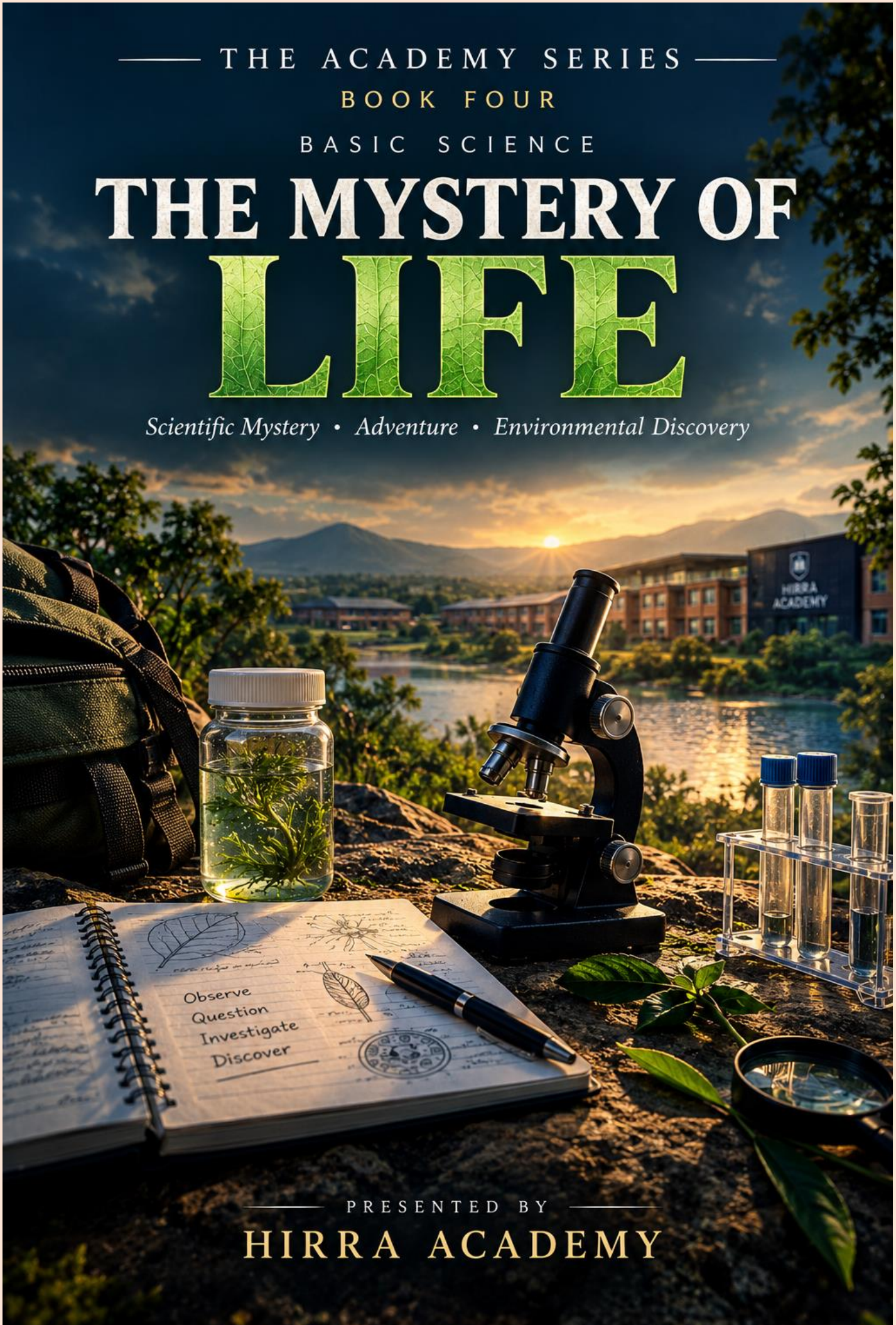
THE ACADEMY SERIES

BOOK FOUR

BASIC SCIENCE

THE MYSTERY OF LIFE

Scientific Mystery • Adventure • Environmental Discovery



PRESENTED BY

HIRRA ACADEMY

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BOOK FOUR

Basic Science

THE MYSTERY OF LIFE

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A Hirra Academy Story

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About This Book

The Academy Series follows the students of Hirra Academy as ordinary school life quietly opens onto something larger, a mystery, an investigation, a question that won't let go, and each book is built around a different subject, not as a lesson to be memorised but as something the characters must actually use to understand their world. This is Book Four, and it dives into the mystery of life itself, made for secondary level students with a science-related mind, because the world is full of mysteries and science gives us a way to understand them.

PART I
The Change Begins

Chapter 1
The Garden

The garden behind Hirra Academy's science block had never been a place anyone paid much attention to. It was simply there, a modest square of soil and beds where the JSS classes took turns planting beans, maize, and the occasional stubborn tomato that refused to fruit no matter how carefully anyone watered it.

So when Aisha Bello grabbed her arm at the start of break time, practically pulling her off the veranda, Mariam's first thought was that something had gone wrong with the football field, not the garden.

"You have to see this," Aisha said, already walking fast. "I don't even know how to describe it properly. That's exactly why I need you to see it yourself instead of me getting it wrong."

What Mariam found, crouching at the edge of the third planting bed, was strange enough that she understood immediately why Aisha hadn't tried to put it into words. The bean plants nearest the garden's drainage corner had grown taller than any bean plant Mariam had ever seen at this stage of the term. They looked pale and oddly spindly, leaning at angles that made them seem almost unwell despite their height. A few beds further along, the maize was doing the exact opposite. It was stunted and yellowing at the tips, barely reaching Mariam's knee when it should have cleared her waist by now.

"It's not the same problem," Samuel Okoro said, arriving behind them with the loose, unhurried energy he brought to everything that wasn't actually classwork. He'd clearly already been circling the garden before they got there. "Look, over here, the soil's darker, almost black in patches. And there's more of these" - he pointed to a scatter of small, unfamiliar insects clustered along the drainage corner's edge - "than I've ever seen back here before. I come out here most lunchtimes. This wasn't here even a week ago."

"So what happened?" Mariam asked, mostly to herself, crouching lower to look at the soil Samuel had pointed out.

"Someone probably dumped something," Aisha offered. "Chemicals, maybe, or fertiliser gone wrong."

"Or it's just been a strange season," Samuel said with a shrug. "Plants do weird things sometimes."

Mariam didn't answer either theory right away. She had a habit, one that occasionally irritated her classmates and regularly irritated her older cousin, of refusing to settle on an explanation

just because it was the first one offered. It wasn't that she doubted her friends specifically. She doubted convenient answers on principle, the way some people doubted weather forecasts.

The three of them brought it to Mrs. Ibrahim that same afternoon, catching her just as she was locking up the science laboratory for the day. She listened to their overlapping, slightly excited descriptions of the tall pale beans, the stunted maize, the dark soil, the unfamiliar insects, without once interrupting. Mariam had learned over two terms of her class that this was usually a sign something had genuinely caught her attention.

"Show me," Mrs. Ibrahim said simply, once they'd finished.

She walked the garden slowly, the four of them trailing behind her, saying almost nothing herself, occasionally crouching to look more closely at a plant or a patch of soil the way Samuel had. When she finally straightened up, she didn't offer an explanation either, which Mariam found, in the moment, almost more frustrating than helpful.

"So what caused it?" Mariam asked, unable to help herself.

"I don't know yet," Mrs. Ibrahim said, and there was something almost pleased in the way she said it, as though not knowing were itself an interesting fact rather than a disappointing one. "And neither do you, not really. You have observations, which is an excellent start, but you don't have an explanation. Those are two very different things, and the students who confuse them are the ones who end up wrong most often."

"But something must have caused it," Aisha said.

"Almost certainly," Mrs. Ibrahim agreed. "But 'something caused it' and 'I know what caused it' are not the same sentence. Right now, all three of you have already offered me a guess, chemicals, fertiliser, a strange season, without checking a single one of them against actual evidence. That's how rumours start, not investigations."

She let that settle for a moment before continuing, her tone shifting into something closer to a challenge than a scolding.

"If you're genuinely curious, and I think you are, all three of you, or you wouldn't have come to find me instead of just gossiping about it at lunch, then I'll help you learn to investigate this properly. But you have to promise me something first."

"What?" Mariam asked.

"Don't tell me what you think happened," Mrs. Ibrahim said. "Show me what you actually observed. Every time. No matter how tempting the shortcut looks."

Mariam thought about that sentence for the rest of the day, turning it over the way she turned over most things that didn't quite sit comfortably yet. She was fairly certain, by the time the closing bell rang, that it was going to be a harder promise to keep than it sounded.

WHAT DID SCIENCE REVEAL?

Science begins with careful observation noticing exactly what can be seen, measured, or recorded rather than assumption, which is a guess made without checking the evidence first. Mistaking an assumption for an observation is one of the most common errors in early scientific thinking, since assumptions often feel just as certain as facts, even when nothing has actually been tested yet.

SCIENCE TERMINOLOGY

Observation • *Assumption* • *Living Things* • *Non-Living Things*

What Did You Observe?

1. What three separate changes do Mariam, Aisha, and Samuel notice in the garden?
2. What promise does Mrs. Ibrahim ask the students to make before helping them investigate?

Science Questions

1. What is the difference between an observation and an assumption?
2. Why might jumping straight to an explanation (like "someone dumped chemicals") cause problems in an investigation?

Chapter 2
The Pond

The pond came to their attention three days later, and this time it was impossible to miss, even for students who had never once, in three years at Hirra Academy, bothered to walk the path behind the science block that led down to it.

It had always been an unremarkable pond, modest, half-shaded by an old mango tree, home to a handful of frogs whose evening chorus was so constant that most students had long since stopped hearing it at all. There was also a scatter of dragonflies, a few small fish nobody had ever bothered to identify properly, and the general quiet business of pond life continuing largely unwatched.

What Mariam found, arriving with Aisha and Samuel at lunchtime after word had spread that something was wrong with the pond, was a body of water that looked and smelled entirely different from the one she remembered from the term before.

The water had turned a cloudy greenish-brown, thick in a way that made it hard to see more than a few centimetres beneath the surface. A faint, unpleasant smell hung over the whole area. It wasn't overwhelming, but it was noticeable enough that several students standing nearby had their noses wrinkled in obvious discomfort. And it was quiet, properly quiet, in a way Mariam only recognised as strange once Samuel said it out loud.

"Where are the frogs?" he asked, crouching at the water's edge, scanning the reeds with the focused attention he usually reserved for actual animals rather than schoolwork. "I counted at least a dozen different calls most evenings last term. I can't hear a single one right now."

"Maybe they're just hiding," Aisha offered.

"Maybe," Samuel said, though he didn't sound convinced. "But look at this instead." He pointed toward a cluster of small flying insects hovering thickly over one section of the water's surface, far more of them, and far more concentrated, than Mariam remembered ever seeing at the pond before. "Those weren't here in these numbers either. Something's definitely different. I just don't know if it's one thing or three separate things happening at once."

It was Aisha, notebook already open, who suggested they treat the pond the same way. She had, without anyone officially asking her to, appointed herself the group's record keeper the moment Mrs. Ibrahim had agreed to help them investigate the garden.

"We should write all of this down properly," she said. "Not just remember it. The colour, the smell, what's missing, what's increased. If we don't record it now, we'll only remember the parts that feel important later, and we don't actually know yet which parts those are."

Mariam watched her friend fill half a page with careful, dated notes on the pond's colour, its smell, the absence of frog calls, and the unusual density of insects at the surface, and felt something click into place that Mrs. Ibrahim's earlier lesson hadn't quite managed to on its own.

"This is what she meant," Mariam said slowly. "About observation. It's not just looking at something. It's writing down exactly what you saw, properly, so you can't accidentally change the story later just because you want it to fit an explanation."

"Exactly," Aisha said, not looking up from her notes. "I don't trust my memory. I trust my notebook."

They brought their findings to Mrs. Ibrahim that same afternoon, and this time, rather than simply walking the site herself, she asked to see Aisha's notes directly, reading through the dated, careful observations with obvious approval before finally looking up.

"This is good work," she said. "Properly recorded, dated, specific. Now, and I want you to notice that I'm not answering this myself, what do you three think connects a change in the garden's plants to a change in the pond's water and its animals? Are these definitely separate problems? Or could they be related?"

"I don't know," Mariam admitted, and for once, the words didn't frustrate her the way they usually did when she said them out loud. "But I want to find out."

"Good," Mrs. Ibrahim said. "That's exactly the right answer at this stage. Not a guess. A question you're genuinely willing to investigate."

WHAT DID SCIENCE REVEAL?

An ecosystem is a community of living things (plants, animals, and microorganisms) interacting with each other and with their non-living environment (water, soil, air, sunlight) within a particular habitat, such as a pond. Careful, dated record-keeping — writing down exactly what is observed rather than relying on memory is essential to scientific investigation, because memory can unconsciously shift to fit a preferred explanation over time, while written records stay accurate.

SCIENCE TERMINOLOGY

Ecosystem • *Habitat* • *Record-Keeping*

What Did You Observe?

1. What three changes do the students notice about the pond?
2. Why does Aisha insist on writing everything down immediately, rather than just remembering it?

Science Questions

1. What is an ecosystem?
2. Why is a habitat like a pond home to many different kinds of living things at once?

PART II
Asking Better Questions

Chapter 3
What Is Alive?

Mrs. Ibrahim's Basic Science lesson the following Tuesday was, on paper, about something that had nothing at all to do with the garden or the pond: the differences between living and non-living things. It was a topic Mariam vaguely remembered from JSS1 and had assumed, wrongly as it turned out, would feel like old, settled information rather than anything genuinely useful.

"Before we go any further with your investigation," Mrs. Ibrahim announced to the class, though her eyes were mostly on Mariam, Aisha, and Samuel in the front row, "I want everyone to be completely clear about something basic that people get wrong far more often than you'd expect. What actually makes something alive?"

Hands went up around the room with the usual scattered confidence of a class that mostly remembered fragments of an old lesson.

"It can move," offered one boy near the back.

"Some living things barely move at all," Mrs. Ibrahim said. "Plants don't walk anywhere. Try again."

"It grows," someone else tried.

"Better. What else?"

By the end of the discussion, the board carried a list Mariam copied carefully into her own notebook, right below Aisha's neat, dated pond observations from three days earlier. Living things grow, feed, respire, respond to their surroundings, reproduce, excrete waste, and move in some form, however subtle. Non-living things, water, soil, a rock, the wooden desks they were sitting at, did none of these things, however useful or important they might otherwise be.

"Why does this matter to your mystery?" Mrs. Ibrahim asked, once the list was complete, addressing the whole class now rather than just the three investigators. "Because whatever is happening in that garden and that pond involves both categories at once, and you need to be able to tell them apart clearly if you want to understand what's actually changing and what's simply reacting to a change."

She turned to Mariam directly. "Your beans and maize are living things. They grow, they feed, they respond to their environment. Your soil is not alive, but it affects everything that is. Your pond water isn't alive either, but it's currently supporting, or failing to support, an entire community of things that are."

"So the water might be the actual problem," Mariam said slowly, "even though it's not alive itself. It's just affecting the things that are."

"That's a hypothesis," Mrs. Ibrahim said, and something in the way she said the word made it clear this was significant. "Not a fact yet. A hypothesis is an idea that could explain what you've observed, but it has to be tested before you trust it. Do you know how you might begin testing that particular idea?"

Mariam didn't, not exactly, not yet. But for the first time since the strange bean plants had first caught Aisha's attention, she felt the shape of an actual plan starting to form, rather than just a pile of separate, unexplained observations.

After class, the three of them gathered by the garden fence during break, notebooks open, working through what they now knew, in the deliberately careful way Mrs. Ibrahim had modelled for them all week.

"We have living things behaving strangely," Mariam said, counting off on her fingers. "The beans, the maize, the missing frogs, the extra insects. And we have non-living things that might be connected to it, the dark soil, the cloudy water."

"So the question isn't 'what's wrong with the plants' or 'what's wrong with the pond' separately," Aisha said, writing as she spoke. "It's whether something in the non-living environment, the soil, the water, changed first, and the living things are just responding to that change."

"That would explain why it's not just one plant, or one animal," Samuel added. "If it was some kind of plant disease, it probably wouldn't also be messing with the frogs and the insects at the pond, would it? Diseases don't usually jump between completely different kinds of living things like that."

Mariam looked between her two friends, feeling something settle into place that had nothing to do with having an answer yet, and everything to do with finally asking the right kind of question.

"We need to test the water," she said. "And the soil. Properly. Not just guess about them."

WHAT DID SCIENCE REVEAL?

Living things share a set of characteristics often called life processes: they grow, feed, respire, respond to stimuli, reproduce, excrete waste, and move. Non-living things, even important ones like water and soil, do not perform these processes themselves, though they can strongly affect the living things around them. A hypothesis is a proposed explanation for an observation, a reasonable guess that must still be tested before it can be trusted, distinguishing it from both a wild assumption and a confirmed conclusion.

SCIENCE TERMINOLOGY

Life Processes • *Hypothesis* • *Living vs Non-Living*

What Did You Observe?

1. What list does the class build to describe the characteristics of living things?
2. What hypothesis do Mariam, Aisha, and Samuel form about the connection between the soil/water and the living things at the garden and pond?

Science Questions

1. Name four characteristics that living things share.
2. What is a hypothesis, and how is it different from a fact?

Chapter 4
Under the Microscope

Testing the soil and water "properly," as Mariam had confidently announced by the garden fence, turned out to be considerably harder than saying the sentence out loud. Mrs. Ibrahim seemed to find this quietly amusing when the three of them showed up at the laboratory door the next morning asking, essentially, how does anyone even do this.

"Real scientists don't usually have unlimited equipment either," she told them, gathering a modest collection of items from the supply cupboard: a few clean containers, a simple pH testing kit meant for classroom use, a magnifying glass, and a stack of clean slides. "Part of good science is working carefully and honestly with what you actually have available, rather than waiting for perfect conditions that rarely arrive."

She walked them through it patiently. How to collect a water sample without contaminating it further. How to record its colour and clarity before testing anything else. How to use the simple pH kit to check whether the water had become more acidic or more alkaline than it should be. And carefully, with clear safety instructions repeated more than once, how to collect a small soil sample from both the affected corner of the garden and an unaffected section further away, for a fair comparison.

"Why do we need a sample from somewhere unaffected too?" Samuel asked, already halfway to grabbing a container before he'd finished the question.

"Because otherwise you have nothing to compare against," Mrs. Ibrahim said. "If I told you a plant was too short, your very next question should be, too short compared to what? A single measurement means very little on its own. You need a baseline, something normal, to measure the strange thing against."

This turned out to be one of those small lessons that reorganised something bigger in Mariam's head almost immediately. She had been assuming, without quite realising she was assuming it, that the strange bean plants and the cloudy pond water were simply, obviously abnormal. But abnormal compared to what, exactly, if nobody had bothered to check the normal, unaffected areas properly?

The testing itself took most of the week, squeezed into lunch breaks and the one free period Mrs. Ibrahim allowed them each Thursday for what she'd started calling, half-seriously, "official investigation time." The water sample from the pond came back noticeably more acidic than the classroom's reference sample, though not so wildly different that Mariam felt confident calling it dangerous. It was just different enough that it registered as a real, measurable change rather than a feeling.

The soil told a similar story. The dark, affected corner of the garden held noticeably more moisture than the unaffected section further away. When Mrs. Ibrahim allowed them a careful

look under the laboratory's single old microscope, angling it patiently for each of them in turn, adjusting the light, reminding them not to touch the lens, the water sample from the pond revealed something none of them had expected to actually see with their own eyes: tiny, moving specks, far too small to notice with the naked eye, drifting and pulsing faintly across the slide.

"What are those?" Mariam breathed, barely daring to move the microscope's focus in case she lost them.

"Microorganisms," Mrs. Ibrahim said. "Living things too small to see without help like this. Some are always present in pond water. They're a completely normal part of a healthy ecosystem. But the real question isn't whether they're there. It's whether there are far more of them than there should be, and if so, why."

Aisha, predictably, was already recording everything in careful, dated detail: the pH readings, the moisture comparison, a hurried but careful sketch of what they'd seen under the microscope, each entry labelled clearly enough that Mariam knew, even without being told, that this notebook was quietly becoming the single most important object in the entire investigation.

"So we have three real, tested differences now," Mariam said that evening, laying it all out for her father, Dr. Yusuf Hassan, across the dinner table, watching his expression carefully for any sign of confirmation or correction. "The water's more acidic. The affected soil holds more moisture. And there are unusually many microorganisms in the pond water."

"That's good, careful work," her father said, setting down his own fork the way he always did before a real question rather than a quick answer. "But tell me, does having three separate measurements automatically tell you they're connected to each other? Or could they, in principle, be three unrelated changes that just happened to occur around the same time?"

Mariam opened her mouth to answer quickly, the way she usually did, and then stopped herself, turning the question over properly instead, the way an entire week of Mrs. Ibrahim's patient, deliberately unhelpful mentorship had slowly been teaching her to.

"I don't know yet," she said finally. "But I think that's actually the real question now. Not what changed. Whether the changes are connected."

Her father smiled, the small, satisfied smile she was beginning to recognise as his version of genuine praise. "Now you're asking the question a real scientist would ask," he said. "Which is considerably harder than the question you started with."

MARIAM'S SCIENCE NOTEBOOK

QUESTION: Why is the pond water more acidic near the affected area, and what lives in it?

OBSERVATION: Water sample from the pond tested more acidic than the classroom reference sample; the affected soil held more moisture than an unaffected sample; the pond water contained many tiny, moving microorganisms under the microscope.

HYPOTHESIS: The non-living water and soil have changed, and this change may be affecting the living things that depend on them.

TEST: Compare pH and moisture readings from the affected area against an unaffected baseline sample; examine pond water under a microscope.

RESULT: The affected water and soil showed measurable differences from the baseline; an unusually visible population of microorganisms was present in the pond water.

CONCLUSION: The evidence supports the hypothesis, but does not yet prove the different changes are connected to one another.

WHAT DID SCIENCE REVEAL?

A control or baseline sample taken from an unaffected area — gives scientists something normal to compare their results against, since a single measurement alone can't reveal whether something is truly unusual. pH is a measurement of how acidic or alkaline a substance is; changes in a water source's pH can affect the organisms living in it. Microorganisms are living things too small to see without magnification, and while many are a completely normal part of a healthy ecosystem, an unusually large number can be a meaningful clue that something in the environment has changed.

SCIENCE TERMINOLOGY

pH • *Microorganism* • *Baseline / Control Sample* • *Comparison*

What Did You Observe?

1. What three measurable differences do the students find between the affected and unaffected areas?
2. What do they discover when they examine the pond water sample under the microscope?

Science Questions

1. Why is it important to test an unaffected "baseline" sample alongside the affected one?
2. What is pH, and why might a change in a pond's pH matter to the organisms living there?

PART III
The Web of Life

Chapter 5
The Missing Chorus

The missing frogs, as it turned out, had not entirely disappeared. Samuel discovered this almost by accident, crouched at the pond's far edge one humid afternoon, patient in the specific, motionless way that came naturally to him and never quite came naturally to Mariam, who found stillness for its own sake almost physically difficult.

"There," he said quietly, not moving anything except his eyes. "Two of them. Just sitting in the shade under that overhang. There are just far fewer of them than there used to be, and the ones left aren't calling in the evenings the way the whole group used to."

Mariam followed his gaze carefully and found them, two frogs, motionless and watchful, tucked into a shaded gap where the bank overhung the water. Alive, Just quiet, and far less than the chorus Samuel remembered from the term before.

"Why would they stop calling?" she asked.

"Frogs mostly call to attract mates, or to defend territory," Samuel said, with the easy confidence of someone reciting something he'd genuinely enjoyed learning rather than merely memorised for a test. "If the pond's stressed somehow, the water, the food supply, whatever's actually changed here, it would make sense that they'd be quieter. Fewer resources, less energy for anything that isn't just staying alive."

This observation, small as it seemed on its own, sent the three of them back to Mrs. Ibrahim with a new and slightly larger question than any single measurement had raised so far. Not just what had changed in the water or the soil, but what a change like that might mean for every living thing that depended on the pond, directly or indirectly, for its survival.

"This is where food chains become useful to understand," Mrs. Ibrahim told them, pulling out a simple diagram on the classroom board rather than launching into a lecture. Over the past two weeks she had become noticeably more inclined to let the investigation itself decide what needed explaining, rather than working through a fixed syllabus in order. "A food chain shows how energy moves from one living thing to another. It starts, almost always, with a producer, something that makes its own food, usually a green plant using sunlight. Then consumers, things that eat the producers, or eat other consumers in turn."

She sketched it out simply. Pond plants and algae as producers, small insects and tiny water creatures feeding on them as primary consumers, frogs and small fish eating those insects as

secondary consumers, and birds, further along, sometimes feeding on the frogs and fish themselves.

"Now," she said, turning back to the three of them, "if something changes at the very bottom of this chain, the water quality, or the number of microorganisms and algae in the pond, what do you think happens further up it?"

Mariam stared at the diagram for a long moment, turning it over the way she'd been learning to turn over every piece of the mystery rather than reaching for the first plausible-sounding answer.

"If the water's different," she said slowly, "then whatever grows in the water changes too. And if that changes, whatever eats it has more or less food than before. And if that changes, whatever eats those things changes too. It goes all the way up."

"That's exactly right," Mrs. Ibrahim said. "A food chain isn't simply a list. It's a series of dependencies. Change one link, and the effects can travel through every link connected to it, sometimes in ways that aren't obvious until you've actually traced the whole chain, the way you three are starting to do."

Aisha, characteristically, was already redrawing the diagram in her own notebook, adding small notes beside each link: more microorganisms observed, insects increased, frogs decreased, watching the pattern take shape on paper in a way that made something click for Mariam that the spoken explanation alone hadn't quite managed.

"The insects went up," Mariam said slowly, tracing the chain with her finger. "And the frogs went down. What if that's not two separate mysteries? What if the frogs are quieter because there's actually more food further down the chain, not less, but something else is stopping them from thriving anyway?"

"That's an excellent question to test," Mrs. Ibrahim said, and there was something in her voice, real approval, not just encouragement, that made Mariam sit up a little straighter. "I don't know the answer either, not yet. But you're finally asking questions that could actually explain everything you've observed at once, instead of treating the garden, the water, and the animals as separate little puzzles."

WHAT DID SCIENCE REVEAL?

A food chain shows how energy passes from one living thing to another, typically starting with a producer (usually a green plant, which makes its own food using sunlight) and moving through consumers that eat producers or other consumers in turn. Because each link in a food chain depends on the ones before it, a change at any point even at the very bottom, such as a shift in water quality affecting microorganisms can affect every organism connected further along the chain, sometimes in ways that aren't obvious without carefully tracing the whole sequence.

SCIENCE TERMINOLOGY

Food Chain • *Producer* • *Consumer* • *Adaptation*

What Did You Observe?

1. What does Samuel notice about the frogs that remain at the pond?

2. What new question does Mariam form by combining the increase in insects with the decrease in frogs?

Science Questions

1. What is a producer in a food chain, and why does a food chain usually start with one?

2. Explain, in your own words, how a change at the bottom of a food chain can affect organisms much further along it.

Chapter 6
Beyond the Fence

It was Mariam's father, in the end, who first asked the question none of the three friends had quite thought to ask yet. Not what was happening inside the pond and garden, but what might be happening around them, beyond the school's fence, that could actually explain how a change had reached the water in the first place.

"Where does the pond's water actually come from?" Dr. Hassan asked one evening, as Mariam worked through Aisha's latest notes spread across the dining table. "Not rainfall alone, surely. Not enough to explain a pond that size staying full most of the year."

Mariam realised, with the specific discomfort of noticing an obvious gap in her own thinking, that she genuinely didn't know. She'd been so focused on testing the water itself that she'd never once asked where it had come from before it arrived at the pond at all.

"I don't know," she admitted. "I just assumed it was always just there. Filled by rain, maybe some groundwater. I never actually checked."

"That's worth checking," her father said, careful, as always, not to hand her the answer directly. "Water doesn't behave the way a sealed container does. It moves. It arrives from somewhere, and it carries whatever it has passed through along the way. If something changed upstream of your pond, even somewhere well outside the school grounds, it could easily explain a change that seems, from where you're standing, to have started right there at the water's edge."

The next morning, armed with this new question, the three friends approached Mrs. Ibrahim with something that felt less like a report and more like a genuine request for direction. The investigation, for the first time, had outgrown what they could reasonably map out entirely on their own.

"We need to know where the pond's water comes from," Mariam said. "Before it reaches the school at all."

Mrs. Ibrahim looked, for a moment, almost startled. Then something crossed her face that Mariam would later recognise, once she understood the full shape of the mystery, as quiet approval at exactly how far the question had travelled from where it started.

"That," she said, "is precisely the right question to be asking now. Let me arrange something."

What she arranged, two days later, was a short, carefully supervised walk beyond the school's back fence, following the narrow drainage channel that fed into the pond upstream. It was something none of the three friends, in three years at Hirra Academy, had ever thought to trace before, despite having walked past its entrance dozens of times without a second glance.

The channel ran, it turned out, past the edge of a small farming plot maintained by a family in the neighbouring community, then along a stretch of recently cleared land where new construction had begun the term before. The soil there was exposed, unprotected, with nothing yet planted to hold it in place against the rains.

"There," Samuel said, stopping at the edge of the cleared plot, pointing to where the channel ran directly alongside the exposed, freshly turned earth. "Every time it rains hard, this soil has nowhere to go but straight down into that channel. And the channel runs directly into our pond."

Mariam stood at the edge of the drainage channel for a long moment, watching a thin trickle of visibly cloudy water move steadily downhill, tracing with her eyes the exact path it would take. Past the cleared construction site, along the narrow channel, straight through the school's back fence, into the pond that had, for three years, seemed like the most unremarkable, unchanging part of Hirra Academy's grounds.

"It's not one thing," she said slowly, feeling the separate pieces of the last two weeks finally beginning to arrange themselves into something that looked less like a pile of clues and more like an actual explanation. "The soil from the cleared land washes into the channel. The channel carries it into the pond. That changes the water, the acidity, whatever nutrients or materials it's carrying with it. The changed water affects the microorganisms. The microorganisms affect what eats them. That affects the frogs, the insects, everything all the way up."

"You're describing an ecological chain reaction," Mrs. Ibrahim said quietly, watching her with an expression Mariam couldn't entirely read. "One change, moving outward through an entire connected system. But notice something important, Mariam, you've just built a hypothesis, a genuinely strong one. You haven't proven it yet. What would you still need to check, before you were confident enough to tell the rest of the school this is actually what happened?"

Mariam thought about that the entire walk back to school, past the cleared land, past the narrow channel, past the fence she'd walked through hundreds of times without ever once wondering what lay just beyond it.

WHAT DID SCIENCE REVEAL?

Runoff is water often from rainfall that flows across land into streams, drains, or other water bodies, and it can carry soil, nutrients, and other materials along with it. Erosion is the process by which soil is worn away and moved, often by water, especially from land left exposed without plant cover to hold it in place. When runoff carrying eroded soil or other materials enters a water body like a pond, it can trigger an ecological chain reaction — a connected sequence of changes moving through an entire ecosystem, from the water itself, to the microorganisms within it, and onward to every organism that depends on that ecosystem in turn.

SCIENCE TERMINOLOGY

Runoff • *Erosion* • *Ecological Chain Reaction*

What Did You Observe?

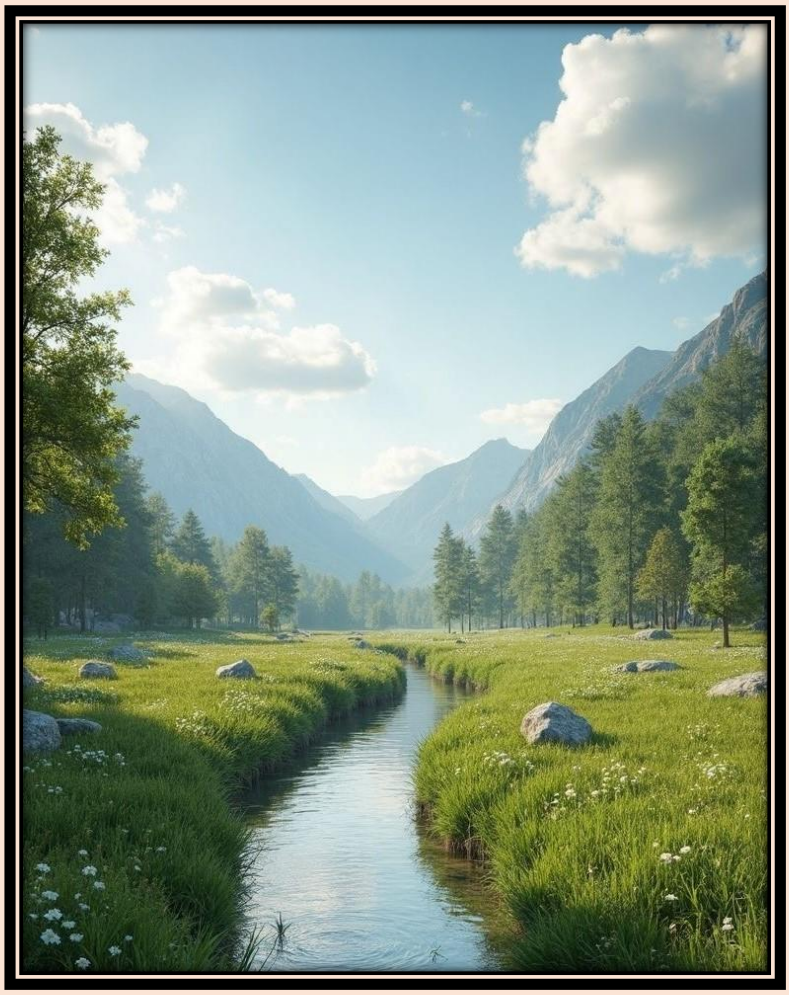
1. Where does the pond's water actually come from, and what does the drainage channel pass by along the way?

2. What hypothesis does Mariam form after tracing the water's path back to the cleared construction land?

Science Questions

1. What is runoff, and how can it carry materials from one place to another?

2. What is erosion, and why might newly cleared, unprotected land be more likely to erode?



PART IV
Proof and Responsibility

Chapter 7
Testing the Hypothesis

Proving a hypothesis, Mariam was quickly discovering, was an entirely different kind of work from forming one. A hypothesis could arrive in a single satisfying rush of insight, the way hers had at the edge of the drainage channel. Proof, by contrast, arrived slowly, in small, careful, occasionally tedious pieces, and required a person to keep being willing to find out they were wrong.

Mrs. Ibrahim made this explicit the following week, gathering the three of them around a fresh sheet of paper rather than launching straight into another round of testing.

"You believe runoff from the cleared land is changing the pond's water, which is changing the microorganisms, which is affecting the rest of the ecosystem," she said. "That's a coherent chain. But a coherent story isn't the same as a proven one. What predictions does your hypothesis actually make? Things that should be true if you're right, and things that would surprise you if you're wrong?"

This turned out to be harder than any of them expected. Aisha, naturally, was the one who eventually organised it into a proper list. If the hypothesis was correct, the water closer to the drainage channel's entry point should be more affected than water on the pond's far side. The soil nutrients washing in should show up, in some testable form, in both the channel water and the pond water, at similar concentrations. And this was Samuel's addition, delivered with the quiet confidence of someone who had spent considerably more hours actually watching the pond than either of his friends. The pattern of insect increase and frog decrease should be strongest nearest the channel's entry point too, tapering off further around the pond's edge.

"If none of that turns out to be true," Mariam said slowly, working through the uncomfortable logic of it, "then our hypothesis is probably wrong, even if it sounded convincing standing at that drainage channel."

"Exactly," Mrs. Ibrahim said. "And I want you to notice something about how you're thinking right now, because it's more important than any single test result you're about to collect. You're not just looking for evidence that agrees with you. You're identifying exactly what evidence would prove you wrong, and then going to look for it honestly. That's the difference between someone who wants to be right, and someone who wants to know what's true. They're not always the same person."

The mapping took the better part of another week. It was careful, patient, occasionally damp work, wading along the pond's shallow edges in old shoes Mrs. Ibrahim had specifically

approved for the purpose, taking water samples at four different points around the pond's circumference, along with soil and plant observations at matching intervals, all of it recorded by Aisha with the same unbothered thoroughness she brought to everything.

The results, once fully laid out across the classroom table, told a story more precise than any of them had quite dared hope for. The water nearest the channel's entry point tested more acidic than water on the pond's far side, which was itself only mildly different from the reference sample they'd taken weeks earlier from an entirely separate, unaffected water source across the school grounds. The insect clusters were, indeed, thickest nearest the channel. The remaining frogs were concentrated furthest from it, in the shaded overhang on the pond's opposite bank, exactly where Samuel had first spotted them.

"It matches," Samuel said, staring at Aisha's carefully drawn map with something like genuine astonishment, as though he hadn't quite believed their own prediction would actually hold up once tested properly. "All of it. Right down to where the frogs are hiding."

"It matches your prediction," Mrs. Ibrahim corrected gently, though there was real warmth behind the correction. "Which is meaningfully different from matching what you originally wanted to believe. You built a hypothesis, made it specific enough to be wrong, and then tested it honestly instead of just looking for anything that confirmed it. That, more than the actual result, is the part I'm proud of."

Mariam looked at the finished map for a long moment. Four sampling points, a clear gradient from the channel's entry to the pond's far side, insects and frogs distributed in exactly the pattern their hypothesis had predicted before they'd gone looking for it, and felt something settle in her chest that was quieter and steadier than the excitement she'd expected to feel at finally being right.

"We still don't know exactly what's in that runoff, though," she said. "Just that it's coming from the cleared land, and it's definitely reaching the pond."

"No," Mrs. Ibrahim agreed. "That's your next question. You've proven the connection exists. You haven't yet identified precisely what's being carried along it."

MARIAM'S SCIENCE NOTEBOOK

QUESTION: Is the pond's water quality connected to runoff from the cleared land near the drainage channel?

OBSERVATION: Cloudy runoff visibly enters the drainage channel from an exposed, recently cleared plot of land before reaching the pond.

HYPOTHESIS: Water quality, insect density, and frog presence should form a gradient — most affected nearest the channel's entry point, least affected furthest from it.

TEST: Sample water, insects, and frog locations at four points around the pond's circumference, from nearest to furthest from the channel entry.

RESULT: All three measurements formed the predicted gradient: most change nearest the channel, least at the pond's far side.

CONCLUSION: The evidence strongly supports the hypothesis that runoff from the cleared land is affecting the pond, though the exact substance involved is still unknown.

WHAT DID SCIENCE REVEAL?

A strong hypothesis makes specific predictions things that should be observably true if the hypothesis is correct, and things that would be surprising or contradictory if it is wrong. Testing a hypothesis honestly means actively looking for evidence that could disprove it, not only evidence that supports it. A gradient, in this context, refers to a pattern that changes gradually across a distance such as water becoming progressively less affected the further it is from a pollution source which can provide strong supporting evidence for a hypothesis about cause and spread.

SCIENCE TERMINOLOGY

Prediction • *Testing a Hypothesis* • *Gradient*

What Did You Observe?

1. What three specific predictions do the students make based on their hypothesis?
2. What pattern does their mapping of the pond reveal, and how closely does it match their predictions?

Science Questions

1. What makes a hypothesis "testable," according to Mrs. Ibrahim?
2. What is a gradient, and how does the pond's water quality show one in this chapter?

Chapter 8

What the Water Carried

Identifying exactly what the runoff was carrying turned out to be beyond what the school laboratory's modest equipment could manage on its own, a limitation Mrs. Ibrahim acknowledged plainly rather than pretending around.

"We can measure pH. We can look at microorganisms under a microscope. We can compare moisture and observe visible sediment," she told the three of them. "But identifying specific dissolved nutrients or chemical compounds properly requires equipment this school doesn't have. That's not a failure on your part. That's simply the honest limit of what we can test here, and knowing the limits of your own investigation is part of good science too."

It was Dr. Hassan, once Mariam explained the gap over dinner, who offered a way past it. Not by solving the problem himself, which would have violated what had become an unspoken rule of his mentorship all term, but by suggesting a resource neither Mariam nor Mrs. Ibrahim had thought to ask about.

"There's an environmental office in town that handles exactly this kind of water testing, for exactly this kind of situation," he said. "I know someone there. I can ask whether they'd be willing to test a sample as a courtesy for a school investigation, but you'd need to prepare your samples and your case properly first. They won't take an unlabelled jar of pond water seriously, and they shouldn't."

What followed was, in Mariam's own private opinion, the most genuinely satisfying week of the entire investigation. Not because anything dramatic happened, but because it required her, for the first time, to organise everything they'd learned into something that could be handed to a stranger and understood immediately, without her standing there to explain it.

Aisha's notebook became the backbone of it. Dated observations from the very first strange bean plants, through the pond's changed colour and smell, the living-versus-non-living framework Mrs. Ibrahim had taught the whole class, the pH and moisture comparisons against their careful baseline samples, the microscope sketches of the pond's microorganisms, the food chain diagram tracing energy from producers up through frogs and birds, and finally, the four-point map showing the clear gradient of change radiating outward from the drainage channel's entry point.

"This is remarkable work," said the woman at the environmental office, a soft-spoken engineer named Mrs. Adeyinka, flipping slowly through Aisha's notebook with an expression of real, unhurried attention that made Mariam suddenly, fiercely proud of her friend's months of unglamorous, careful record-keeping. "Properly dated. Properly compared against a baseline. This is more organised than some reports I receive from actual adults."

The water sample results took another full week to return, a wait that Mariam found almost unbearably long after everything that had led up to it. When they finally did, delivered to Mrs. Ibrahim's office in a plain envelope that Mariam was invited to open herself, the answer was both simpler and more specific than any of them had quite predicted.

The runoff was carrying elevated levels of nutrients, nitrogen and phosphorus compounds, most likely originating from a combination of disturbed, unprotected soil and possibly some agricultural fertiliser from the neighbouring farming plot, washed loose by recent heavy rains with nothing left in place to hold the soil or slow the water down. These nutrients, entering the pond in unusually large quantities, had triggered exactly the kind of change Mariam's hypothesis had described. A surge in microorganism and algae growth, feeding directly into the surface insects that fed on them, while the pond's overall water quality, its clarity, its oxygen levels, its balance, shifted enough to genuinely stress the frogs and other more sensitive pond life.

"So it wasn't poison," Samuel said, reading over Mariam's shoulder. "It wasn't anyone dumping chemicals on purpose. It was just nutrients. Too many of them, in the wrong place, at the wrong time."

"Which is, in its own way, a more useful answer than a villain would have been," Mrs. Ibrahim said, and there was something quietly satisfied in her voice that Mariam recognised now as the particular pleasure of watching a genuinely difficult question finally resolve into something solid. "A villain is a single person to blame. This is a process, one that can actually be fixed, once it's properly understood, and one that will very likely happen again elsewhere if nobody learns the right lesson from it."

WHAT DID SCIENCE REVEAL?

Nutrient pollution occurs when excess nutrients often nitrogen and phosphorus from fertiliser or disturbed soil — enter a water body, frequently through runoff. This can trigger rapid, excessive growth of algae and microorganisms (sometimes called an algal bloom), which can, in turn, reduce a water body's water quality and dissolved oxygen levels as the excess organic material breaks down, placing stress on more sensitive organisms like frogs and fish that depend on stable, well-oxygenated water to survive.

SCIENCE TERMINOLOGY

Nutrient Pollution • *Algal Bloom* • *Water Quality* • *Dissolved Oxygen*

What Did You Observe?

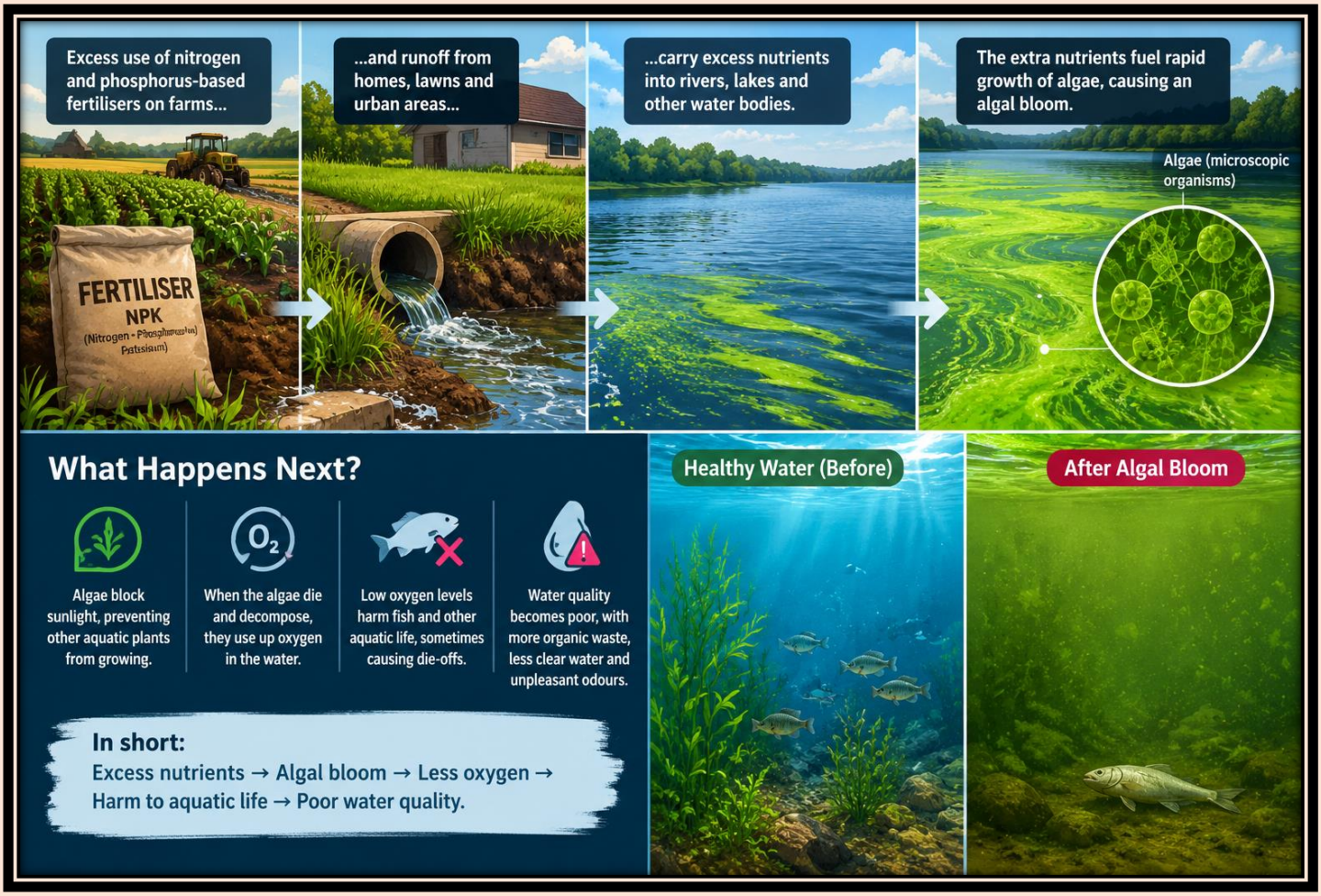
1. Why couldn't the school laboratory identify exactly what the runoff was carrying on its own?

2. What did the environmental office's water sample results reveal was actually in the runoff?

Science Questions

1. What is nutrient pollution, and where can excess nutrients like nitrogen and phosphorus come from?

2. How can an increase in algae and microorganisms end up harming other organisms like frogs, even though the algae itself isn't directly poisonous to them?



Chapter 9

More Than an Answer

Knowing the answer, Mariam discovered rather quickly, was not remotely the same as being finished with the investigation. This realisation arrived almost immediately once Mrs. Ibrahim asked, with obvious anticipation, what they intended to do with everything they now understood.

"Do?" Mariam repeated, caught slightly off guard. "I thought the point was just to find out what was happening."

"That was the beginning of the point," Mrs. Ibrahim said. "Finding out what's happening in the world and doing absolutely nothing with that knowledge is a strange kind of half-finished science, don't you think? You've identified a real problem, with a real, traceable cause, affecting a real ecosystem that other students and other living things depend on. What happens now that you know?"

This question occupied the three of them for longer, in some ways, than any single piece of laboratory testing had, precisely because it didn't have a clean procedure to follow the way collecting a water sample did. Samuel, predictably, wanted to act immediately. Build something, plant something, physically intervene at the pond's edge before the next heavy rain made things worse. Aisha, just as predictably, wanted to document everything thoroughly first, arguing that a poorly explained solution could do as much harm as no solution at all, if the wrong people acted on an incomplete understanding of the problem.

"We need both," Mariam said eventually, after nearly a week of the two of them circling the same disagreement without quite resolving it. "Aisha's right that we need to explain this properly, to people who can actually do something about it. The school administration, maybe even someone connected to that construction site. But Samuel's right that explaining it isn't enough on its own if nothing at the pond actually changes while we wait."

What they eventually proposed, after several more days of planning under Mrs. Ibrahim's careful, deliberately hands-off supervision, was a two-part plan. The first part involved a formal presentation, not just to their own class, but to the whole school, and, at Mrs. Ibrahim's quiet suggestion, to the school's administration directly, since the drainage channel and its cleared source land fell partly within decisions the school itself had some influence over as a neighbouring landholder.

The second part was smaller, more immediate, and entirely Samuel's contribution. A simple, temporary barrier of packed earth and salvaged wood, built with permission along the most exposed section of the cleared land nearest the drainage channel, designed to slow the runoff's path just enough to let some of the loosened soil settle before it ever reached the water. Not a permanent fix, Mrs. Ibrahim was careful to make clear, but a genuinely useful stopgap while the

larger, more permanent solution made its slower way through actual decisions and actual budgets.

"This is called mitigation," Mrs. Ibrahim explained, as the three of them, along with several other students who'd asked, with increasing curiosity over the past weeks, to help, worked through a Saturday morning packing earth along the barrier's length. "Reducing the harm of a problem while a more complete solution is worked out. It's rarely as satisfying as fixing something all at once. But it matters. Real environmental problems are almost never solved in a single dramatic moment. They're solved in exactly this kind of patient, unglamorous, repeated effort."

Mariam, dirt under her fingernails, watching the modest barrier take shape along a stretch of exposed earth that had, only weeks earlier, seemed like nothing more than a piece of scenery on the walk to somewhere else, found herself thinking about how differently she saw the whole landscape now. The cleared plot, the narrow channel, the fence, the pond beyond it, not as separate places anymore, but as a single connected system, the way Mrs. Ibrahim had been quietly, patiently trying to teach them to see it since that very first afternoon in the garden.

WHAT DID SCIENCE REVEAL?

Mitigation refers to actions taken to reduce the harm of a problem, often as an immediate or temporary measure while a more complete, permanent solution is developed. Addressing real environmental problems typically requires both understanding the cause (through investigation) and taking responsible action based on that understanding, often involving cooperation between multiple people or groups sometimes called stakeholders — who have some connection to or influence over the affected environment.

SCIENCE TERMINOLOGY

Mitigation • *Environmental Responsibility* • *Stakeholder*

What Did You Observe?

1. What disagreement do Samuel and Aisha have about what to do with their findings?
2. What two-part plan do Mariam, Aisha, and Samuel eventually propose?

Science Questions

1. What is mitigation, and how is it different from a complete, permanent solution?
2. Why might it be important to explain an environmental problem properly to people who have influence over it, rather than just fixing it quietly alone?

PART V
The Mystery of Life

Chapter 10
The Presentation

The presentation, when the day finally arrived, took place not in a classroom but in the school hall, with the whole of JSS2 and JSS3 gathered along with several teachers and, seated somewhat formally near the front in a way that made Mariam's stomach genuinely flip when she first noticed him, the school's administrator himself, along with a representative from the construction company managing the cleared land. This had been arranged, Mariam later learned, through a series of quiet, patient phone calls Mrs. Ibrahim had made over the preceding week without mentioning a word of it to any of them.

Mariam had rehearsed her opening line more times than she was willing to admit to anyone, including herself, but standing at the front of the hall with Aisha's notebook open on the table beside her and Samuel's simple ecosystem diagram pinned to the board behind them, the words came more easily than she'd expected, mostly because she wasn't reciting anything. She was simply describing, in order, exactly what had happened.

"Six weeks ago," she began, "some bean plants in the school garden started growing strangely. We didn't know why. So we decided to find out."

She walked the whole hall through it, step by careful step, the way Mrs. Ibrahim had insisted they always present it. Not "we solved the mystery," but the actual, honest shape of an investigation, including its wrong turns. She described the garden's strange plants, and admitted, plainly, that their first instinct had been to guess, chemicals, deliberate pollution, a strange season, before Mrs. Ibrahim taught them to distinguish observation from assumption. She described the pond's changed colour and smell, and Aisha's insistence on writing everything down properly rather than trusting memory. She described learning to identify living and non-living things clearly enough to form a real hypothesis, and the patient, occasionally tedious work of actually testing that hypothesis against evidence specific enough to potentially prove it wrong.

She showed the pH results, the microscope sketches, Aisha's careful gradient map with its four sampling points radiating out from the drainage channel's entry, and finally, the environmental office's water analysis confirming what the evidence had already strongly suggested. Nutrient-rich runoff, carried by rainfall across exposed, unprotected soil, entering the school's pond and triggering a chain reaction that moved outward through the entire ecosystem, from the water itself, to the microorganisms within it, to the insects that fed on them, to the frogs and birds further along the chain that depended, in turn, on all of it.

"We got things wrong along the way," Mariam said, near the end, and this was the part she had worried about saying out loud more than any other, until Mrs. Ibrahim had gently insisted it was the single most important sentence in the entire presentation. "We assumed it was probably pollution, deliberately caused, before we had any real evidence for that. We didn't think to check where the pond's water actually came from until someone else asked the question for us. Good science isn't about never being wrong. It's about being willing to keep testing your ideas even after you think you already know the answer."

The representative from the construction company, when Mariam finally finished and the hall's polite, slightly stunned applause had settled, stood up and said something Mariam would remember for a long time afterward, not because it was dramatic, but because of how plainly, unglamorously true it was.

"I came here today expecting to be told my company had done something wrong, and defending myself," he said. "Instead I've just watched three JSS students explain, more clearly and more fairly than most adult reports I've seen, exactly what happened and why, including the parts where you weren't sure yet, or got it wrong at first. That's not an accusation. That's just good work. We'll be fixing the drainage and replanting that cleared section properly, starting this week."

Mariam sat back down beside Aisha and Samuel, her heart still going faster than she expected it to, and felt something settle into place that had nothing to do with being right and everything to do with having done the work honestly enough that being right had actually mattered to someone.

WHAT DID SCIENCE REVEAL?

Presenting scientific findings clearly which including uncertainties, mistakes, and the reasoning behind conclusions, is an essential part of the scientific process, sometimes supported by peer review, in which other people examine and question the evidence before it is fully trusted. Honest scientific communication can also support accountability, helping the people responsible for a problem understand it clearly enough to take meaningful action.

SCIENCE TERMINOLOGY

Scientific Communication • *Peer Review* • *Accountability*

What Did You Observe?

1. What specific mistake does Mariam admit to during the presentation?

2. How does the construction company representative respond to the students' presentation?

Science Questions

1. Why does Mrs. Ibrahim insist that Mariam include the parts of the investigation where they got things wrong?

2. Why might presenting evidence clearly and honestly help convince people to take responsible action?

Chapter 11
The Chorus Returns

The pond did not recover overnight, a fact Mrs. Ibrahim made a point of preparing all three of them for well before the drainage repairs and replanting even began, in the same careful, unhurried way she'd prepared them for nearly everything else across the past several weeks.

"Ecosystems don't reset the way a cleared blackboard does," she told them, the week after the presentation, as the construction company's workers began laying new drainage piping along the cleared land's edge. "The water quality will improve gradually, as the nutrient load decreases. The microorganism population will settle back toward its normal balance over weeks, not days. The frogs, if they return at all in the same numbers, will do so slowly, as the conditions that support them genuinely stabilise, not the moment someone announces the problem is fixed."

Mariam found this, to her own quiet surprise, easier to accept than she might have expected a few months earlier. The investigation itself had taught her something about patience that no single lesson had managed to on its own, the difference between wanting an answer and being willing to wait for the evidence that actually supported one.

Over the following weeks, the three of them kept visiting the pond regularly anyway, notebooks in hand, less out of any remaining mystery to solve and more, Mariam suspected, out of the simple habit the investigation had built in all of them. Noticing things properly, rather than walking past them unseen the way she had for three entire years before that first strange afternoon in the garden.

The changes came slowly, exactly as Mrs. Ibrahim had predicted. The water cleared, by degrees, as the new drainage system diverted the worst of the rainfall runoff away from the pond's edge and the replanted section of cleared land began, however modestly, to hold its soil in place again. The unpleasant smell faded first, weeks before the water's colour fully settled back to something closer to what Mariam remembered from before any of this had started. The dense clusters of surface insects thinned gradually, matching, as Aisha's careful notes confirmed, a slow but measurable decline in the pond's microorganism population back toward something like its original balance.

The frogs took the longest. It was nearly two months after the presentation, on an ordinary Tuesday afternoon that Mariam would otherwise have entirely forgotten, when Samuel came sprinting across the school field at break time, breathless and grinning in a way that made half the students nearby stop what they were doing just to watch him run.

"Come and listen," was all he managed to say, tugging both Mariam and Aisha toward the path behind the science block without waiting for either of them to ask why.

The evening chorus, when they returned after classes ended that day, was not yet what it had once been. It was thinner, quieter, with gaps where Mariam suspected entire small populations simply hadn't returned yet, if they ever fully would. But it was there. Real, unmistakable, several distinct frog calls overlapping across the pond's still-recovering water, in a sound Mariam realised, standing at the water's edge with her two closest friends, she had never properly appreciated until the afternoon she'd first noticed its complete absence.

"It's coming back," Aisha said quietly, notebook already open, dating a new entry with the same careful attention she'd brought to every single one before it. "Not all the way. Not yet. But it's coming back."

Mariam said nothing for a long moment, simply listening, letting the sound settle into her in a way that felt different from anything the investigation's more technical victories, the pH readings, the confirmed hypothesis, the successful presentation, had quite managed to on their own.

"I used to walk past this pond almost every day," she said eventually, "and I never once really listened to it. Not properly. I just heard noise, if I heard anything at all."

"And now?" Samuel asked.

Mariam considered the question properly, the way she'd been learning to consider almost everything over the past two months, rather than reaching for the easiest answer available.

"Now I know what it actually sounds like when something is quietly, slowly working," she said. "I don't think I'll ever walk past it without listening again."

WHAT DID SCIENCE REVEAL?

Ecosystem recovery is typically a gradual process rather than an immediate reversal, since populations of organisms from microorganisms to frogs need time to grow, stabilise, and re-establish a healthy ecological balance once the conditions supporting them improve. Monitoring a recovering ecosystem over time, through repeated, careful observation, allows changes in a population (the number of individuals of a particular species in an area) to be tracked accurately, rather than assumed based on a single visit or a hopeful guess.

SCIENCE TERMINOLOGY

Ecosystem Recovery • *Ecological Balance* • *Population*

What Did You Observe?

1. What changes does Mrs. Ibrahim warn the students to expect gradually, rather than immediately, after the drainage repairs begin?

2. What does Samuel excitedly bring Mariam and Aisha to hear at the end of the chapter?

Science Questions

1. Why doesn't an ecosystem "reset" immediately once a source of harm is removed?

2. Why is it useful to keep observing an ecosystem regularly over time, rather than checking on it only once?

Chapter 12
The Mystery of Life

The garden, when Mariam walked past it on an ordinary afternoon near the end of term, looked almost entirely unremarkable. Which was, she was beginning to understand, exactly the point. The bean plants in the once-affected corner had returned to something close to their expected height, neither the strange pale spindliness of two months earlier nor anything else worth a second glance from anyone who hadn't spent the whole term learning to actually look at it properly.

She stopped anyway, the way she'd started stopping at all sorts of unremarkable things over the past several weeks, and watched a small insect land on one of the recovering bean plant's leaves. Nothing dramatic, nothing that would have caught her attention even a term earlier. It simply sat there for a moment, wings folded, entirely unconcerned with the JSS2 student watching it with an intensity that would have struck her own past self as slightly ridiculous.

She smiled, watching it, because she understood something now that she hadn't at the very start of all this. The insect wasn't separate from the story she'd just spent two months investigating. It was part of it, connected, however invisibly, to the soil beneath it, the water down the slope, the microorganisms she'd once viewed under a borrowed microscope, the frogs whose chorus she'd learned to actually hear for the first time in her life. Nothing about it was insignificant. It simply hadn't looked significant, before she'd learned how to look at all.

Mrs. Ibrahim found her there a few minutes later, apparently on her way to lock up the laboratory for the final time before the term's end, and paused instead of walking straight past.

"So, Mariam," she said, settling into the familiar rhythm of a question rather than an answer, one last time. "What did the mystery teach you?"

Mariam thought about it properly, the way she'd learned to think about nearly everything since that first strange afternoon with the pale, spindly bean plants. Not reaching for the quickest satisfying answer, but actually turning the question over until something true settled into place.

"That life is connected," she said finally. "The water, the soil, the tiny things in the water too small to see, the insects, the frogs, even us. None of it was ever really separate. It just looked separate, if you weren't paying attention properly."

Mrs. Ibrahim smiled, the same quiet, satisfied smile Mariam had come to recognise, over an entire term, as her teacher's highest form of praise. "And?"

Mariam looked past her, toward the path that led down to the pond, where she could just make out, faintly, the beginning of the evening chorus starting up early, still thinner than it had once been, still recovering, but real.

"And when we don't understand something," she said, "we shouldn't invent an answer just because it's convenient. We should investigate. Properly. Even when it takes longer than we want it to. Especially then."

Mrs. Ibrahim didn't say anything else immediately, and Mariam had learned, over an entire term of exactly this kind of teaching, that this particular silence was not the absence of a response but the whole of one. The specific quiet of a teacher watching a lesson finally arrive somewhere it could actually stay.

Later that week, at the very back of Aisha's notebook, beneath months of dated observations, pH readings, microscope sketches, and the careful gradient map that had finally cracked the whole mystery open, Mariam added one final entry of her own, in her own handwriting, beneath a small, simple line drawing Samuel had insisted on contributing: a single insect, wings spread, resting on a single leaf.

THE WORLD IS FULL OF MYSTERIES,

ASK QUESTIONS, OBSERVE CAREFULLY, TEST YOUR IDEAS,

FOLLOW THE EVIDENCE AND DISCOVER THE ANSWER.

She closed the notebook gently, the way something is closed not because it's finished, but because it's ready, finally, to be picked up again whenever the next question arrives.

WHAT DID SCIENCE REVEAL?

Interdependence describes how living things and their environment rely on one another in interconnected ways, so that a change affecting one part of a system can ripple outward to affect many others, often in ways that aren't obvious without careful investigation. Scientific inquiry —observing, questioning, hypothesising, testing, and revising conclusions based on evidence, is not just a method used in laboratories, but a way of engaging thoughtfully with the everyday world, including the small, easily overlooked parts of it.

SCIENCE TERMINOLOGY

Interdependence • *Scientific Inquiry* • *Environmental Awareness*

What Did You Observe?

1. What does Mariam notice about the small insect on the bean plant at the end of the chapter, and why does it matter to her now?
2. What final message does Mariam add to the back of Aisha's notebook?

Science Questions

1. What is interdependence, and how does the pond mystery illustrate it?
2. Why is scientific inquiry described as more than just something done in a laboratory?

WHAT DID SCIENCE REVEAL?

Full Glossary

A complete list of the Basic Science terms encountered across Mariam's investigation.

• Observation / Assumption — noticing verified facts versus guessing without evidence.

• Living Things / Non-Living Things — things that grow, feed, respire, respond, reproduce, excrete, and move, versus things that do not.

• Hypothesis — a proposed, testable explanation for an observation.

• Ecosystem / Habitat — a community of living things interacting with each other and their environment, within a particular home area.

• pH — a measurement of how acidic or alkaline a substance is.

• Microorganism — a living thing too small to see without magnification.

• Baseline / Control Sample — an unaffected reference point used for fair comparison.

• Food Chain / Producer / Consumer — the path energy takes from a food-making organism through the things that eat it and each other.

• Runoff / Erosion — water carrying loosened soil and materials across land into a water source.

• Nutrient Pollution / Algal Bloom — excess nutrients causing rapid, excessive growth of algae and microorganisms.

• Mitigation — action taken to reduce harm while a full solution is developed.

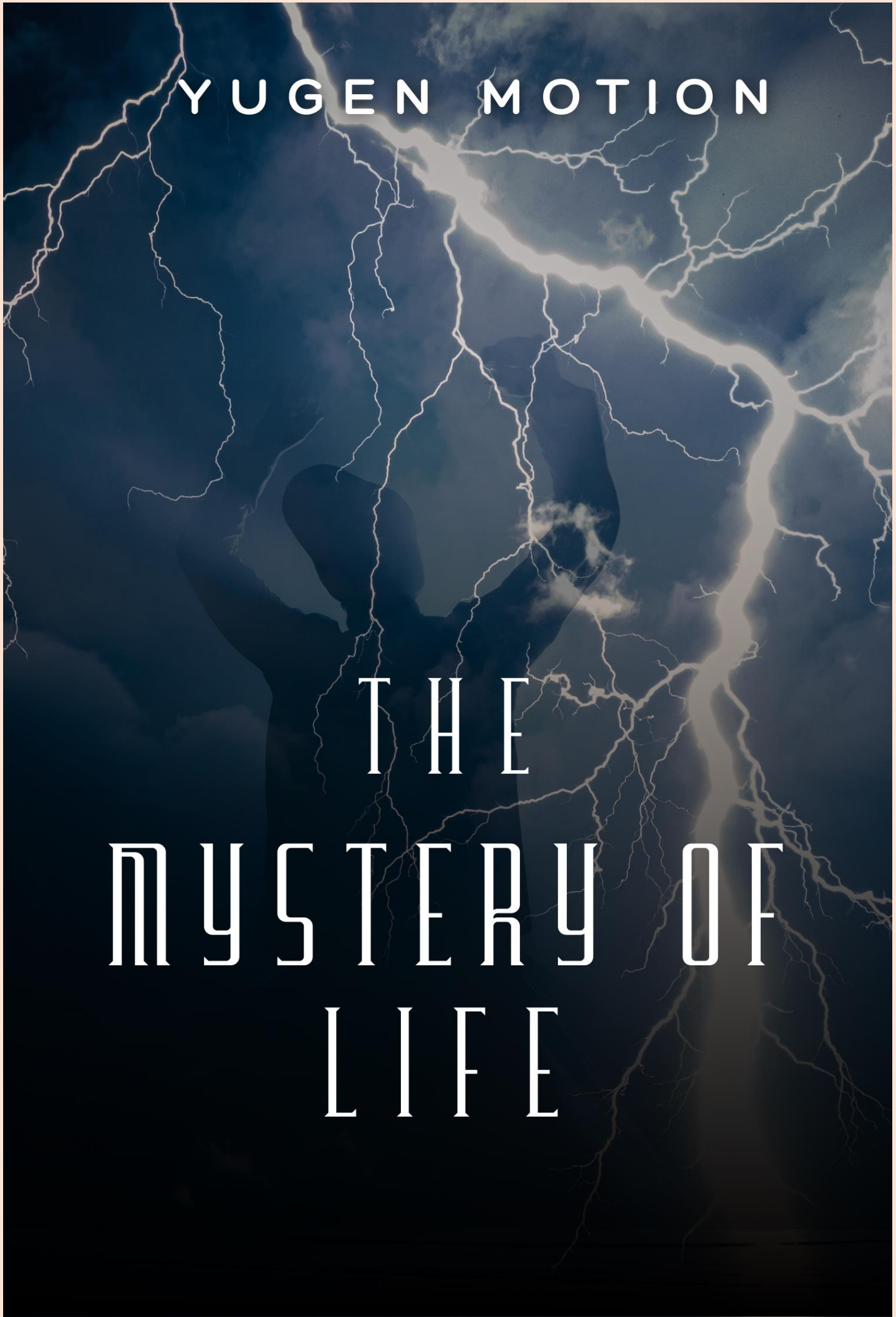
• Interdependence — the way living things and their environment rely on one another in connected systems.

The Mystery Board

POND → WATER CHANGE → MICROORGANISMS → PLANTS → INSECTS → FROGS/BIRDS → ECOSYSTEM

Final Question

Mrs. Ibrahim says a scientist can be wrong, as long as they are willing to test their idea and change their conclusion. Can you think of a time you changed your mind about something after looking at the evidence more carefully?


YUGEN MOTION
THE
MYSTERY OF
LIFE