash our hands often. But with Gallup closed, who will bring me water to wash my hands? Still, don't worry," she added, looking at Clinton, "I'll give you water to wash the dirt off that scrape on your arm."

Clinton's hand covered his arm. "Oh, no, don't worry about me, please, Mrs. Yazzie," he said. "I was just doing something dumb."

"Don't worry, Grandmother," Billy said. "I heard Gallup is open again, and I'm sure Father will bring us more water."

He jumped up and went over to the water bottle, where he turned the spigot and wetted a towel. He brought the towel to Clinton, who winced as he wiped his arm clean.

"Is that all, children?" asked Mrs. Yazzie. "Because now I would like to teach my grandson some of our Diné language, because how can young people have roots if they don't know who they are and the stories of their people?" She smiled, but her eyes looked sad.

Mae got to her feet. "Your grandson is so lucky," she said. "I always love it when my grandma tells me stories."

Clinton rose too. Both of them thanked the storyteller and her grandson, and as they exited, they heard the woman's soft voice speaking again in the Navajo language. They closed the door quietly. Clinton stood in the yard, eyeing the pony until Mae dragged him by the elbow farther down the path.

Clinton looked up at the bare, blue sky, not knowing how to feel. The land was so bare and beautiful, the house so small, but the little boy seemed so happy riding his pony and then sitting at his grandmother's feet. Clinton hardly

ever saw his grandparents, who lived in Korea.

Beside him, Mae said, "It looks like we're not quite done yet. We're visiting Sara Del Valle at the Los Alamos National Laboratory." And with that, the blue sky above Clinton's head began to swirl, and he felt a lurch in his stomach.

* * *

They stood in an empty, clean hallway that looked like so many other laboratories they had visited on their various journeys. A door with a window panel stood half open, and a sign by the door read, "Dr. Sara Del Valle, mathematical epidemiology." Mae stepped up the door and knocked.

A young Latina woman with long, straight, black hair sat at a desk with a computer. When she invited them to enter, she pulled on a mask, pink with galloping horses on it. Clinton rubbed his hip and looked down at his still-dirty jeans. He hoped he didn't smell too bad.

"Good afternoon," Mae said with her usual politeness. "Are you Dr. Sara Del Valle? We're Mae Harris and Clinton Chang, here to learn more about COVID. Do you think the disease is worse for the Navajo than for other people in New Mexico?"

"How did you get here?" Dr. Del Valle asked, turning her head right and left as if she expected to see a parent pop out from somewhere.

"We rode our bikes," Clinton said.

"Hmm. Well… come in, sit down," said Dr. Del Valle. "No question it's worse for the Navajo. Native Americans make up only 11 percent of the population of New Mexico, but more than half the cases of COVID in the state have hap-

pened among Native Americans."

Clinton turned to Mae. "Oh, I get it now, what Selectra said about looking at percentages. If only a small percent of the people are members of one group, but that group has a big part of the cases…"

Mae answered, "Then that group is getting more than their fair share of sickness. That's what I was trying to figure out."

"Exactly," Dr. Del Valle said. "Some populations or races or ethnic groups are disproportionately affected. More of them turn up sick than you would expect based on their percentage in the population." She paused. "Of course, we only find that out if the reporting is good. If the states only publish plain numbers without all the other information we need—age, sex, race, ethnicity, other diseases they have, etcetera—it's much harder to figure out the details of who is getting sick and whether it's fair."

"But why is it happening?" Mae asked. "Why is it worse for the Navajo?"

"And also for all the other tribes in New Mexico," Dr. Del Valle said. "The Hopi, the Pueblo tribes, but most of all the Navajo."

Clinton said, "We know a lot of them might not have running water and they live a long way from the hospital."

Dr. Del Valle nodded. "And because they don't have as much medical care, they are more likely to have other conditions, like high blood pressure and liver disease from too much alcohol, lung disease from smoking, and diabetes. All of those may make the infection worse."

Mae, thinking of the dirt floor at the storyteller's house,

said, “And they’re poor.”

“That’s true for many of them. Maybe they have wood fires that put out a lot of smoke, which can make asthma and lung disease worse. Besides, a lot of people with less money can’t just work from home, where they might be safe.”

“They might not have computers or internet,” Clinton said.

“Exactly. And they might be health aides or grocery workers or people who work in meat-packing plants, where they work hard right beside lots of other people.”

“And Mrs. Yazzie told us there have been some large gatherings,” Mae said.

“That’s a good thought. Even people who live far apart in a rural area might have very large social events when lots and lots of them gather. The bigger the group, the bigger the chance that somebody there is infectious with the virus. And there’s one more factor we think might be important.”

What’s that?” Mae asked.

“Multigenerational households. Children and parents and grandparents all living together. The children might bring an infection home from their friends, or their parents might bring it home from work, and then the grandparents catch it from them. As you probably know, older people are more likely to get very sick.”

Mae said, “My mom always showers and changes when she gets home from work.”

“That’s a very good idea,” Sara Del Valle said, nodding.

"It's a lot to think about," Clinton said. "But what's the government doing to help? What about people like you? What do you do?"

Sara Del Valle smiled. "I'm a modeler," she said.

"You build models?" Clinton asked, picturing her gluing pieces of a model airplane together.

Sara laughed. "Computer models. You can imagine I'm playing a computer game like Sim City, where I set up a simulation and put in all sorts of conditions, like whether people wear masks or ride buses or go to restaurants, so we can see what's likely to happen."

"Mae wrinkled her nose. "How does that work?"

"I use mathematics and all sorts of data, from hospitals to estimate how many people will be hospitalized next week, from Twitter to see what people think about face masks, and from transportation records to tell us if people are reducing their travel and movements.

"I work with a team that pulls that information all together and tries to figure out what's likely to happen and what rules might make a difference."

She took a deep breath. "And the government uses our information to set policies like testing rules, or to decide that bars or restaurants have to close, or people need to all be wearing masks, or schools should shut down for a while, or people coming from another state have to quarantine for a week or two, which means not see anybody until we know they're not carrying infections."

"But how does that especially help the people who are hurting the most?" Mae said.

"That's a hard question. The governor works with the heads of the various tribes so they can have a say in the decisions. The tribal leaders help find ways to reach out to their own people, and think about things like getting food to people who are stuck at home. But some of the problems date so far back—"

"Like clinics that are too small," Mae said.

"You're right. Not enough funding for the Indian Health Service. Not enough clean water, not enough broadband, not enough Native doctors and political leaders and—"

"I get it," Clinton said. "Not enough power." He turned to Mae. "I really do get it," he said. "Things are just set up more against some people. And we all have to help figure out what to do about it, even if it's just giving food to a food bank, or, or"—he looked at the X-PA in Mae's hand—"or translating medical advice into other people's languages, or something."

Mae looked at Clinton and felt tears pricking at the corners of her eyes, because her friend understood. "And we have to talk to people about what we know," she said. "About what's fair, and what's right."

She glanced at the X-PA, which had begun to flash red, "Power Low! Return to Base." Hastily, she thanked Dr. Del Valle and pulled Clinton into the hallway, where she pressed the Home button on the X-PA.

## CHAPTER 8

# THE END OF SMALLPOX

### MASSACHUSETTS, MAY 30, 2020
### BOSTON, MASSACHUSETTS, MAY, 1721
### BHOLA ISLAND, BANGLADESH, OCTOBER, 1975

"This is crazy," Mae pleaded. "I promise I won't even go in his house. I'll just stand outside his window, ten feet down, and talk to him."

"And what if he coughs, and the droplets fall down on you?" her grandmother asked. "You may not go see Clinton. You're always saying you don't even like him that much. And your mother will be home in a few days."

"Only if she tests negative two times first," Mae grumbled. But since her grandmother showed no sign of backing

down, she went back to her bedroom, stomping as loudly as she dared.

And there, lolling on her bed—with his shoes on!—lay Clinton, gazing at the X-PA, while Selectra stood beside him peeking out through the curtains.

"We wondered when you'd stop arguing and come back in to see us," Clinton said, and he swung his feet onto the floor.

"Shhh!" Mae hissed at him. "My grandma's pretty old, but she's not deaf." But though she tried to frown, she had to fight off an urge to throw her arms around him. *Two weeks being stuck at home does weird things to people,* she thought.

"Okay," Clinton said in a softer voice. "Selectra here thought seeing your mom would be enough for you, but she can see you're going crazy—"

"How does this end?" Mae interrupted. "When do we get back to school, and volleyball, and shopping? It's not the stuff," she added. "It's seeing people."

Selectra turned and looked at her. "I thought you were the patient one," she said. "Clinton's built a medieval village in his bedroom—"

"I got in a little trouble over the moat," Clinton said. "But the drawbridge really works."

"Anyway," Selectra said, "You know how an epidemic ends."

"Everybody gets sick," Mae said gloomily.

"Maybe." Selectra said cheerfully. "Enough people get sick there's no one left to infect. But otherwise…"

"They keep people apart forever, so the infection doesn't spread." Mae didn't want to look at Selectra. She didn't want to be reasonable.

Clinton said, "Or they invent a vaccine. Which is going to take forever."

"Probably not forever," Selectra said placidly. "Which is why you two gloomy moomies are going on a little vaccine reminder trip."

Mae's heart leapt, but she tamped down her excitement to make her voice grumpy again. "I hope if we're visiting sick people, it's something we've been vaccinated against."

"Nope," Selectra said. "Smallpox. You'll wear your suits." And with that, she glowed, sparkled, and disappeared.

Mae blinked. "That was abrupt," she said.

"You mean sudden?" Clinton asked. "Rude? Maybe she doesn't like being around people in a bad mood. But hey, I don't mind. I brought the suits, all fresh and washed." He pulled the two suits out of his backpack, and as Mae pulled hers on, he said, "Huh, we have two places to choose from. Boston, 1721, or Bangladesh again, 1975."

"We do them in order," Mae said. "With luck, we get to do both."

"Right," Clinton said. "Boston it is." He made his selection, looped the X-PA around them and pressed the button.

They stood in front of a fine brick building with a massive wooden door. Behind them lay the green expanse of Boston Common, with scattered flocks of sheep grazing on

the tall grass. As Mae reached her hand to lift the knocker, a carriage drew up behind them and deposited a portly man in a blue coat and a wig of curly white hair. He came up the steps and nodded his head to them. “Children,” he said, “I am Dr. Zabdiel Boylston. And you?” He nodded at Clinton. “A cabin boy from China, perhaps?”

“I was born here in America,” Clinton said stoutly. “And my parents are from Korea, not China.”

The doctor raised his eyebrows in astonishment. “And is this your servant girl?”

Mae glared at him. “I’m nobody’s servant. Mae Jemison Harris. Usually, it’s *me* telling *him* what to do.”

“Indeed?” Dr. Boylston’s eyebrows rose even higher. “And what brings you here, pray tell?”

Clinton hastily checked the X-PA. “To see Rev. Cotton Mather. About smallpox.”

The doctor frowned. “You mean the Reverend Cotton Mather. Respect, boy, no revs here.”

“Yes, sir,” Mae said. “We want to talk about preventing smallpox.”

“Indeed,” Dr. Boylston said again. “You astonish me. I, too, have come to discuss his dangerous ideas.” And with that, he lifted the iron knocker and let it thump loudly on the door.

A white servant girl with a frilly white cap opened the door and showed them into a simple parlor whose walls were lined with books. A moment later, Cotton Mather entered, wearing a plum-colored suit and without a wig. “Forgive me, Zabdiel,” he said in a booming voice. “My wig

is being powdered. He scratched his head. “Lice again. How the good Lord doth visit small trials upon us even as we face the great ones. But I do thank you for coming. And are these your new apprentices?” He gave the two children a doubtful look.

“They appear to be street urchins,” Dr. Boylston said, “but they know what we’re about.”

“Protecting against smallpox,” Mae said.

Cotton Mather fixed her with an intent gaze. “And do they do it in your home country too?” he asked. He turned and bellowed out the door. “Onesimus!” Then he addressed Clinton. “And do you know your Bible, my lad? Do you know the meaning of Onesimus?”

“Er…” Clinton said, as a large black man dressed in a short coat and knee breeches entered the room and bowed his head toward his master.

Mather frowned. “I trust you are not a worshipper of some Chinese idols,” he said. “Onesimus is named after a Biblical servant, and his name means useful. Useful he has been. Tell them, Onesimus.”

“In the land where I was born,” the black man said, in a slow, deep voice, “we also had this disease of spotted sores on the body, and people died. But then our people learned how to make it weak. When one is sick, we take the fluid that arises from a sore, a pox mark, and we rub it into a scratch on the skin of one who is well. See, it was done to me, and to all who had the courage to accept it.” He showed them his forearm, which had one deep pitted scar. “And then, when your smallpox comes through the village, very few people die. We are protected.”

Dr. Boylston put his head to one side and regarded his friend. “And what, Mather? You take counsel from this savage?”

Mather waved a hand, but before he could answer, Mae spoke up. “It’s true, sir. They used to do it even in ancient India.”

“I prayed over it, Zabdiel,” Mather said. “When my son Sam came home from Cambridge and durst not go back, for the smallpox was spreading in both communities after that sailor carried it into our harbor, I confess, I did send my servant Onesimus to gather some scabbed material from a man who lay ill and bring it home. How my heart did beat in my chest as Onesimus ground it, and I myself made an incision in the arm of my beloved son. There Onesimus rubbed the powder. That night and for two days, a fever came over my son, and within a week, one or two pustules appeared, but he is well now and has gone back to college, though few enough are the courses on offer now.”

Dr. Boylston harrumphed and turned to the two children. “And you also? Do you bear scars of inoculation to show me how you survived this barbarous treatment?”

“Er...” Clinton said again. “We don’t—”

Mae interrupted him. “Clinton did so well he made no scar. And I—Doctor, I am too ladylike to show you mine, as it is deep under my clothes.” She batted her eyes and tried to look as bashful as possible. “But I do assure you both, gentlemen, neither Clinton nor I have any fear of smallpox.” *Because there is no smallpox anymore in the world we live in,* she thought. *And right now, with smallpox all around us, we’re safe because we’re wearing our body gloves.*

"Three witnesses," Mather said. "Four, if you count my son, though he has not yet had long to show he will not get a fiercer form of the disease."

"Yet I never heard of one who suffered smallpox twice," Dr. Boylston said. He stroked his chin. "And you are saying, Reverend, that I should take it upon myself to offer this treatment to my patients?"

"Not offer, good doctor. Insist. To save their bodies as I insist upon saving their souls."

"As you insist by hanging witches?" Boylston demanded.

"Only where there is evidence, dear doctor," Mather replied, clasping his hands together and wringing them.

"You call it evidence, when hysterical girls say evil witches floated in on them in the night, bearing the countenance of their elderly neighbors? Spectral evidence, you call these dreams. No man of reason can bear it."

"It was long ago," Mather pleaded. "And we used the spectral evidence only as cause to begin our investigations. Surely you agree, Doctor, that something was amiss in the town of Salem."

"Something was amiss, yes. Bitter jealousy and superstition, fanned by the clerics like yourself," Boylston said. "And yet, this time you bring me evidence, real evidence in the words of witnesses who are awake. So yes, I will try your cure. God grant we may save enough people to atone for the citizens of Salem you helped hound to false confession and death."

"How dare you…?" began Mather, lifting a hand as if to strike his friend. But then he let it drop, and said, lowering

his eyes. “Perhaps, indeed, He will have mercy on us all as He has had mercy on my son.”

As the minister turned away, Mae saw tears glinting in his eyes. She stepped forward and offered him her hand. “Goodbye, sir,” she said. “You were wrong about the witches, and you are very wrong to enslave people like Onesimus, but you are right to save the people of Boston from smallpox.”

With that, she nodded to the two gentlemen, and she and Clinton went out to stand on the front steps of the house, looking out toward the Common.

“Wow,” Clinton said. “What a mixed-up, confusing man. Good and bad, all jumbled in together.”

“Yup,” Mae said grimly. She took the X-PA from his hand. “Okay, Clinton, looks like we’re going to Bangladesh again. This time it’s October, 1975.” She turned the language dial to Bangla and looped the X-PA.

* * *

A little girl stood at the door of a low wooden building with a sign that read “Public Health Office.” Apparently she heard something as Clinton and Mae materialized behind her, and she turned to confront them.

“Who are you?” she demanded. “I am Bikisunessa, and I am eight years old. You may not report the case before I do. I got here first, and I should get the reward.”

Clinton and Mae introduced themselves, and Mae promised her, “We don’t want any reward. We’re just here to learn about smallpox. Have you been vaccinated?”

“Of course,” Bikisunessa answered. “My parents are


Public Health Office

very clever."

Just then the door opened, and a man in a white shirt looked out. "Who knocked?" he asked.

"I did. I, Bikisunessa. These two are just following me." The little girl stepped into the building. With a glance at each other and a shrug, Mae and Clinton followed.

"I am here to report a case of smallpox," Bikisunessa said. "There is a little girl in our village, three years old, and she has the spots on her face and body. I learned about smallpox in school. The little sick girl's name is Rahima Banu. If I take you to her, will I get the reward?"

The man pulled his head back and looked down at her.

"And do you confirm this?" he asked Mae and Clinton.

"We just got here," Clinton said.

"But I'm sure there's something," Mae added.

"Well," said the man. "How did you get here, Bikisunessa?"

"I took the bus, and changed twice, and it cost a taka."

"We will go back to your village in my car," the health officer said. "But first, let me call somebody."

He got on the phone and began speaking swiftly. "Yes, she says it is smallpox. We will have to be prepared to vaccinate all the villagers. I will let you know very soon."

He picked up a bag of supplies and led them out to the side of the building, where there sat a battered looking Toyota van. "Bikisunessa, ride up here with me," he said. He opened the passenger door, and the little girl gave a hop and clambered into the seat. Mae and Clinton got in

the back.

"My name is FaizuMasumder," the health worker said, looking in his rearview mirror. "What brings you two to Bhola Island, and how do you come to understand Bangla?"

"Oh, we've been here before," Mae said. "We are Mae and Clinton, and we're here to learn about smallpox."

"Ah, well then, you may be in luck," Mr. Masumder told them. "Because if all goes according to plan, you may be seeing one of the last cases of smallpox ever."

"Ever?" Clinton echoed. "How do you know?"

"Because the World Health Organization has been vaccinating against this disease since 1955," Mr. Masumder said. "One continent after the other has freed itself of smallpox." He sighed. "We have had smallpox in this world for a long time," he told the little girl in the passenger seat. "There are mummies in Egypt who carry scars from this disease under their linen wrappings. And even in this century, smallpox kills thirty percent of those it infects. We have no treatment against it."

"But we have vaccination," said the little girl.

"We know about that," Clinton said. "You take a little pus from a smallpox sore and rub it into a scratch in the skin."

Mr. Masumder wagged a finger at them in the mirror. "Not at all. That is a most primitive way, not in use for over 170 years." He turned the car abruptly onto a dirt road, and they passed a bus whose roof was loaded with luggage and cages with chickens inside.

"In 1801," Mr. Masumder said, "Dr. Edward Jenner of England published his famous treatise 'On the Origin of the Vaccine Inoculation.' Have you heard of it?"

Mae and Clinton shook their heads.

"Not very far along in your smallpox studies, are you?" their driver said. "Now, Dr. Jenner had noticed that milkmaids often had very fine complexions, lacking the smallpox scars carried by so many other people. He learned that almost all of them, however, had been infected by cowpox—a similar disease to smallpox, but less serious. They caught it from their cows. He came up with the hypothesis that cowpox infection might protect people against smallpox, and he tried it out. When a young milkmaid named Sarah Nelmes fell ill with cowpox, Dr. Jenner took a little of the pus from that sore and scratched it into the skin of a nine-year-old boy, a certain James Phipps, who was his gardener's son."

"At least Cotton Mather started with his own son!" Mae said. "I can't believe how these old-time doctors just barreled ahead trying things on people."

"Um, well, I'm sure the gardener consented."

"But what about the little boy?" Mae demanded.

"I would say yes if it was me," Bikisunessa chimed in from the front seat.

"It gets worse, I guess," Mr. Masumder said. "Dr. Jenner then exposed the boy to smallpox—twice. But the boy did not fall ill. Then Dr. Jenner inoculated more people and wrote up his report. In it he said, 'the annihilation of the smallpox, the most dreadful scourge of the human species, must be the final result of this practice.'"

"And I guess it was," Clinton said. "Because nowadays we don't have to get vaccinated."

"You don't?" Bikisunessa said from the front seat, twisting around to look at them in amazement.

"Clinton!" hissed Mae.

"I thought so," Mr. Masumder said. "You two are from America, aren't you? In the States, there have been no vaccinations since 1972. But now you are visitors here in Bangladesh, and you definitely will need vaccination. We will do it today."

"Great," Mae muttered to Clinton. "You first, buddy."

Clinton bit his lip and didn't reply.

The car made another turn and bumped over a rutted road into a small village, where it came to a stop. The houses stood on stilts and were roofed with palm fronds. Chickens pecked underneath the decks of the buildings. "Now we will see," Mr. Masumder said.

"There she is," his passenger said, pointing. "In her mother's arms."

"You two stay in the van," Mr. Masumder ordered Mae and Clinton. He got out of the car and came around to open the door for his youngest passenger.

Mae rolled down her window and called through it, "I've been vaccinated, just Clinton hasn't!"

"No, you haven't," Mr. Masumder called back over his shoulder. "Stay there." He walked over to a tired-looking woman with a pink shawl and blue dress, who stood cradling a little girl in her arms. The girl, who looked too small to be three years old, was half-wrapped in her mother's

shawl. She buried her face in her mother's shoulder and bawled.

"Let me see," Mr. Masumder said, and he gently took the girl's head and turned it toward him.

The little girl's face was covered in little sores like tiny, weeping volcanoes. Mr. Masumder stretched out her arms and then her legs, examining them. He spoke a few words to the mother and then came back to the van. "Yes, she has smallpox," he said to Clinton and Mae. "First case I've seen in well over a year." He spoke rapidly into the car radio, saying something about guards and vaccination kits.

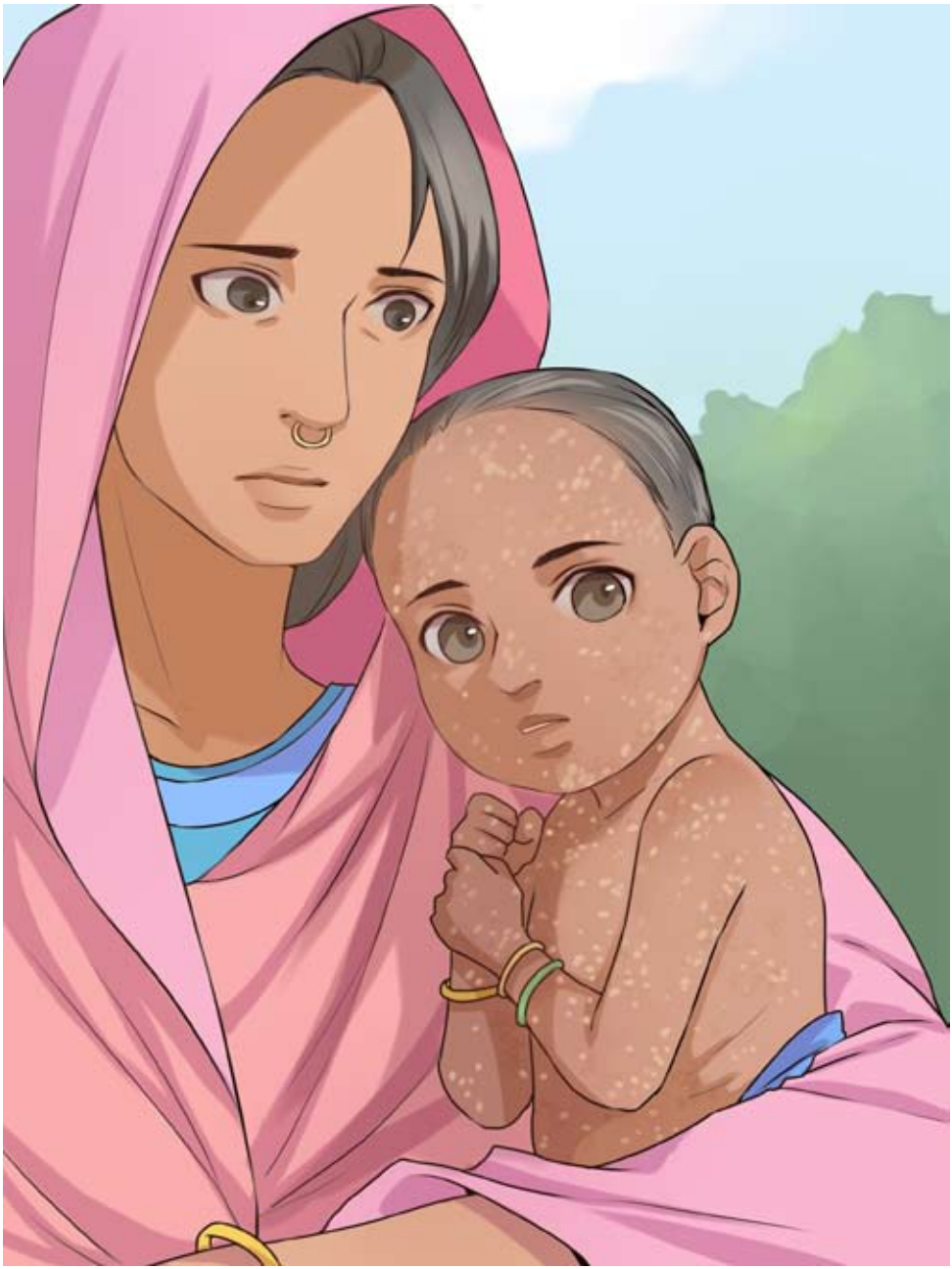
Then he sat sideways in the driver's seat with the door open and his feet outside. "You know, kids," he said. "This is a disease that has killed hundreds of millions of people in the twentieth century alone. And now we have it on its last legs. We may be about to end one of the greatest calamities humanity has ever known."

"What will you do?" Mae asked.

"Vaccinate everyone in this village," Mr. Masumder said. "Vaccinate anybody who walks by this village. In the schools, at the mosque. That's the thing, you see. There are so few cases now, we can surround every single one with vaccination. In the old days, all we could do was to tell the victims to stay home and mark their doors so no one would go there."

"You're doing ring vaccination," Clinton said. "What's the R0 of smallpox?"

Mr. Masumder looked back at him. "You know about ring vaccination and R0? I am astounded. For smallpox, in an unvaccinated population, the R0 is between 3.5 and 6.



Maybe about four. Enough to spread so fast in the Indians of North and South America when the Europeans came that it wiped out whole civilizations, the Aztecs, the Incas. That wasn't just the work of a few Spanish conquistadors, you know. They had the help of a little, vicious virus. And now, today, we are on the verge of wiping it out."

"But can't it come back?" Mae asked. "Isn't there an animal reservoir somewhere?"

"So you know about animal reservoirs too," Mr. Masumder said, sounding more and more surprised. "No, there is no animal that carries smallpox. You know all this, and yet you don't know enough to get vaccinated when you come to this part of Bangladesh. Who are your parents? Diplomats?"

Just then, Bikisunessa came running up to him. "Now do I get my reward?" she demanded.

"Yes, you do," Mr. Masumder said. "Here is 250 taka for you. Do not let anyone take it from you. Save it for school uniforms and books and someday you too can be a health worker. And be sure to tell all your friends to be on the lookout for any more cases of smallpox."

"That's a lot of money," Clinton said as the little girl skipped away.

Mr. Masumder gazed fondly after his little informant. "And that is how we have health surveillance in Bangladesh," he said. "More eyes and ears than you can imagine, to root out every last case." He looked up; an army jeep was pulling up behind them. "And here are the guards who will watch little Rahima's house until she fully recovers from her disease. No one in, no one out. And in a moment will

arrive the team from the Intensified Eradication Program, who will go house to house vaccinating everyone, starting with you two."

"In that case," Mae said firmly, "since you're going to vaccinate us anyway, we're getting out of the car." She gestured at Clinton, and the two of them opened their doors and got out.

As Mr. Masumder walked over to talk to the army officers, with Bikisunessa skipping after him, Mae pulled Clinton across the road and into the tall grass. "I don't want a vaccination we don't need, do you?"

"No way!" Clinton agreed. He pulled out the X-PA. "But do you think this is really the last case of smallpox in the world?" he asked, as he made the looping gesture and pressed the button to take them home.

## CHAPTER 9

# A MESSAGE OF HOPE

**MASSACHUSETTS, JUNE 6, 2020**
**KINSHASA, CONGO, DECEMBER 2019**
**WASHINGTON DC, MARCH 3, 2020**

Clinton ran on a backward slant to try and catch the Frisbee Mae had thrown—her longest throw yet, but just as far off-target as all the others. At the last moment, as he leapt for it, he caught a glimpse of pink and green, turned his head, missed the Frisbee, and rolled into a somersault-like fall.

"Selectra!" he said, as he rolled up onto his feet. "Hey, Mae, she's here!"

Mae hurried to retrieve the Frisbee and join them under the beech tree.

Selectra stood with one hand on the tree trunk, her forehead furrowing into an uncharacteristically thoughtful look.

"What's wrong?" Mae asked. "Did you get in trouble again?"

"Wait," Clinton said. "You're not planning to give us bad news, are you? Because COVID's almost over. Cases in the whole country have been falling for a month. Like in Massachusetts we're down to about 800 people getting sick each day compared to 2400 a month ago. Don't tell us there's going to be another peak, like with the 1918 flu!"

Mae gave him a withering look. "She's not going to show us the future, Clinton. She never does."

Clinton scratched his head. "Yeah, I know. So where are you sending us, Selectra?"

"Your second visit will be to a lab at the National Institutes of Health, to see how they're working on a cool new way to make vaccines."

"Sounds good," Mae said. "We like vaccines."

Selectra smiled. "Moonbeamed to hear it. And the first visit is back to the Congo—"

"No way!" Mae said.

"—to the capital, Kinshasa, in December 2019. Mae, you wanted to know what happened with the Ebola outbreak. You will see Dr. Jean-Jacques Muyembe. You won't see any sick people. And no militia."

"We'll just be talking to a doctor?" Mae asked. "Are you sure?" When Selectra nodded, Mae said, "Okay, then."

* * *

They landed inside the corridor of a building that felt awfully up to date. One set of glass windows showed a courtyard where goats were nibbling at scraggly bushes. Through smaller windows on the opposite side of the corridor, they saw a laboratory with tall refrigerators, shining sinks, microscopes, and workstations with metal hoods. Beyond the laboratory, a door marked, "Dr. Jean-Jacques Muyembe, Director" stood open an inch or two. Clinton stepped forward and knocked.

"What is it? Come in," answered a deep, pleasant voice.

Clinton and Mae entered a surprisingly cold room. A large man with hair that was graying at the temples leaned forward behind his desk. "Children? How may I help you?" He beckoned them inside. "I suppose you are not with the press. The press conference is this afternoon. We have to wait for our colleagues in the States to get up."

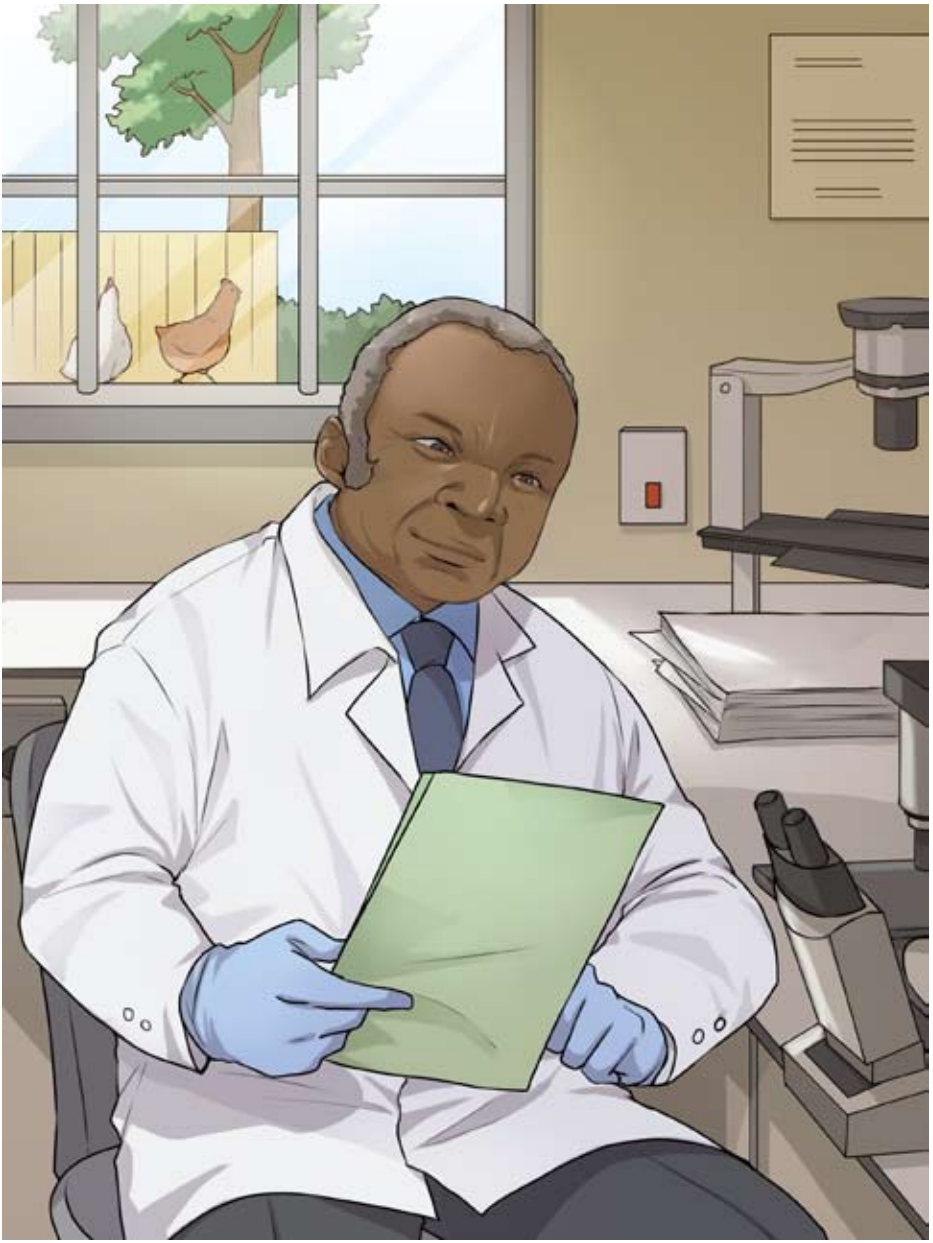
Mae and Clinton exchanged a look, and then Mae shrugged and took a chance. "We're students. We thought maybe our student newspaper could get the story first, straight from you."

Dr. Muyembe laughed. "You want to scoop all the international papers? But I assume your paper will not come out before tomorrow."

Clinton nodded. "That's right, sir."

"Well, in that case, I can tell you—but perhaps I can go back to the beginning."

"Yes, please," Clinton said. "We have a strong interest in Ebola, and we really want to know as much as we can."



"Well then, I can tell you that after getting a PhD in virology in Belgium, I came back to my country, which was called Zaire in those days. We had no laboratories for doing virology, so instead I was sent out to investigate diseases. I became an epidemiologist, if you know what that is."

"We do," Mae said.

"Shouldn't you be taking notes?" Dr. Muyembe asked.

Clinton held up his cellphone. "We'll record you, if that's okay," Clinton said.

Dr. Muyembe nodded. "Good. Forty-three years ago, in 1976, I was called to check on an outbreak in central Congo. People thought it might be yellow fever or typhoid. I examined all the people who were sick and knew right away this was a disease I'd never seen before. I took blood samples, and I convinced one Belgian nun to come back to Kinshasa with me." He shook his head. "Sadly, she died like so many others, but I sent some of the blood I took from her to Belgium. Scientists there and at the CDC in the US identified a brand-new virus that looked like a long hair curling in on itself. They called it Ebola, after a river nearby."

"You discovered the Ebola virus!" Clinton said in awe.

"You will usually find the Western doctors credited with the discovery," Dr. Muyembe said. "They had the labs and facilities. But they would have had nothing to examine if I hadn't drawn the blood in the first place."

"Did the patients bleed a lot?" Clinton asked.

Mae elbowed him. "You just can't stop asking about blood, can you?" she said.

Dr. Muyembe laughed. "When I took their blood, they

kept bleeding from the place the needle went in," he said. "Blood got all over me. I washed my hands, but still, I was lucky never to get Ebola. At that time we knew nothing about it. But I dedicated the next 43 years to fighting it, and I am still fighting it today, after nine more outbreaks here in the DRC."

"DRC?" Clinton asked.

"Do you not know geography, young man?" Dr. Muyembe asked. "Democratic Republic of the Congo, as Zaire was renamed in 1997."

"Oh, right," Clinton said.

"But today you are here for our big announcement," Dr. Muyembe said. "And this story, too, starts and ends in the Congo. In 1995, during another outbreak, I began to wonder whether serum from patients who had survived Ebola might help patients who were still sick. Now, you may know that when people get a disease, their blood systems make antibodies against whatever infected them."

"Yes," Mae said. "We've learned about this. Special white blood cells called lymphocytes make molecules called antibodies—"

Dr. Muyembe scratched his head. "That's right. Well, usually we try to create a vaccine by finding a particle of the virus or a dead version of the virus that can be injected into people to help them make these antibodies themselves. The blood cells, the lymphocytes, remember how to make the antibodies, so if a real infection ever comes along, they respond very quickly and defeat the disease."

"Like a factory that has the blueprints and the machinery all ready to go," Mae said.

"Exactly! And in fact, we do now have a vaccine for Ebola. But back in 1995 we didn't. And besides, a vaccine is not a cure. It prevents you from getting the disease, but if you already have the disease, a vaccine cannot work fast enough to save you. But what if you can get antibodies straight from someone who already survived the disease?"

"How do you get the antibodies out of somebody else?" Mae asked.

"The antibodies are present in serum, which is the liquid left at the top of a tube of blood after the blood has clotted. I thought we should try to see if the serum from Ebola survivors could help other Ebola patients. And it did! We first tried it on eight patients, and seven of them survived. Without such treatment, usually more than half of patients died."

He sighed and tapped a pencil on a pad of paper in front of him. "Scientists in the West did not believe our results at first. But eventually, more experiments were done and they were successful. This method, giving convalescent serum, is now often being tried in other diseases as well. The patient uses someone else's antibodies for a while, until they break down. It's like borrowing someone else's weapons for a battle until you have time to forge your own weapons." He made a gesture as if he was a blacksmith beating a new sword into shape.

Clinton stood and began shadow sword fighting around the room. Mae hid her eyes, but Dr. Muyembe just laughed.

Mae said, "And is that what you are announcing today?"

Dr. Muyembe shook his head. “No, now we are at a new phase of development. Colleagues in the West took these ideas and used them to create something new, something called monoclonal antibodies. They learned how to copy molecules in the convalescent serum to make millions of clones that are pure and all identical. We now have three different drugs that are monoclonal antibodies, and one other drug called remdesivir. What we have done in this current outbreak is very careful research trying out the four drugs in double blind experiments. You can imagine how difficult this is in the middle of an outbreak.”

“And in the middle of civil war,” Mae said. She closed her eyes and tried to imagine carefully sorting patients into groups and handling different drugs while a rebel militia was shooting at a hospital.

“So difficult,” Dr. Muyembe said again, shaking his head.

“Why do they call it double blind?” Clinton asked.

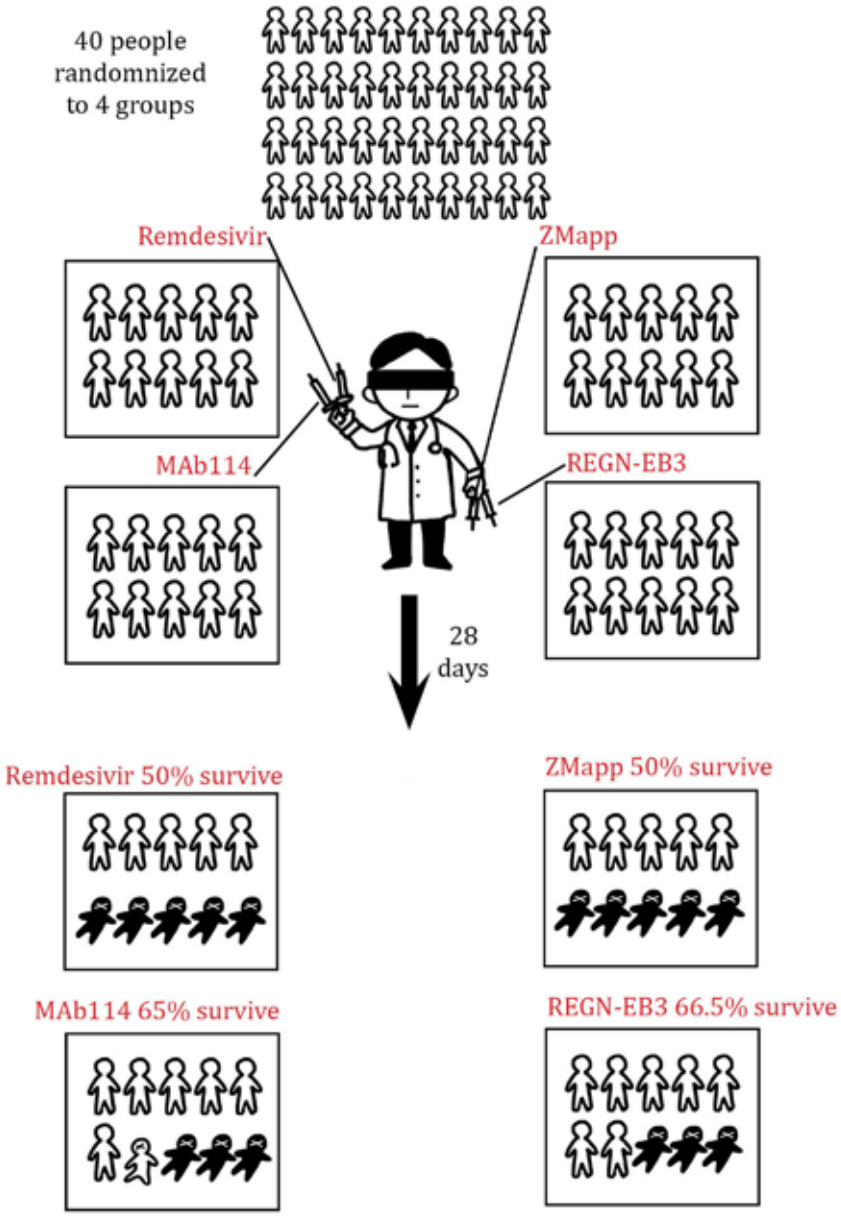
“Perfect!” Dr. Muyembe said. “I am hoping someone in the press will ask this, so I have made a PowerPoint slide. Come look.” He half-turned his laptop computer toward them, and Mae and Clinton leaned close.

“We call it ‘double blind’ because no one involved, not the doctors or nurses or patients themselves, knows who is getting which treatment. Now, do you think my little slide shows that?”

The slide showed a blindfolded doctor and forty little stick-man patients sorted into four groups.

“Is that why the little men all have plus-signs for eyes?” Mae asked.

# Double Blind Trial




MAb114 and REGN-EB3 are effective treatments!

"Yes, to show they are blind to the treatment."

Clinton said, "It makes them look like they're all dead."

"Oh, no, that is not good!" The doctor stared in dismay at his screen.

"Not in a country where people are already afraid of going to the hospital," Clinton said. "But I can help you fix it. May I?"

Clinton bent over the laptop, carefully replacing each dead-looking stick figure with one that looked alive.

Dr. Muyembe said, "To make sure nobody knew which treatment they were getting, all the drugs came in covered bags for IVs. Even though no one knew who was getting which drug, the patients gave informed consent."

"They must have really trusted you," Clinton said.

"Because we are also African," Dr. Muyembe said. "This is not research that Westerners could have come here and done without us. We have our own top-notch medical schools and research laboratories. We are partners, leaders, not guinea pigs or poor, ignorant Africans to be saved by white foreigners."

"No, no, of course not," Clinton said, leaning back from the computer. "But at least I helped you fix your PowerPoint slide."

"What did you find?" Mae asked.

Dr. Muyembe relaxed, sat back in his chair and spread his fingers on his desk. "Two of the monoclonal antibodies worked very well," he said. "For patients who are already very sick, they bring the death rate down from almost 75%

to just around 30%."

"Ouch," Mae said, thinking of the young mother she had helped a few weeks earlier. "That still sounds very risky."

"Ah, but if the patients come in early, fewer than ten percent of them die," Dr. Muyembe said. "And this is the message we must spread across the country. As more people survive and tell their friends and families, more patients will come in early enough to be saved."

Dr. Muyembe put his hands on his desk and stood, slowly enough that they could see he was certainly not a young man. "For forty years I have fought this disease in my country," he said, "and today at the press conference I can say we have a way to conquer Ebola. From now on, we can no longer say that it is incurable. And now I must go."

"Thank you so much for talking to us," Mae said. "You're a hero."

"I am a man who has been fortunate to do good work," said the doctor.

Clinton stepped forward and shook his hand, and then the two travelers exited to the corridor and walked toward the elevator. Just past it was a stairwell. They entered it and let the door close as Mae took a deep breath. "I'm glad we came back," she said. Clinton nodded.

Mae pulled out the X-PA, meaning to hit the "Home" button. But to her surprise, a new destination gleamed in green letters: **National Institutes of Health, March 3, 2020**. She showed Clinton, raised her eyebrows, and pressed the button.

**Vaccine Research Center,**
**National Institutes of Health,**
**Washington DC, March 3, 2020**

"We're looking for Dr. Kizzmekia Corbett," Mae said politely to the young man in a white coat and curly hair who came from behind a rack of test tubes.

"The news conference isn't until the President's tour in a few hours. You'll have to wait," the young man said.

*The President?* Mae thought. But she said in her most convincing voice, "But we're students. We have to be back at school in an hour."

The young man gazed at them with suspicion, but Mae edged closer with the X-PA, which had its usual softening effect. "Well, we can ask," he said.

Mae and Clinton exchanged a glance as they followed him to the far corner of the lab, where a young Black woman sat on a tall stool in front of a lab bench.

"Kizzy, more visitors for you," their guide said.

The young woman swiveled around to see them. "But you're kids!" she said with a laugh. "I thought you'd be journalists."

"We write for our school newspaper," Mae said, and Clinton added, "We're cub reporters."

"All right then," the woman said, nodding at the young man to leave them. "I'd rather talk to kids anyway. Sorry I can't shake your hand. I'm Dr. Kizzmekia Corbett but everyone calls me Kizzy. What can I do for you?"

"Is the President really coming here?" Clinton asked.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Kizzy smiled. “So they say. The Secret Service has been here checking everything out, and we’re all super nervous.”

Mae said, “Well, um, we won’t take much time. We just…” *What are we here for?* she wondered.

Clinton jumped in to save her. “We want to know what you’re planning on telling the President.”

“About our work on a COVID vaccine,” Kizzy said.

“Right,” Clinton said. “We know a lot about vaccines.”

Kizzy raised her eyebrows. “Yes?” She waited.

“Vaccines for measles and smallpox and ring vaccination for Ebola and of course flu vaccines…”

“We know vaccines work by getting the person’s own immune system all worked up,” Mae added, before Clinton chimed in again.

“Yeah, you see, people have special blood cells called lymphocytes that make antibodies—”

Kizzy leaned back on her stool. “Wow, you guys *do* know a lot already.”

She came down from her stool and walked over to a whiteboard, where she picked up a marker and wrote on the board:

>150

“That’s how many COVID vaccines are being developed all over the world right now,” she said. “More than 150. Some are being tested on cells, some have moved on to mice, but more than half are already in human trials. Do you know how we do human vaccine trials?”

"Uh, not really," Clinton said.

"Well, first we give trial shots, all different doses, to a few people to see if it's safe. We check in a week or two to see if they've made any antibodies. That's a Phase I trial.

"Then, if everything works out, no bad side effects or anything, we move to Phase II, where we give the vaccine to a few hundred people, male and female, different races, young and old, to see if it's just as safe for all of them."

"Including kids?" Mae asked.

Kizzy looked apologetic. "Kids usually come later. But anyway, if Phase II works out okay, we go to the big one, Phase III, an efficacy trial."

"To see if it works," Mae said.

"Exactly. And that's the part that takes the most time, because we give half the volunteers a dose of vaccine and half a dose of placebo, which is just salt water, and then we wait."

"A double-blind experiment," Clinton said, throwing a look at Mae.

Kizzy nodded. "The people go about their usual business. We tell them all to be just as careful as before. Nobody knows, including them, whether they got the real vaccine or placebo. So we just have to wait until there's enough COVID going around naturally that a lot of our volunteers get sick. I mean, if *nobody* is getting sick, we have no idea whether the vaccine is working."

"I get it," Mae said. "It's kind of like comparing rates to look at racial disparities. If twenty percent of the placebo people get COVID but only 5% of the vaccinated people,

you know it's effective."

"Exactly," Kizzy said again. She gave Mae a big smile. "In fact, can you figure out what the efficacy of that vaccine would be?"

"Um…" Mae said. "Let's see, five percent versus twenty percent, that's one fourth. So it's 25% effective. Oh, no, wait… it's the opposite. Fifteen people out of every twenty who would probably have gotten sick with only placebo stayed healthy instead, so is it 75% effective?"

"Exactly," Kizzy said for the third time. "You really understand. And of course, we also look at how sick people get, whether they have to go to the hospital, whether anyone dies, for example."

Clinton scratched his ear. "Okay," he said. "But wouldn't it be quicker if you just asked all your volunteers to go to restaurants and visit people with COVID in the hospital without masks and all? I mean, get the ones who are going to get sick get sick faster?"

"Clinton, that's terrible!" Mae said. "That's like Dr. Jenner and the gardener's boy!"

"But if they volunteered…" Clinton said, and Kizzy held up her hand.

"That would be called an exposure trial," she said. "Researchers have debated that. Would it be ethical to expose people on purpose to a virus that might kill them, even if they volunteered?" She shook her head. "The scientists decided not to do it. After all, some people are already very suspicious about being experimented on. You ever hear of the Tuskegee trial?"

The kids shook their heads.

"Well, for forty years, from 1932 to 1972, four hundred Black men with syphilis were followed in clinics at the Tuskegee Institute, which is a respected college for African Americans. Syphilis is a horrible disease that slowly kills you. At the beginning of the study, the treatments people used for syphilis were really harsh and hardly worked at all, but after a while, penicillin came along and all those men could have been cured. But the scientists back then wanted to see what would happen if syphilis wasn't treated at all. They lied to the men. They told them they were getting medical care, but they were getting nothing. The idea was to just observe them all until they died."

"That's terrible," Mae said, at the same time that Clinton said, "That's disgusting!"

"Yep, and you notice they didn't choose white men to do this experiment on," Kizzy said. "Finally, in 1972, a newspaper made a big stink about it, and the study was stopped and the men were treated. But ever since then, it's been really hard to get African Americans to sign up for studies for any medical treatment. They don't trust the system, and can you blame them?"

"I feel sick," Mae said, and she sank down to the floor. "My mom is a research nurse," she said. "She never told me this."

Kizzy crouched down beside her, and so did Clinton, peering at her in such a worried way that she closed her eyes. That helped her head stop swirling, and she was able to stand up again. In a voice that she tried to make firm, she said, "Thanks for explaining. Maybe we better go now."

Kizzy said, "You forgot to ask me the most interesting question of all."


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"What question?" Clinton demanded, as Kizzy pulled up a stool for Mae to sit on.

"How we made our vaccine," Kizzy said. "You see, nowadays there are a lot of different ways to make vaccines, and here at NIH we used a revolutionary new one." She looked at Mae. "Want to hear about it?"

Mae lifted her head. She still felt really sick to her stomach about the Tuskegee story, but here was Kizzy, Black, really smart, so excited about what she was doing, giving off hope. "Yes," she said. "Please tell us."

"Glad to," Kizzy said. "You see, there are a lot of labs trying the usual way of using dead bits of virus to teach the immune cells to respond. But we're trying something new that we think will work even better. You know how viruses have DNA or RNA inside them?"

Clinton said, "Uh, yes," and Mae said, "Those are the instructions that fool the human cell into making new copies of the virus, right?"

"Right," Kizzy said. "Now, SARS-CoV-2, which causes COVID, is an RNA virus. The cell it invades just naturally translates the message of its RNA into proteins which arrange themselves into new viruses. But what if we give people just part of the RNA, say the part that tells the cell to make the spike proteins?"

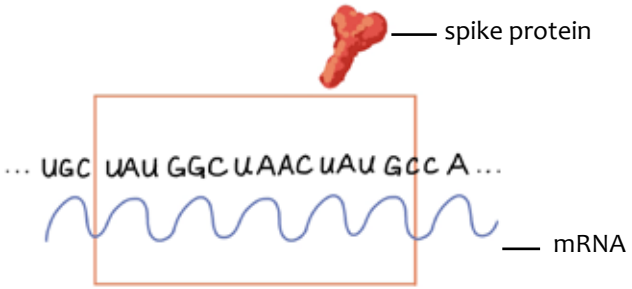
Clinton pursed his lips. "So you mean you could fool the cell into spitting out spike proteins… And with lots of spike protein around, the people will get really immune really fast!"

"Well, that's what we hope."

"And that's what you're working on?" Mae asked. "What

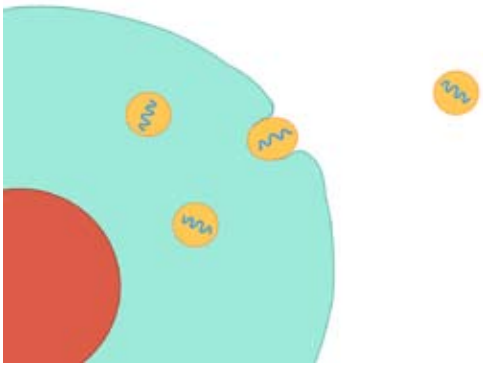
# mRNA Vaccines

1. Find the sequence of viral RNA. What section of RNA codes for the spike protein?

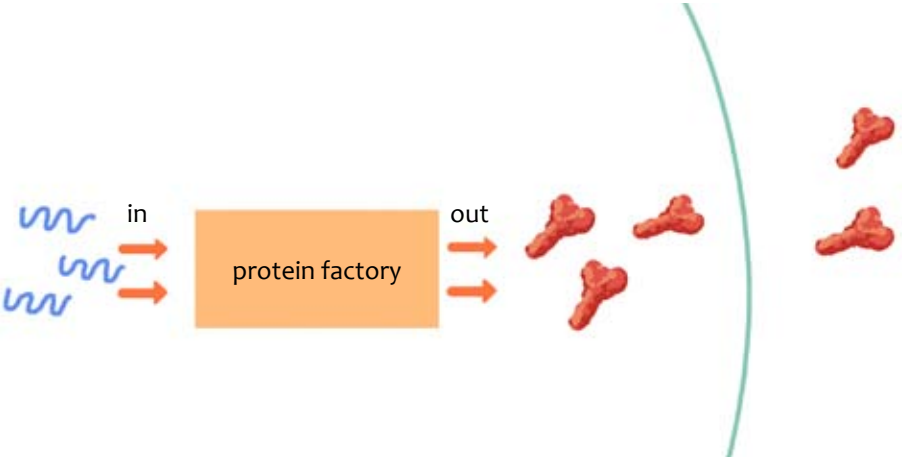



2. Make copies of just that RNA section and put them in tiny fat blobs.

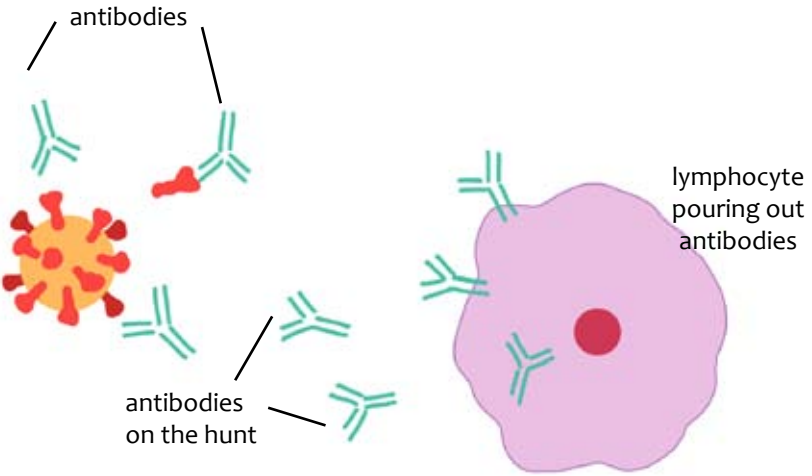
3. Inject your vaccine into a person or animal, whose cells will absorb the fat blob.



4. The cell's own system for making proteins will start translating the RNA message into spike proteins.




5. With so many spike proteins in the blood, the body's immune system will "learn" to find and destroy any virus carrying that protein.



part did you do?"

Kizzy leaned back against the wall. "We got the RNA sequence, the full set of instructions, for the COVID virus from our colleagues in China right away, back in January."

"You mean the Chinese helped you?" Clinton asked. "I thought they were the bad guys in all this."

"The Chinese scientists were great," Kizzy said. "And you know, within a week I was able to make our own string of RNA. Then we had to figure out which piece of RNA was going to be helpful—a piece that would code for just the spike protein. And we did that really fast. In just days, really."

"And then what?"

"We made bits of RNA and packed them in tiny blobs of fat we can inject into people."

"And these little bits of fat get inside the people's cells?" Mae asked.

"Yes, and once the blobs are inside, they release their RNA."

"I get it!" Clinton exclaimed. "The RNA inside my cells tells them to start making and spitting out spike protein, and my lymphocytes see the spike proteins and start cranking out antibodies. Then, if COVID ever tries to get me, KA-POW!! My antibodies will grab onto the spike proteins so they can't even work!" He pumped his fist. "A shot, then freedom!"

Kizzy laughed, "Remember, we still have to go through the clinical trials. We have to be absolutely sure these vaccines are safe. And that they really work. Just think: it used

to take years and years to develop a brand new vaccine. What we're seeing right now is amazing, with so many scientists and volunteers working toward the same goal, all around the world."

Just then, a sharp voice spoke from the end of the room. "Mogul coming, Mogul coming."

"It's the President," Kizzy said, so flustered she began flapping her hands. "You're not supposed to be here."

A strong-looking man in a suit and dark glasses stood across the room, looking this way and that. A wire hung from one ear.

"Secret Service," Clinton said. "Cool."

"We said no visitors," the Secret Service agent shouted at them. "What are you two doing here?" He started across the room, and two other agents entered the room after him.

"Fire escape!" Kizzy said, as she pulled them to a door marked *Exit*.

The kids hurried through, but on the other side, Mae glanced back. Beyond Kizzy, she saw a tall, big man with a blue suit, yellow-orange hair and a long red tie enter the room. Other people surrounded him, but he was clearly the center of them all. She caught her breath. The President, code name Mogul.

She let the door close and started down a darkened hallway after Clinton. The door yanked open behind her. "You! Stop! We need to question you."

Clinton was already running down the hallway toward another door marked *Emergency Exit*. Mae couldn't use the


EXIT

X-PA until she was next to him, so she sprinted. Behind her she heard shouting, and then, just as she caught up with Clinton, the Emergency Exit door burst open and a second agent stood in their way.

Mae grasped Clinton by the arm and with her left hand fumbled for the Home button on the X-PA.

## CHAPTER 10

# POLIO PIONEERS AND THE EPIDEMIC OF SADNESS

### MASSACHUSETTS, NOVEMBER 9, 2021
### SHAKER HEIGHTS, OHIO, MAY 1954

Clinton's backpack bounced on his back as he trotted toward the gym for basketball practice. But in the middle of the hallway, Mae held up her hand to stop him. He pulled up. "What are you doing here, Mae? Shouldn't you be in the library studying or something?"

She ducked her head, and Clinton saw to his surprise that she had been crying, the way she did way back at the beginning of COVID. "What's wrong?" he asked, more gently.

"Can you come sit with me?" Mae asked. She looked off

to the side, as if she couldn't quite face him.

"Maybe after practice," Clinton said.

Mae let out a gulping sob. "I need you."

Amazed, Clinton took hold of her arm. "Okay, okay, I'm here. What is it?" He glanced down the hallway and then drew Mae into an empty classroom. There were equations on the board and posters of famous mathematicians on the walls.

He helped Mae take off her backpack and settled her into a chair, then sat around the corner from her and put his elbows on the table. "Tell me."

Mae wiped her face with her sleeve. "My mom's in the hospital."

"She got COVID again?"

"No, it's… she's really depressed."

"Oh." Clinton shifted in his chair uncomfortably. "Did she try to commit suicide or something?"

"No!" Mae half-shouted at him. "You're so dumb, you're so…" and she melted into tears again.

For once Clinton didn't feel offended that Mae was calling him dumb. He wished she was still yelling at him instead of crying.

"She stopped going to work," Mae said with a gulp. "The past two weeks, my grandma and I did all the cooking. Mom just sits in a chair shaking. Finally my grandma called a friend, and they took her to the hospital and the hospital is going to keep her for a couple of days. They say she has major depression. Maybe she'll lose her job. And now I feel

like I'm the one going crazy. I couldn't sleep last night. I got myself together to come to school, but I didn't go to most of my classes today. I just hid in the girls' room crying."

"Wow," Clinton said. He patted her hand and said in a voice that sounded awkward even to him, "I'm going to take you to the new school counselor."

"She's not there. She's home sick or something, or maybe she quit."

Clinton thought for a moment. Seeing Mae like this was scary. He took two deep breaths and then said, "I guess a lot of people are really burnt out from this pandemic."

"My mom took care of so many really sick people. But… now there aren't as many of them. Shouldn't she be feeling better?" Mae paused. "It's like COVID already broke her and now she's giving up."

Clinton said, "Maybe she's just really, really tired."

Mae reflected for a minute. "Like when we came home from Congo the first time," Mae said. "I wanted to hide under my covers and sleep for two days."

Clinton said, "All I wanted to do for two days was shoot baskets. My mom could hardly get me to come in for dinner. And now, well—" He looked at Mae. "Things still aren't back to normal, are they? We still don't know if this will ever end."

Mae shook her head and sighed. Then her eyes widened as she looked past Clinton's shoulder.

Clinton turned around. The air behind him shimmered pink, and the image of Selectra Volt came into view.

"I've come to cheer you up," Selectra said.

"Uh," Clinton said. "I'm not sure Mae's in the mood for time travel."

"Of course she is, aren't you, Mae? You'll get to see people coming together and celebrating to conquer disease." She held the X-PA out to Clinton.

"No more diseases right now," Clinton said.

"Don't be so rhomboid. It will take Mae out of herself." Selectra handed him the X-PA and twinkled away.

"Where are we going?" Mae said.

Clinton stared at her in surprise. She actually seemed interested. "I have basketball practice," he said weakly.

Mae took the X-PA from his hand and looped it around them. Only as she pressed the button did she see the destination: "Polio. Shaker Heights, Ohio, May 1954."

Tall, leafy trees loomed above them. They stood at the edge of an empty playground, with one swing twisting gently as if someone had just left it. To the right was an empty baseball field, and behind that they saw a gathering of families with a smoking barbecue pit and blankets spread on the grass.

Clinton looked over Mae's shoulder at the X-PA. "What's polio?" he asked.

Mae said, "It's one of those old diseases we get shots for as babies. It used to be really bad. It hit mostly kids, and they got high fevers and some of them got paralyzed."

Clinton groaned. "Oh, great. And now we're supposed to go talk to some paralyzed kids and that's supposed to

make you feel better?"

Mae glared at him. "They're just kids like us," she said.

Clinton followed Mae across the empty ball field, his shoes scuffing the dirt. Mae walked in front of him with her back and shoulders very straight. As they reached the picnic ground, they saw that half the children were in wheelchairs or wearing leg braces and using crutches.

*Okay,* Clinton thought. *Act normal. They're just kids like us. I can do this.* He came to a stop at Mae's side.

In front of them, a girl with brown braids who looked close to their age sat in a wheelchair. A quilt was spread on the grass beside her, but it held no sign of a picnic.

Clinton took a breath and approached the girl. "Hi, I'm Clinton. Can I… get you some lunch or anything?"

The girl looked them both up and down. "My parents are standing in line. Unless they've stopped to talk to somebody. What are you two doing here?"

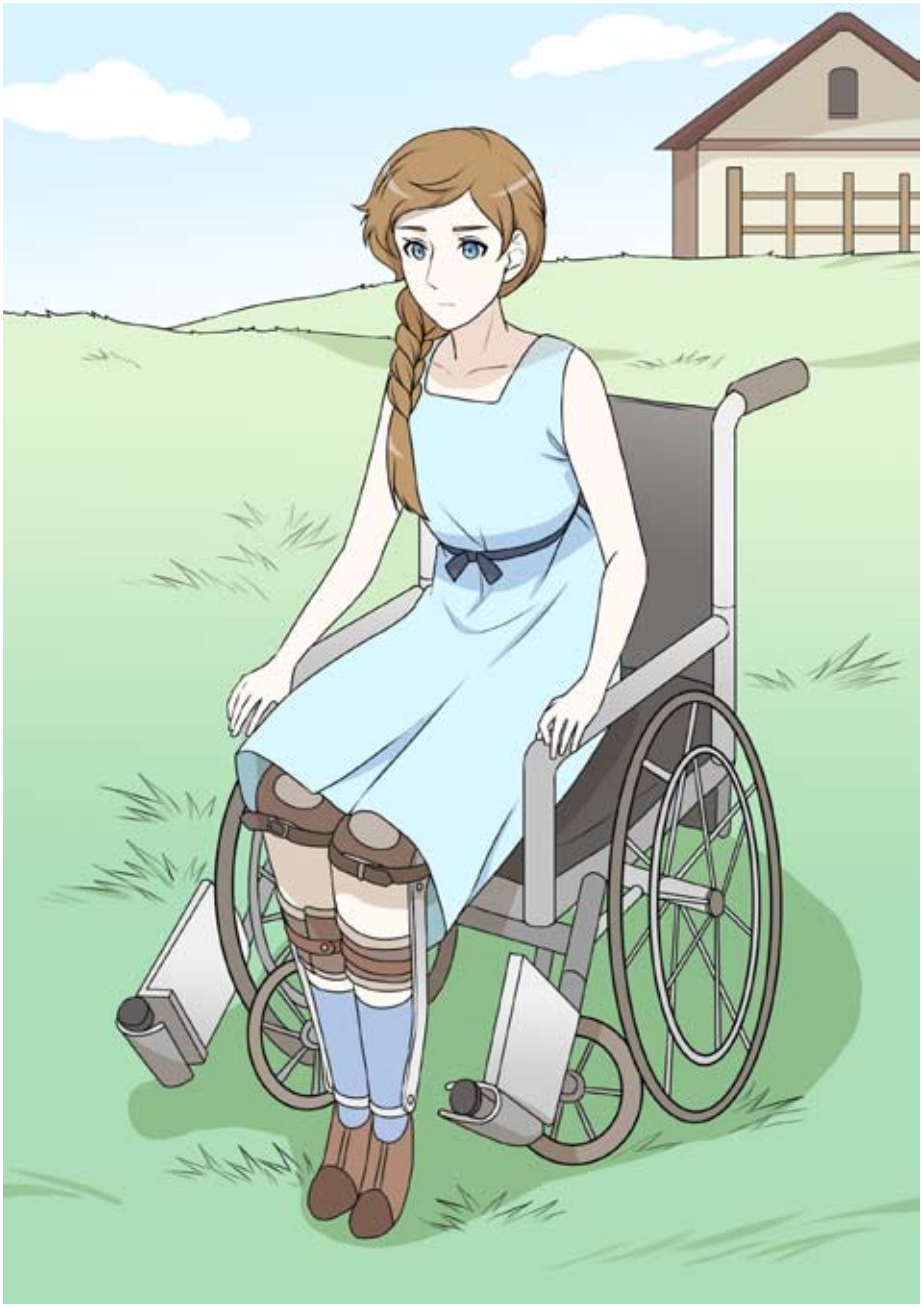
"We're… um… visiting," Clinton said.

"You're not afraid of us polio kids?"

Mae came up beside Clinton. "No. Why should we be?"

The girl peered at them. Mae glanced around. All the families spread across the grass were white. Maybe this girl hadn't seen many Black or Asian kids. *Who's afraid of who?* Mae wondered.

But then the girl let a smile cross her face. "No reason. It's just most kids stay away. I'm Jill, by the way. Can you help prop me up in my chair? I always start collapsing."



Clinton went behind her and lifted her from her armpits, and Mae rearranged the pillow behind her to prop her straighter.

Jill said, "Thank you. Welcome to our picnic. The March of Dimes arranges things like this to cheer us up. Are you surprised? Most people think they only fund research for a vaccine." She narrowed her eyes. "Are you two Polio Pioneers, I hope?"

"Excuse me?" Mae said.

Jill scoffed. "Did you sign up for the vaccine trial? Did you get your shot?"

"Oh, that," Clinton said. "Yeah, of course, we both got all our shots." *When we were babies,* he added silently.

"Good for you," Jill said. "My dad says it's amazing, the way the whole country has come together like this. People, kids, gave hundreds of thousands of dimes. And now we're just waiting. By the end of this summer, we'll know if the vaccine works."

"It works," Mae said. "I know it will work."

Jill sighed. "Too late for me. But at least my sister Alice won't get it." With one thin arm and drooping hand, she gestured toward a group of children who were laughing and running in circles. "You know, when I was in the hospital, Alice couldn't even visit me, in case I infected her. I was afraid she would forget what I looked like."

Mae asked, "Really? How long were you in the hospital?"

"Six months," Jill said. "I was even in an iron lung* for a while." She bit her lip. "I felt like a mummy. When I got out of

*An iron lung "breathes" for a person whose muscles are too weak to do it alone. The person lies inside a cylinder, with only the head sticking out. Air is pumped in and out of into cylinder to create high and low pressure, causing the person's chest to rise and fall. When pressure inside the cylinder is low, the chest expands, allowing air to flow from outside through the person's nose and mouth to the lungs.

that, all my muscles still hurt so much, and the stretching treatments hurt even more." She looked down at her lap, and her voice trembled. "But the worst thing was, I was so lonely."

"That's terrible," Clinton said, thinking, *Selectra! You're messing up again. How's this supposed to make Mae feel better?*

Mae squatted beside Jill's wheelchair. "I'm sorry," she said. "Loneliness is the worst."

Jill nodded, looking down at her hands folded in her lap. "I tried so hard to be brave. Everybody said I was so brave. And I got better and stronger and I did all the exercises and I try really hard, but I don't know if I'll ever get strong enough to walk. Kids still avoid me, and I get tired of being brave all the time."

"Of course you do," Mae said. "My mom—"

She stopped.

"I hear my mom crying at night sometimes," Jill said. "Oh, I'm sorry to be talking to you like this. No wonder other kids stay away from me."

"But people should all be talking to each other," Mae said. "Because you—I mean we—are really all in it together."

Jill said, “I guess… I mean, parents are still afraid of their kids getting it. They don’t let them go to swimming pools or the movies. Maybe not even picnics like this. So if the vaccine works, it will get so much better. Everyone will be happy because they can start living their normal lives again. But there will still be some of us… I mean, it won’t be completely over even when it ends.”

“I know what you mean,” Mae said.

Clinton said, “Is there anyone…” He stopped and stared at his shoes. “Does anyone, like, talk to you about it? How it feels to be so lonely, and how to keep from getting depressed?’

Jill pulled her head back. “No. Why would they? I mean, I survived, didn’t I? I’m supposed to count my blessings and move on.” Biting her lip, she looked past Clinton, and then a small smile twitched her lips.

Mae turned to look. Coming slowly toward them was a young man in a red hat and a striped shirt, stopping beside each child to pump up balloons and twist them into shapes.

“Oh! I want a dog!” Jill said. “See, these March of Dimes people are really nice. They don’t really understand, but they do what they can. And here come my parents.”

“We better go,” Mae said. “We’re supposed to get home.”

“Thank you for talking to me,” Jill said, as the balloon man approached. “It really did make me feel better to talk.”

She waved at them as they walked away, and when she turned her attention to the balloon man, Mae waved the

X-PA.

Standing in the math room again, Mae said, “I get it. Polio kids seventy years ago went through a pandemic, and doctors took care of their bodies but not their minds.”

“No kidding,” Clinton said. “Six months just lying there without ever seeing your family!”

“But now it’s different,” Mae insisted. “Now they let parents stay with kids who are sick.”

“So?” Clinton asked, because it seemed as if Mae meant to say more.

“So, at nowadays doctors know that people have emotions, and probably they’ve discovered ways to help.”

“Maybe,” Clinton said doubtfully.

Whenever he could, Clinton sat near Mae during English class so he could keep an eye on her. At lunch, he waved at his friends and found a quiet table with just Mae and himself. Some of the boys teased him about being her boyfriend, but he shrugged it off. At lunch, he listened to Mae talk. Sometimes she didn’t say much, but he handed her a napkin if her eyes began to well up.

But after two weeks, she joined him in the lunch line with a bit more bounce in her step.

“How’s your mom?” Clinton asked.

“She came home. She’s taking medicine, and she talks to a therapist by Zoom, and she seems much calmer. She’s

just doing ordinary home things and taking time off from work. But she still gets sad sometimes."

Clinton nodded. "That sounds better."

Mae added, "And I'm going to a support group for kids. It's funny. Clinton, did you know that there's a big mental health crisis for kids going on? The leader of our group says it's like another whole epidemic. So many kids are sad, so many have been lonely, lots have lost a relative or their families aren't doing well."

"Like an epidemic of sadness," Clinton said.

Mae said, "O-oh, that's a good way of putting it. But it's not just sadness. The therapist says it's normal to be sad and cry sometimes, and that's not depression. But if you can't look forward to anything, don't have any hope, keep blaming yourself or feeling like a failure, or if your thoughts just keep going around and around and torturing you, or you're exhausted all the time and hurting too much to even eat or sleep right—plus a lot of other stuff—Well, if you can't get out of the feeling, then you could be depressed. It's a real illness, and you really need serious help."

"What kind of help?" Clinton asked.

"Well, talking to a doctor or a therapist, first of all. And sometimes taking medicine can help."

"Are you depressed?" Clinton asked. "Do you have to take medicine?"

Mae shook her head. "No. I thought about it, and even though I'm scared and upset and sad, I can still enjoy things, at least a little bit. Not that I feel great. At first, I felt ashamed to be in the support group when so many

kids had it worse. All we really do is sit in a circle and talk. But I decided it's good to be part of a group to help kids feel their way through a really hard time. I mean, things still aren't really normal, and like Jill said, this sickness is not just going to go away and suddenly leave everybody fine again. Not that I'm paralyzed like Jill, obviously. But if I stay really down, how can I help my mom? I deserve to have someone to talk to so I can stay healthy."

"You have me," Clinton pointed out.

"I know. That helps. But it's a lot to put on you. And I got embarrassed about crying and falling apart and not doing homework and everything the last two weeks. But now... our therapist says it's good to be with friends and go outside and not spend too much time on social media and... I wondered if after your basketball practice we could go to the park and play Frisbee like we used to."

"Sure," Clinton said. "Only, I'm always starving after basketball practice."

"I'll bring apples and cookies," Mae said. "I'll meet you at the park, we can both bring friends, and we can have a picnic."

Clinton said, "Like the March of Dimes. Celebrate a bit, even if we're sad. That sounds really good."

## CHAPTER 11

# FEELING FLUSHED

### JANUARY 15, 2022

Two months later, Clinton stood on the steps to Mae's front door with his backpack hoisted over one shoulder. They had just finished doing math homework together. That is, Mae had been doing math homework while Clinton sketched pictures of her in his notebook—how she twisted her mouth and wrapped hair around her finger when she was concentrating.

"Those were some amazing cookies your mom made," he said. "She looks really good."

"You know why? She's working in the newborn nursery now.

Cute babies instead of COVID patients."

"There aren't so many COVID patients anymore," Clinton pointed out.

"I know," Mae said. "But would you ever have thought we'd still be thinking about COVID after two years? Selectra never warned us."

Clinton looked out over the darkening street. Through a hedge on the opposite side, he saw a shimmering of pink and green sparkles.

Clinton touched Mae's arm and pointed, and Mae's mouth fell open. "Selectra?" she said in a low voice.

The hedge rustled. Mae and Clinton darted across the street and clambered through a gap in the hedge. Selectra stood grinning at them. "You missed me!"

"So what's going on?" Clinton asked.

"I had to persuade the higher-ups," Selectra said. "They gave me so many reasons not to come. One: we have a shortage of X-PAs. And they use a huge amount of power, you know. Two: time travel gets harder as you get older. And three: they say you know enough now about epidemics to keep figuring stuff out on your own. So this last trip is really just a thank you from the Galactic Academy of Science."

She held up a battered-looking X-PA that was held together with electrical tape.

"Wow," Clinton said, holding out his hand to take the X-PA. "Where to and what date?"

Mae stepped close to look over his shoulder. "Deer Island Wastewater Treatment Plant," she read. "Dr. Mariana Matus. And the date is today!"

"See?" Selectra said, turning on her toes and sparkling. "In case the X-PA runs out, it's easy to get home from."

* * *

Mae and Clinton stood on a paved walkway on an island in the middle of Boston Harbor. The island was long, with a water tower standing on a heaped-up hill in the middle. Not far away from them, at one end of the island, loomed a cluster of large, cream-colored, egg-shaped buildings. Between the kids and the giant eggs stood a group of three people, talking. A large man with longish gray hair raised his head and called, "Hey, kids, what are you doing here?"

Clinton mumbled, "School field trip."

The man narrowed his eyes. "We haven't re-started school field trips yet. Besides, where's the rest of your class?"

Mae walked toward him, holding the X-PA so it faced him. She hoped that, old and worn out as it was, the X-PA would still have its effect of softening up people near it. "Sorry, sir, we didn't know. We're home schooled. This is a private field trip. And we wanted to meet Dr. Mariana Matus and, uh"—she checked the X-PA—"Dr. Larry Madoff."

A second man, mild-looking, with brown hair, a neat gray beard and glasses, looked surprised. "I'm Dr. Madoff, from the Department of Public Health. What can I do for you?"

Mae shook his hand. "Mae Jemison Harris and Clinton Chang."

The man who had first called out to them said, "I'm Steve Rhode (he pronounced it 'Roadie') from MWRA, the Massachusetts Water Resources Authority. We manage this treatment plant."

Then the woman spoke up. She was young with curly black hair that hung below her shoulders, and her voice had a soft Mexican accent. "I'm Dr. Mariana Matus, CEO of Biobot, which tests the wastewater here for COVID particles."

"The CEO? Isn't that the big boss?" Mae said.

Dr. Matus laughed, looking from Mae to Clinton. "Big boss of a small company, though we're growing fast! How can we help you?"

Mae hesitated, but Clinton spoke up. "We want to know when COVID will be over and what this place has to do with that."

Dr. Madoff smiled. "That's just what the governor asks me every day." He looked more serious. "Most of us in public health don't talk about COVID disappearing anymore. It's all over the world, mutating all the time, infecting animals that can infect us back and others that can't… but it's going to be with us for a while."

"People talk about it becoming endemic," Dr. Matus said.

Steve Rhode turned and led the group toward some low buildings that stood in front of the giant eggs. Clinton said wistfully, "Endemic, that says END, doesn't it? Doesn't it mean we won't have to worry about it anymore?"

Dr. Madoff took off his glasses and wiped them as they walked along. "That would be wonderful," he said. "Some people think that's what will happen. Ever hear of the Russian Flu of 1890?"

Mae said, "We only know about the Spanish flu, which wasn't really Spanish, from 1918."

"That's one example of what might happen with COVID," Dr. Madoff said. "The 1918 flu swept across the world in waves, killing millions of people, and then it just sort of faded away. Turns

out it's come back around, but it isn't as strong now. It takes turns with other flu viruses to pop up in the winter season, and together they still kill 40-60 thousand people a year in the U.S. That seems to be how flu viruses work—they come and go. But we think what was called the "Russian flu" in 1890 might have been a coronavirus."

"How could you know what caused what?" Mae asked, thinking back to Dr. Armstrong and his microscope in 1918. "I mean, people didn't know about viruses in 1890. Not even in 1918."

"Good point," Dr. Madoff said. "But you see, scientists have been able to find some very old samples of lung tissue from people who died in 1918 and test them. We can show that that pandemic was caused by a strain (or variant) of the influenza virus called H1N1, which, as I said, still shows up every few years today, though it's milder now. Flu shots do a pretty good job of protecting us, from getting too sick, but the immunity wears out quickly, and the viruses change, so we have to get a flu shot every year. Do you two get your flu shots?" He looked down at them with his glasses glinting.

"Yes, we do," Clinton said virtuously.

"Good for you," Dr. Madoff said, "because even though the flu usually isn't too bad in school age kids, you could spread it to babies or old people, where it could be dangerous."

"It's like that with COVID too," Mae said. "It's sort of like being a good citizen to get vaccinated."

"You are so right," Dr. Matus said, and everybody nodded.

"Back to the Russian flu," Dr. Madoff said. "We haven't found good, preserved lung tissue samples from 1890 to test for virus, so we just have to go from history. The infection closed down schools and factories and spread all over the world. Old people

were the hardest hit. And here's the strange thing: *People reported losing their sense of smell and taste.*"

"Oooh," Mae said. "My mom lost hers when she got COVID."

"Lots of people do," Dr. Madoff said. "Now, here's one more hint. Do you know that we have four different coronaviruses circulating today? They cause the common cold."

"Yeah," Mae said. "I remember when some people said COVID was no big deal, just a bad cold."

Dr. Matus said, "You don't get almost a million people in the US dying from a bad cold. But Larry, back to your story."

Dr. Madoff said, "There's one coronavirus called OC43 that does cause a bad cold. Virologists have analyzed its RNA, and based on how often that mutates—"

"Often, I bet," Clinton interrupted.

"—They think it may have originated in a coronavirus in cows and passed over to humans around 1890."

"Like this one did from pangolins or minks or—"

"Or raccoon dogs," Dr. Madoff said. "So if the 1890 "Russian flu" was caused by a coronavirus that came from cows, and now the same virus only causes a bad cold, maybe that means COVID will gradually mutate so it causes a cough and runny nose and nothing more. It could become just another cold virus, and we could all learn to live with it."

Steve Rhode brushed past them to open a door in front of them. "But we're sure not there yet, are we? Shall I show you all around inside?"

"Sorry, of course," Dr. Madoff said. He said aside to the kids, "This is my first time here. I've come to see how the wastewater

sampling works, because we might be using it more and more."

Mae and Clinton followed the adults into the room. Clinton held his nose just in case, but inside, Mae elbowed him. "It doesn't smell bad," she said.

Clinton unpinched his nostrils. "You're right." He spoke to the adults. "Why doesn't it smell bad? This stuff does come from toilets, right?"

Steve Rhode answered. "Yes, and from showers and snow melt and washing machines and dishwashers, any water you see running into drains on the street… Any that comes from toilets is pretty well diluted by the time it gets here. Then we scrub it right away with activated carbon and hypochlorite and vent the stinky gases away. This is the pumping station. You see, the wastewater flows out from the mainland, under the harbor, in four huge pipes, and when it gets to Deer Island, we pump it to the surface. The North System pump in front of you pumps more than 900 million gallons through this plant every day. And right here is where…" he bowed to Dr. Matus. "Mariana, take it from here."

Dr. Matus walked them over to what looked like a small refrigerator with some pipes running along its side down into the flow of water. "Here's the automatic sampling system," she said. "Every quarter hour, it pumps some of the inflowing wastewater and takes a small sample. At the end of the day, it mixes all the samples together in three tubes which get packed in ice and sent to our company in Cambridge, where we analyze them for COVID."

"You see," Dr. Madoff said, "even before people know they're infected with COVID, before they have symptoms, they can be excreting virus in their feces."

"He means they're pooping out virus," Mr. Rhode said.

Clinton made a face, but Mae said, "How do you find a tiny virus in all this water?"

Dr. Matus bit her lip. "Hmm, how much do you know? Every COVID virus has RNA at its core…"

"We know that much," Clinton said.

"…but it's far too little for us to detect. Instead we add enzymes to the sample which copy that piece of RNA backwards into DNA. Then the DNA is copied into a second strand of RNA. It keeps going like that, backwards and forwards, doubling the number of copies of RNA each time. Finally there's enough that we can detect it. We know how many cycles of doubling it took until there was enough for us to see, so that tells us how much viral RNA—and how much COVID—was in the sample in the first place."

"I get it," Clinton said.

"We turn all the data into graphs of change over time," Dr. Matus said. "We check it and send it to the Department of Public Health, and then the MWRA posts the results on its website so anyone can see. The whole process takes a couple of days."

Dr. Matus continued, "When I came from Mexico for graduate school, I wanted to figure out how to use technology to improve public health. And I found this way to do it, by monitoring data, and my friend and I got a lot of advice and started our own company. And then COVID came along!"

"Is Boston the only place that does this?" Mae asked.

"Oh, no. We get wastewater on ice mailed in from all over the country. And even in this state, it's not just the MWRA—we test for towns and hospitals and businesses and colleges, all to help the leaders figure out what's happening and what they need to do—tell people to stay home for a week, or make sure everybody

wears their mask, or whatever."

Mae asked, "Could you use this system for other diseases too, like measles or something?"

Dr. Madoff answered, "In other parts of the world, it's used to watch for polio. Polio passes through 99 people without symptoms for every single case where a child gets paralyzed. Now, we don't have polio here, but if it suddenly showed up, we could rush to make sure everyone gets vaccinated.

"And then there are other uses. Hepatitis, for example, or maybe the yearly flu. We'd also like to know how many antibiotics are going down our drains, and how much of each. And we'd like to know what kind of antibiotic resistance there is in ordinary bacteria we find in sewage, because that would warn us about what we should look out for in hospitals."

"That's a lot of things to track," Mae said soberly.

"It is," Dr. Madoff agreed. "But that's part of public health. Being on the lookout, keeping track."

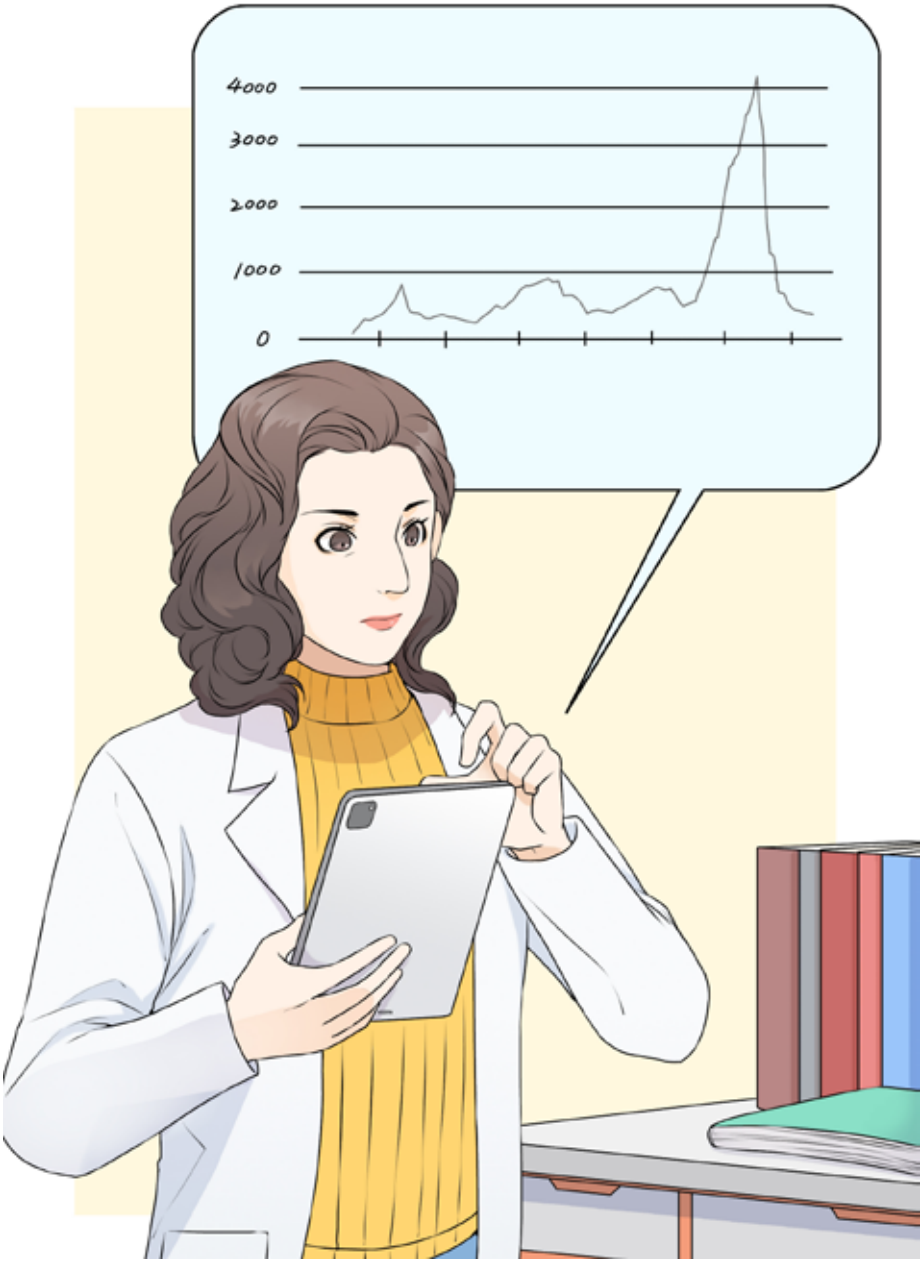
"Besides," Dr. Matus said, "The science is fascinating, and the engineering to get all the tests working just right is really challenging." She rubbed her hands.

"So how's it going with COVID?" Mae asked her.

The three adults looked at one another. "That's what we're here for," Dr. Madoff said. "We want to make sure it's accurate."

"Take a look for yourselves," Dr. Matus said, opening the cover on her tablet computer and showing the kids. "Here's the date, and here's the amount of virus we've found each day."

The kids bent over the computer, and Clinton traced the curve with his finger. "Whoa, it just kept going up all through December. That's when omicron came in, right? the highest point ever was—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it looks like January 6, and since then it's on the downslope."

"Still very high," Mae said with a frown. "But half what it was a week ago."

"And that's very good news," Dr. Madoff said. "Because for as long as we've been measuring, wastewater virus levels predict the number of infections we're going to see—the number of people in hospitals, the number of people who die. We think omicron may be starting to go away."

"Can you see when COVID really started to spread around here?" Mae asked Dr. Matus.

"Sure. We have samples going back to January 2020, but the first date for which we can find COVID was March 2. We wrote one of the first papers in the world about detecting COVID in wastewater—the Netherlands scooped us by a couple of days."

Mae felt an odd fluttering in her chest. "You were really seeing science right as it happened."

"So were you," Dr. Matus said. "So were we all, this past two years."

Mae thought about that. It sounded heroic somehow, everybody doing their part.

Clinton jumped in. "What happens if it just keeps going down?"

Dr. Madoff said, "That's part of what we talk about with the governor when he calls in for the Poop Report, as we call it. When do we pull back on mask mandates? For vaccinated people? For everyone? I think the time is coming."

Mae sighed. "But then what do we do if it comes back? A new variant, maybe worse?" She took a breath. "What if someone got both delta and omicron, and the two viruses kind of mixed, and

you got a new virus that spreads as fast a omicron and makes people as sick as delta?"

"That could happen," Dr. Madoff said.

"It's already happened in Sweden," Dr. Matus said, "but only a few cases. So we watch for it. We monitor. We keep tracking how much viral RNA is in the wastewater, and what variants."

Dr. Madoff added, "Along with that, we keep tracking how many positive tests we see in the community, how many people enter the hospital or miss work for respiratory illnesses. If the trends start going the wrong way, we'll have to warn people to be very careful, maybe even to wear masks again and socially distance."

"But don't we have better drugs now?" Mae asked.

Dr. Madoff took his glasses off and began polishing them again. "Much better drugs, and we know better how to treat COVID. The world has made huge advances in knowledge. Still, we don't want the hospitals to start overflowing again, because then nobody gets the best care."

He paused, and then added, "The most important thing everybody can do—both to protect themselves and to protect others, is—"

"We know," Clinton said, and Mae joined her voice to his. "Get vaccinated."

"Vaccinated and boosted. Encourage other people to get vaccinated and boosted. Do you know, in this last wave, how much more likely you were to be hospitalized if you weren't vaccinated? Go ahead, guess."

"Twice as likely," Mae said.

"Five times?" Clinton guessed.

"Sixteen times. And much more likely to die. It's strange, when the whole country has pulled together to help each other through this pandemic, when science created vaccines in such a miraculously short time, how some people won't use them. But when they get sick, they want every tool of modern medicine…" He shook his head. "I know we should be respectful of people's beliefs, but sometimes we all get so frustrated."

"Hey, never mind, Larry," Mr. Rhode said. "Why don't you two—" he nodded at Drs. Madoff and Matus "—keep noodling on what the numbers mean and whether we can trust them, and when our masks can come off. I'll take these two on the rest of the Wastewater Treatment Facility tour. Come on, kids."

"Bye for now," Dr. Madoff said. "Study hard in school."

Mae and Clinton thanked the two scientists. Then Steve Rhode took them on a tour of the facility, explaining the steps of water purification. "This is where the water comes in and gets its first cleaning, like I told you. And then in this primary tank, the water flows through very slowly, allowing the solids to settle out. A mechanical rake clears out the bottom sludge and"—he took them outside and pointed at one of the huge eggs—and sends it over here, where it gets digested and broken down into methane. That's a fuel we can use to help power the pumps, along with power from those wind turbines up there."

He walked them past the huge digesters, over to a series of long rectangular pools. "The water flows out here, where we do the secondary cleaning. First it gets lots of fresh oxygen. We allow new bacteria to grow in it. The bacteria clean out all sorts of toxins, which settle out again, leaving clean water on the top."

"What do you do with the clean water?" Mae asked.

"We test it." Mr. Rhode led them to a laboratory. "This is where

we test for toxins and metals and bacteria that can cause diseases. I don't know if you ever burned metal in chemistry class." He peered at them hopefully, and when they shook their heads, he said, "Well, here we heat some sample solids up until any metal in them glows in its specific color. Cadmium glows green, arsenic white… etc. Not as fancy as Biobot's work, but very important. We don't want to hurt any fish."

Clinton asked, bewildered, "What does this all have to do with fish?"

Instead of answering, Mr. Roade let them back outside to walk along the length of one of the open-air tanks. "It takes about 45 minutes for the water to flow through this tank. We gradually add chlorine for the last phase of disinfecting the water. But we don't want any chlorine to make the water taste bad to the fishes, so we remove it all with sodium bisulfate as it goes down the pipe.

"You see, we send the treated water out into the ocean. It goes like a waterfall down a pipe a hundred feet down, and then it travels in a pipe nine miles out toward the open ocean. It spews out, nice and clean. No dead or unhappy fish, that's part of the job."

Mr. Rhode stopped and threw his arms wide. "And that, kids, is how we cleaned up Boston Harbor! Our fish used to get cancer from all the toxins in the water, but now they're healthy and tasty."

"Impressive," Clinton said, and he elbowed Mae to say the same.

"I never really thought about where stuff from the toilet goes," Mae admitted. "I never thought about what you could learn from it."

"Cool subject, environmental chemistry," Mr. Rhode said. "Think about it. We'll always have an environment that needs

protection, and that will take a lot of people asking questions and gathering evidence and data. But now I have to go. Is someone coming to fetch you?"

Mae ducked that question. "Thanks so much to you and to Dr. Matus and Dr. Madoff," she said. "We'll just walk on some of these paths, if that's okay."

"Sure thing," Mr. Rhode said with a shrug. He turned and walked back to the building.

Mae and Clinton strolled along a paved path that ran alongside the water, and then they climbed to the top of the hill and paused beneath the water tower. All around them stretched Boston Harbor, with islands dotted here and there and small boats floating among them like confetti.

"You seem kind of down, Mae," Clinton said.

"It's not like you to notice that," Mae said.

Clinton didn't answer. He just waited.

"One of my cousins called," Mae said. "He's a grownup, and he has diabetes. I just found out. He got COVID and he's out of danger, but he just isn't getting well."

"Long COVID?" Clinton asked.

"Yeah. He's all short of breath, and his joints ache and he feels confused. He can't play basketball with his friends anymore."

"Ouch," Clinton said.

Mae shook her head. "I know worse thing have happened to so many people. It's just I remember how he taught me how to shoot baskets and how he used to take me to dance shows when I was little."

"You mean the ballet?" Clinton asked, sounding doubtful.

"I don't have to defend him to you!" Mae snapped. "It was the Alvin Ailey Dance Company, if you've heard of them."

"Easy, easy, that's cool," Clinton said. "I wasn't criticizing. I'm sorry he's sick."

Mae said after a while, "And now no more G.A.S. missions."

"You never know for sure," Clinton said. "Come on, Mae, it's going to be good. Remember going to school without masks on? Seeing people smile? Parties, concerts, sports games where the stands are packed?"

He kicked at the grass for a while, and then he said in an uncertain tone, "I think this moment in COVID is kind of like this wastewater treatment plant."

That surprised Mae into a short laugh. "Wait, what?"

"Well, think of our lives. Everybody's lives this past two years. They've been like the water flowing here to Deer Island, full of… well, full of a lot of stuff that stinks. But now it's beginning to settle out at last. And all the bad stuff, like having to stay home, or people getting into fights over masks…"

"… or bullying or attacking Asian people…" Mae added.

"… Yeah, and people losing their jobs, and sucky virtual school…"

"... and my mom being tired and discouraged all the time…"

"… and my dad shouting at my sister for being underfoot when he's trying to work…"

"…and all the kids who get in fights at school these days, and how I've forgotten how exponents work…"

"Yeah, that stuff," Clinton said. "That stuff is all starting to settle down. And when we take our masks off, that will be like oxy-

gen bubbling through, a breath of fresh air. And all the bad stuff can just go into some big egg and get digested and vented…"

Mae said, "It will all give off methane. How does that fit in your scheme here?"

Clinton thought for a moment. "It gives us power. All the stuff we've been through, all the stuff we've managed to digest, just shows us how strong we are. It gives us power. We've all been through a lot."

"Yeah," Mae said. "I hate to say it, Clinton, but you're being kind of profound."

"And now," Clinton said triumphantly, "And now our lives are all clear and flowing strong again, joining in again, just like the water flowing from Deer Island back out to sea."

"Yes," Mae said. "And the only thing Is, we have to be vigilant. We have to watch out. We have to keep watching for COVID in the wastewater. "

Clinton nodded. "That's it. That's what Selectra meant about us managing on our own now. Next time, we'll be ready."

"For the Filovirus Frenzy of '37!" Mae said.

"I think it's supposed to be '38," Clinton said.

"Never mind," Mae said. "We'll be ready. Now let's go home."

## Author's Notes

This is a book of fiction, but many of the characters depict real people, as you can see here:

### Real life people

Dr. and Mrs. Armstrong

Banu, Rahima

Bikisunessa

Boylston, Zabdiel

Corbett, Dr. Kizzmekia

Del Valle, Dr. Sara

Floyd, George

Jenner, Dr. Edward

Madoff, Dr. Larry

Martin, Trayvon

Mather, Cotton

Matus, Dr. Maria

Onesimus

Muyembe, Dr. Jean-Jacques

Rhode, Steve

Rice, Tamir

## About the Author

**Pendred Noyce** is a doctor, advocate for science education, and author of fourteen previous books for young people, mostly about science.