



Code Breakers of the Hidden Helix



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Chapter 1: Operation Codeberry Begins

Sana adjusted her backpack and took a deep breath before stepping through the tall glass doors of NovaLab. Her heart pounded with a mix of nerves and excitement. Just last week, she had received the letter inviting her to join the Genetic Explorers Internship Program. Only a few students in the entire city had been selected. She was one of them.

Inside, the air was cool and smelled faintly of disinfectant. The hallway floor shimmered as she walked. It was lined with glowing panels and digital displays showing floating DNA strands and blinking lab alerts. She had never seen anything like it.

At the end of the hallway, a tall woman in a white coat stood waiting. Her dark hair was tied into a neat bun, and her eyes sparkled behind silver-rimmed glasses. A badge on her coat read: Dr. Zoya, Senior Genetic Scientist.

“You must be Sana,” she said, her voice calm but warm.
“Welcome to NovaLab. We’ve been expecting you.”

“Yes, that’s me,” Sana said, trying to sound confident.

Dr. Zoya nodded with a slight smile and turned, motioning Sana to follow. “Come. There’s much to show you.”

They walked through a pair of wide sliding doors into the main research chamber. Sana’s eyes widened. The room looked like something out of a science museum—except real. Large touchscreens lined the walls, some showing 3D models of DNA spirals twisting slowly in space. Tall glass pods stood along the back wall. Inside each pod sat a piece of fruit—apples, bananas, blueberries—and in the center, a plump red strawberry, sealed in a clear cube.

“Each of these samples,” Dr. Zoya said, pointing to the fruits, “is not what it seems. They are genetic avatars, built to safely carry the DNA of real patients. No risk, but very real data.”

Sana walked closer to the strawberry. It looked ordinary at first, but something about how it was displayed gave it importance.

“This,” Dr. Zoya continued, “is your first assignment. We call it Mission Codeberry.”

Sana turned to look at her. “Is that… the patient?”

“In a sense, yes,” Dr. Zoya replied. “This strawberry represents a patient suffering from an unknown condition. You will need to study the DNA inside it to find out what’s wrong.”

Dr. Zoya tapped a tablet and a large screen flickered to life. A digital file opened, labeled Case File #001. The screen showed a list of symptoms:

- Persistent cough
- Trouble breathing
- Stomach discomfort
- Signs of liver complications

“These symptoms suggest a disorder affecting multiple systems,” Dr. Zoya explained. “Your job is to trace the cause to its genetic roots.”

Sana looked up at the glowing DNA spiral rotating on a nearby screen. “What exactly is DNA?” she asked.

Dr. Zoya smiled and stepped closer to the display. “That’s an excellent question. DNA stands for Deoxyribonucleic Acid. It’s found inside every living cell — in your body, in plants, even in this strawberry.”

“Think of DNA as a special code made of four chemical letters: A, T, C, and G. These letters form instructions that tell each cell what to do — how to grow, how to work, and how to stay alive. Just like how a recipe tells you how to bake a cake, DNA tells your body how to build itself.”

“In humans, this DNA is organized into 46 chromosomes,” she added. “These chromosomes are stored in the cell’s nucleus. Each one carries many genes that hold different instructions for the body.”

Sana nodded slowly, eyes fixed on the swirling pattern. “So every part of the body is built from those letters?”

“Exactly,” Dr. Zoya said. “And when even one tiny letter in the code is missing or wrong, it can cause problems — sometimes very serious ones. That’s what we’re here to discover.”

Just then, another student stepped into the room. He was about Sana’s age, with short black hair and an energetic stride. He gave Sana a quick smile before turning to Dr. Zoya.

“Ali,” Dr. Zoya said. “Glad you’re here. You and Sana will be working as partners for this mission.”

Ali gave a quick nod. “Hi, I’m Ali. Ready to dive in?”

Sana smiled back. “Me too.”

Dr. Zoya handed each of them a clean lab coat and a small, glowing notebook. When opened, the notebooks displayed a floating screen that responded to touch and voice. “These are your holo-notebooks,” she explained. “Use them to take notes, track your steps, and store results.”

Sana slipped on her coat and felt a sense of responsibility settle on her shoulders. This wasn’t just any school project. This was real science.

“The condition affecting this sample is serious,” Dr. Zoya went on. “To understand what’s going wrong, you must start at the very beginning. All the answers are inside.”

She didn’t give them instructions yet, only a direction. The tools they’d need were set up at another station, but they wouldn’t touch them until the next session.

Ali looked at the strawberry and raised an eyebrow. “It’s hard to believe that something this small can tell us so much.”

Dr. Zoya glanced at the holo-screen. “It can. Every strand inside it carries the full set of genetic instructions. We just need to know how to read it.”

Sana looked thoughtful. “And we’ll find out what’s hiding in there?”

“You will,” said Dr. Zoya. “But first, you need to learn how to uncover the code. That’s where we’ll begin tomorrow.”

She walked them over to the data wall and pointed to a screen blinking with the words Mission Activated: Codeberry – Sample 001.

“Welcome to the mission,” she said, turning to both of them. “Your journey into the genetic code has begun.”

Chapter 2: The Invisible Code Revealed

Sana leaned closer to the tray, steadyng her hands as she measured the water. She glanced at the printed instructions on the lab counter to double-check the ratio. A half cup of water went into the clear beaker. Next, she carefully added a teaspoon of dish soap. It poured slowly, thick and glossy. Ali held the small salt packet open. Sana tapped in a quarter teaspoon, letting the tiny white grains sprinkle in. The solution started to look slightly cloudy.

Ali picked up the stirring rod and moved it in small circles.
“Should I go faster?” he asked.

“Slow is better,” Dr. Zoya said as she adjusted a touchscreen nearby. “If you stir too hard, you’ll make bubbles. We want the salt to dissolve completely without foaming.”

She stood by their side, her coat neat and pressed, a slim tablet tucked under one arm. Her tone remained calm, but there was a quiet energy in the room, like something important was about to happen.

Sana watched the salt swirl and vanish. “Why these ingredients?” she asked.

Dr. Zoya turned to them and pointed at each item on the table. “Good question. The soap breaks apart the membranes—the walls around the cell and the nucleus. Those walls keep everything inside. If we don’t break them, the DNA won’t come out. The salt helps bring the DNA pieces together. DNA has a negative charge, and salt helps it clump into visible strands. Water is just the base to carry everything.”

Ali nodded slowly. “So, we’re making a kind of DNA-unlocking liquid.”

“Exactly,” Dr. Zoya said.

They moved on to the next step. The strawberry, now soft and ripe, sat in a sealed plastic bag. Sana added two tablespoons of the extraction liquid into the bag. The scent of fruit mixed with soap was odd but not unpleasant. She pressed the bag closed and handed it to Ali.

“Let’s mash,” he said.

They took turns, pushing and pressing gently with their fingers. The fruit softened quickly, turning into pulp. Red and

pink liquid mixed with foam as they worked the mixture evenly.

“Stop when it’s smooth,” Dr. Zoya said, watching. “You want to break the cells but not tear the bag.”

Once done, she passed them a wide glass beaker and a cheesecloth folded into a cone shape. They placed it over the top of the beaker. Ali held the bag while Sana slowly poured the mush into the cloth. The liquid dripped through in slow drops, leaving behind seeds and thicker pulp.

“This step filters the solid parts from the cell contents,” Dr. Zoya said. “The DNA is still in the liquid that passes through.”

She reached for a glass stirring rod and gently pointed to the beaker. “This part is all about patience,” she added. “Every drop that passes through holds molecules too small to see—but powerful enough to guide how every part of a body works.”

It took a few minutes. When only clear pink liquid remained in the glass, Dr. Zoya walked over to the cooler and pulled out a small bottle of cold rubbing alcohol. Drops of condensation slid down the sides as she held it in her hand.

“This part is delicate,” she said. “You’ll pour the alcohol down the side, not in the middle, so it makes a layer on top. Watch carefully.”

Sana took the bottle. Her hand was steady. She tilted it gently and let the alcohol slide down the side of the beaker. It floated above the pink liquid without mixing. Within seconds, something white and cloudy began to form at the boundary between the layers.

“There it is,” Dr. Zoya whispered.

Ali stepped forward. Thin, stringy threads floated up from the pink base. They weren’t like normal bubbles or foam—these were different. They moved slowly, clinging together.

Sana stared, her voice quiet. “It’s happening.”

The strands grew thicker. Dr. Zoya handed them each a wooden stick. “You can lift them out now. They’re sticky. Be careful.”

Ali reached in first, touching the layer gently. A piece of the white clump wrapped around the stick. He pulled it up slowly. It looked like threads or clear yarn, slightly shiny.

“This is the real thing?” he asked.

Dr. Zoya nodded. “That’s DNA—Deoxyribonucleic Acid. The genetic material that controls how living things grow, function, and stay alive. Every living cell has it. What you’re seeing is millions of DNA strands bunched together.”

Sana reached in and lifted a clump too. She held it up to the light. It looked soft, almost like jelly. She placed it carefully on a glass slide, just as Dr. Zoya instructed.

Dr. Zoya activated a device on the bench. A small beam scanned the slide, and a holographic projection rose into the air above the lab table. It rotated slowly—a twisting spiral made of colored lines and shapes.

Ali’s mouth opened slightly. “It’s like a staircase.”

Dr. Zoya tapped a button. The spiral unfolded, revealing letter pairs lined along its structure: A with T, C with G.

“These are the four bases,” she said. “Adenine pairs with Thymine. Cytosine pairs with Guanine. These pairs repeat along the DNA strand to form the entire code.”

She paused and added, “DNA is read in sets of three letters called codons. Each codon gives the cell one instruction, like a word in a sentence.”

Sana looked closer. “So every three letters make one instruction?”

“Yes,” Dr. Zoya replied. “And when one of those letters is missing or changed, that instruction can be damaged—or skipped entirely.”

As they watched, the screen zoomed in to a section of the sequence. The letters rolled past like a long strip of tape.

Sana furrowed her brow. “Wait. What’s that?”

She touched the holo-screen. A short gap had appeared in the line. One base was missing—no pair, no letter, just a space.

Ali leaned over. “That’s not normal, right?”

He opened the holo-notebook and marked the location. He drew a box around it and added a note. “Gap found—possibly linked to symptoms.”

Dr. Zoya reviewed the section and gave a short nod. “Good observation. That’s a mutation. A change in the genetic code. Sometimes it’s a swap. Sometimes a letter is missing, like here.”

Sana looked again at the gap. “What can it do?”

“A mutation like this,” Dr. Zoya said, “can disrupt the code for a protein. If the protein is missing or made incorrectly, the body doesn’t work as it should. That could explain the breathing and digestive problems in our case.”

Ali glanced at the screen again. “So one missing piece... and the whole system gets confused?”

“Exactly. That’s why decoding DNA is so important,” she said. “Now we begin the analysis.”

Sana tapped the glitch into the holo-notebook, marking it with a red dot. She and Ali exchanged a look. They didn’t speak, but both understood something important had just been discovered.

Behind them, the DNA model continued to spin in soft light, quietly holding its secrets.

Chapter 3: The Broken Link

Mrs. Zoya walked over to a square console at the far end of the lab. It was built into the wall and glowed softly with moving graphics. Above it, the label GENA – Genetic Error Notation Analyzer flashed across a narrow screen. She placed her palm over the scanner, and the system opened with a hum.

“We’ll enter the DNA sequence from your sample into GENA,” she said. “This assistant can compare our data with verified medical databases and search for known errors.”

Sana and Ali moved closer. GENA’s display turned into a wide strip of scrolling code. The gap they’d found earlier was highlighted in orange. A digital voice read quietly from the system: “Analyzing variant location. Cross-checking functional region... Matching mutation data.”

Seconds later, the screen froze on a page labeled Results. A diagram of lungs appeared beside a block of text. Underneath, a label blinked in red: CFTR Mutation – ΔF508 Identified.

Ali narrowed his eyes and read aloud, “Diagnosis: Cystic Fibrosis.”

Sana leaned over the display. “What’s that?”

Dr. Zoya tapped the screen and opened a 3D model of the human lungs and digestive system. “Cystic Fibrosis is a real inherited disease. It’s caused by a change in a gene called *CFTR*. This gene gives instructions for making a protein that helps balance salt and water in the body.”

She pointed at the lungs on the screen. “When the CFTR protein isn’t built right, mucus in the lungs and other parts becomes thick and sticky. That can block airways and trap bacteria.”

Ali crossed his arms. “So the DNA error we found... it stops the protein from doing its job?”

“Exactly. That small deletion we saw means the instructions are incomplete. The body can’t build the correct protein.”

Dr. Zoya walked over to the wall board and picked up a marker. She drew two simple columns and wrote at the top: Genotype and Phenotype. Under genotype, she wrote: *CFTR mutation*. Under phenotype, she added: *Coughing, breathing problems, digestive trouble.*

She turned to them. “Genotype is the actual gene change. Phenotype is how that change shows up in the body.”

Sana nodded. “So what the person feels... that’s the phenotype.”

Dr. Zoya smiled. “Right. The DNA doesn’t just stay in the nucleus. It affects everything. But not every mutation is bad. Some do nothing. Some even help. This one is harmful.”

Ali looked thoughtful. “How does one missing piece do all that?”

Dr. Zoya erased a line on the board and drew a simple sentence: **MAKE PROTEIN CORRECTLY.**

“DNA works like a sentence. If you remove a letter, the whole meaning can change. In this case, one instruction is missing. So the protein doesn’t get built, or it comes out wrong.”

Sana watched as the word “PROTEIN” was replaced with “PROTIN.”

“That’s how easy it is to change everything,” Dr. Zoya said.

She turned back to the screen and pulled up a different diagram, showing three boxes connected by arrows. The labels read: DNA → RNA → Protein.

“This,” she said, “is called the central dogma of molecular biology. It explains how information flows in the cell.”

Ali squinted at the screen. “So DNA turns into... something called RNA?”

Dr. Zoya nodded. “Yes. First, the cell makes a copy of the gene’s message from the DNA. That copy is called messenger RNA — or mRNA for short. This is the transcription step.”

She tapped the first arrow. “The mRNA carries the message from the DNA in the nucleus to the ribosomes in the cytoplasm — those are the cell’s protein factories.”

“So it’s like passing a note from one part of the cell to another,” Sana said.

“Exactly,” said Dr. Zoya. “Then comes the second step — translation. The ribosome reads the mRNA three letters at a time. These sets of three letters are called codons. Each codon tells the ribosome which amino acid to add next.”

Ali leaned closer. “Amino acids... those build the protein?”

“Yes. One codon equals one amino acid. The ribosome links them together like beads on a string. This string folds into a working protein. But if the message has a mistake — like a missing codon — the chain is broken or misfolded. That’s what happens in Cystic Fibrosis.”

Sana traced the pathway with her finger on the screen. “So it starts with the gene. Then the gene makes RNA. Then the RNA makes the protein. If there’s a mistake in the gene, it spreads all the way through.”

“Exactly,” Dr. Zoya said. “A small error in the code leads to a faulty protein. That’s why it matters so much. DNA isn’t just information—it’s the body’s instruction manual.”

She moved to the craft station beside the lab benches. A container held small colored beads, wires, and plastic clips. She laid out supplies on the table.

“You’re going to build a simple model of a DNA strand. Each color stands for one base: A, T, C, and G. Match them in pairs. Then we’ll twist it into a double helix.”

Sana picked red for adenine, blue for thymine. Ali chose green for cytosine and yellow for guanine. They worked side

by side, sliding beads onto the wires in matching pairs: A with T, C with G.

Ali leaned forward. “So when we see something wrong in this model, it means something could be wrong in the body?”

“Yes. This lets us feel and see what can go wrong. It’s not just letters on a screen anymore,” Dr. Zoya said.

They finished their helix, twisted it gently, and held it up. It looked simple but important.

Dr. Zoya took the model and placed it next to the diagram of the central dogma. “You’ve now seen where the mistake started and how it affects the body. That’s why genetic research is so powerful — it connects invisible code to real health.”

Ali placed his hand on the table. “So the patient’s symptoms started with just one mistake in this whole chain?”

“Yes,” Dr. Zoya said. “That’s what we call the broken link.”

Sana said quietly, “So now we know what’s wrong. What do we do next?”

Dr. Zoya gave a small nod. “We understand the mutation. The next step is to explore how we can help the body fix the error. That’s where gene therapy begins.”

Ali looked down at their DNA strand. “From this little piece... we’re going to find a cure?”

Dr. Zoya nodded once. “That’s the goal. And now that we’ve mapped the pathway from gene to protein, you’re ready to take the next step.”

The DNA model remained on the table, still and silent, while the central dogma diagram glowed above it — a simple path with massive meaning. The students had followed the trail from base pairs to symptoms, and now, they stood at the edge of something bigger: correction, not just discovery.

Chapter 4: Fixing the Code

The lights above the lab table adjusted slightly as the setting changed to therapy mode. A quiet tone sounded through the speakers, and the digital panels opened to a new section titled **Gene Repair Protocol**. Sana stood on one side of the workstation, carefully organizing small vials labeled with sequences. Ali sat across from her, scanning through the next set of instructions on the holo-notebook. Dr. Zoya stood between them, holding a slim tool used for DNA insertion simulations.

“This is where we try to fix the error we found,” she said, pointing to the virtual strand still spinning above them. “We’ll use gene therapy. It’s a method that adds a working version of the gene into the cells. The idea is simple—give the body the correct message so it can do its job.”

Ali tapped a screen that pulled up a diagram of a virus structure. “This one’s safe, right?”

“Yes,” Dr. Zoya replied. “We’re using a modified viral vector. That means it looks like a virus, and it can enter cells the same way, but it’s been cleared of all harmful parts. Now it acts as a delivery vehicle.”

Sana reached for the virtual control wand and loaded the DNA sequence into the clean virus shell. The code displayed was bright and complete. No gaps, no missing bases. The virus capsule glowed green as it locked in the healthy CFTR gene.

Ali confirmed the sequence match on the other panel. “All markers aligned. Sequence verified.”

They transferred the virus model into the simulation chamber. The digital screen showed a close-up view of a human lung cell. As the delivery started, the virus attached to the outer wall of the cell and released the corrected gene inside. The broken strand was still visible, showing the deletion that had caused the problem.

Within the cell, the new gene slotted into place beside the damaged one. It took over the job of instruction-writing. Ali and Sana watched as small protein markers formed on the screen. These proteins followed the new instructions without any errors.

“There,” Dr. Zoya said. “It’s working. That’s how gene therapy helps—by replacing the wrong message with a correct one.”

The simulation continued. More cells were shown receiving the new gene. One by one, they began to build proper proteins. The mucus regulation system began to normalize. The lung tissue cleared. Small channels inside the digestive system, once blocked, reopened.

Sana’s eyes followed the entire process closely. “So even if the original gene is still there, the new one can take over?”

“In many cases, yes,” Dr. Zoya explained. “That’s the goal. Give the cell what it needs to work properly. One strong signal can make a difference across entire systems.”

She opened a reference panel on the side and displayed a list titled **Gene Function Overview**. On the list, she highlighted a few key facts:

- The CFTR gene controls the flow of salt and fluids in and out of cells.
- A faulty CFTR gene causes thick mucus buildup.
- The new gene provides a working copy of the instruction, allowing normal protein production.

- Proteins created from gene instructions regulate many parts of the body, including lungs, pancreas, and liver.
- Therapy does not delete the mutation; it adds a functioning backup.

Ali nodded and returned to his notebook. He began logging each part of the simulation in order, writing short descriptions for each step: *vector insertion, code match, gene acceptance, protein restoration*. He marked checkboxes after every step.

Sana updated the patient file on the lab's main system. She selected the entry labeled **Treatment Outcome** and typed: “Therapy simulation successful. Normal protein expression restored. Symptoms in virtual model reduced significantly.”

The lab's main screen changed to display the original symptom chart. Next to each item, a blue mark appeared with the word **Reversing** in small print.

Ali looked up. “We're seeing results.”

Dr. Zoya stepped back and gave a rare, quiet smile. “You've done something important. Most people don't see the part where healing begins. But this is where it starts. Right here in the lab.”

The simulation screen faded slowly, and the final strand of DNA, now corrected, glowed softly in place. The model cell continued its work, unaffected now by errors. For the first time since the start of the case, there were no warning messages or red highlights.

The digital clock above the console ticked forward, but the lab remained calm. No loud alarms. No flashing lights. Just quiet success.

Though the diagnosis had been made and the therapy tested, Dr. Zoya reminded them that the file couldn't be closed yet. One final task remained. It wasn't just about solving the problem—they still had to ensure the patient's code stayed protected.

Chapter 5: The Codekeepers of Tomorrow

The genetics table had been reset. The surface was cleared and wiped, but now filled with colorful supplies. Foam blocks in four distinct colors were arranged in trays, each one labeled with the letter it represented — A, T, C, and G. Small beads sat beside flexible magnets and short plastic connectors. Sana stood on one side, her sleeves rolled up, hair tucked behind her ears. Ali leaned slightly over the edge, scanning the instructions as they prepared their final task.

Their assignment wasn't just to build a model. It was to explain everything they had done — step by step — to the senior lab team. This model would reflect the exact sequence from the patient's strand, the part that had held the mutation, and the corrected version after gene therapy.

Ali picked out two foam blocks — blue and yellow — and clicked them into place. "Thymine connects to Adenine," he said. "T always pairs with A."

Sana followed with green and red. "Cytosine and Guanine. C pairs with G."

They worked silently for a moment, matching pairs, linking magnets, and aligning the structure so it spiraled gently as they built. The double helix shape took form, not too tight, not too loose. The sequence was built exactly to reflect the portion of the CFTR gene they had corrected.

Labels were attached below each pair, and small arrows pointed to the mutation site, now repaired. The base that had been missing was shown in bold with a special bead. Next to it was a tag that read: *Inserted: ΔF508 correction.*

Once complete, Dr. Zoya walked over and checked their work. She didn't say anything at first, just studied it closely. Then she gave a short nod and stepped back.

"Now present your sequence," she said. "Explain the connection."

Ali stood straight. "This model shows the exact segment where the mutation occurred. The original strand had a deletion at position 508 — a missing phenylalanine amino acid caused by the loss of three DNA bases. This led to faulty protein instructions. We replaced the code using a corrected gene delivered by vector."

Sana continued, pointing to each part. “These pairs follow the correct order: A with T, C with G. This section here shows the reinserted code. We confirmed success with the simulator. The result was normalized protein production and restored cell function.”

The lab team, now gathered around, watched quietly. Some took notes. A few exchanged glances and nodded.

A sound came from GENA’s terminal. The report had been generated. The display opened automatically with a title:

Final Case Summary — Sample 001

The report included:

- Identified mutation in the CFTR gene
- Symptoms matching Cystic Fibrosis diagnosis
- Confirmed gene therapy process
- Replacement of ΔF508 mutation
- Simulation showing restored protein regulation
- Patient DNA marked stable

As the summary loaded, the main screen lit up. The holographic strawberry, which had floated above the table for most of the mission, changed color. The red faded gently into

green. A green glow pulsed slowly, and the words *Status: Genetically Stable* appeared at the base.

Sana looked at Ali. He exhaled softly and gave a small nod.

Dr. Zoya stepped forward. She held a pair of silver pins, shaped like tiny DNA spirals. She attached one to each of their lab coats. The metal badges read: *Junior Genetic Technologist — NovaLab Certified.*

“You earned these,” she said. “Your first full case, and you carried it through from extraction to repair. You didn’t just observe. You solved.”

Sana stood still for a second, looking down at the badge. Then she looked up and smiled.

“Thank you,” she said.

Ali just grinned, his fingers brushing over the edge of his pin.

Dr. Zoya led them to the corridor behind the main lab. The walls here were lined with tall display towers. Inside each one was a glowing crystal — some blue, some purple, others white. The names on the towers were etched into clear plates. Each crystal represented a past case. Some were from years ago. Others were more recent.

As they reached the end of the row, a new panel began to light up. A pod slowly opened, revealing a glowing red crystal. Text began to form above it.

CASE 001 — STRAWBERRY SAMPLE

TECHNICIANS: SANA & ALI

STATUS: COMPLETED

The light shimmered, and a soft chime played. Their work was now a permanent part of the lab's case record.

Next to the display, a black envelope rested on a pedestal. It had the NovaLab seal on the front. Across the envelope, written in clear red letters, were the words: **Next Case**.

Dr. Zoya didn't say anything. She just handed it to them.

Sana turned to Ali, her voice quiet but certain. "This one was just the beginning."

The lights above shifted as they walked back toward the main lab. From the outside, NovaLab remained hidden among the hills. But above it, the sky was filled with stars. Somewhere, floating through space, were billions of DNA strands waiting

to be discovered, read, and repaired. And now, two new Codekeepers were ready.