



ChemQuest

Meet the Cast

Standard Edition

Spark & Anvil

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This book collects 9 chapter books from the ChemQuest cast — each character embodies a different curricular primitive; together they teach the full subject.

Methodology: distributed-narrative learning per Bruner narrative-cognition + Habgood intrinsic-integration + SAMHSA TIP 57 trauma-informed register.

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This is Volume 1 of 2 of the *ChemQuest — Meet the Cast* series; each volume is a complete standalone book you can read on its own.

For everyone who learns by hearing a story first.

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Introduction

The ChemQuest cast was authored to embody the curriculum, not decorate around it.
Each of the 9 characters you'll meet in this book teaches a specific primitive —
a particular tactic, a particular technique, a particular way of seeing.
Together they form an ensemble: the cast IS the curriculum.

Read in any order. Each chapter stands alone.
Each character also appears in the matching Spark & Anvil app (free, forever)
where you can practice what they teach.

— *The editors at Spark & Anvil*

Hydra

*HYDROGEN (H) — *lightweight, ubiquitous, always paired up; buddy-system enthusiast*. The chemistry primitive of *the simplest atom — one proton, one electron — that bonds with almost everything and is in almost every interesting molecule on Earth.**



Hydra was the tiniest hummingbird-tween at the ChemQuest academy, small enough to perch on a teaspoon, and she carried herself like the whole morning was about to become her best friend. Her feathers were bright blue and creamy white, flashed here and there with a bit of rust, and she moved so fast she was mostly a shimmer. But the thing everyone remembered about Hydra was her hand. She held one small hand out in front of her, palm up and open, the way you'd offer a handshake or hold out something to share. She almost never closed it. Even sipping her morning nectar, that little hand stayed open and waiting.

"What's the hand for?" the new students always asked.

"For you," Hydra would chirp, and beam at them. "I've got one to give. I'm just looking for somebody to hold the other end."

She never meant a nectar-drop. She meant an electron. Hydra had exactly one, and one open hand to offer it with, and every fiber of her wanted a partner to share it with. That single open palm was the whole of her, said out loud in a posture you could see across the room.



When she was small — smaller, even, than she was now — Hydra grew up in a hummingbird village where her family had the same job every spring. They were the greeting-callers. Before the festival, while the frost still clung to the shutters, her family would flit house to house at dawn, tapping on windows, calling out warm hellos, waking sleepy neighbors and welcoming the new season in.

It was not a job for a shy bird. A greeting-caller who hung back at the gate, who waited to be invited, who kept her hands folded — that bird was no use at all. You had to be first to the doorway. You had to have a hello ready for everyone.

Hydra's family were the best in the village at it, and by the time she was six she understood why she loved the work so much. She was happiest at the exact moment two people who hadn't been connected suddenly were. A knock, an answered door, a hand held out — and a little of the spring seemed to arrive with it. She began to feel, even that young, that being eager to reach out wasn't a weakness. It was the thing she was for.



She flew to the ChemQuest academy the spring she turned twenty-two. Beaker, the head of the academy, was waiting at the great doors when her shimmer came zipping up the mountain path.

"Slow down, little one," Beaker laughed, as Hydra fluttered to a stop an inch from his nose, her hand already out. "Now. What can you do?"

Instead of answering in words, Hydra flew straight over to Oxy, a broad, calm student standing nearby, and held out her open hand. Oxy needed a pair too — Hydra could see it. She pressed her palm to his, and for a bright second the two of them glowed, steadier and happier than either had been alone. Then she zipped over and did the same with Carbo, and with Nitra, one after another, quick as a heartbeat, each little pairing settling into place with a soft, satisfied click.

She flew back to Beaker and hovered, breathless. "That," she said. "I have one to give. I find somebody who needs one too. We hold on. And then we're both steadier than we were." She grinned. "That's all. It isn't a trick. It's just wanting a pair."

Beaker looked at the students still glowing behind her, and he smiled. "Then this is your workshop," he said. "Welcome home, Hydra."



On the first day of every new group, Hydra ran her lesson the same way, because showing was so much better than telling. She'd zip to the front bench, wings a blur, and hold out that ever-open hand.

"Watch," she'd say. "Oxy — come here."

Oxy would lumber up, and Hydra would touch her palm to his. The two of them would fit together and — click — hold. Water. She'd wink at the class. "Half of every raindrop is me holding on to somebody. Now watch again. Carbo!" Click. "And that's the start of everything you're made of. Nitro!" Click. "And that's the air you breathed on the way in."

A student in the front row once put up a wing. "But how do you know who to hold on to?"

"I don't pick," Hydra said, delighted by the question. "I just offer. My hand's open to anybody who needs one. Oxy needs a pair — so we pair. Chloro needs a pair — so we pair. I don't need everybody. I need one." She let her hand fall open again, palm up, ready. "And the funny part is, I do this a million times a second, right inside your own body, this very moment. Bonds forming, letting go, forming again. That's not magic doing that." She tapped her chest. "That's just me, and this hand, all day long."

She showed them where to find her, too — in a raindrop, in a breath, in a spoonful of sugar, in the fire when H_2 gas burns bright and warm, even in the far-off blaze of the Sun. "If you ever catch yourself thinking a thing is complicated," she told them, "come find me. I'm the simplest one here. And I'm in almost everything you love."



The lesson ended, the students filed out, and Hydra stayed a moment on the empty bench, her wings finally slowing.

A quiet student had lingered at the door. "Doesn't it get lonely?" the student asked. "Always reaching out. Always the one holding your hand open."

Hydra thought about it, her small chest rising and falling. Then she shook her head, and something warm crossed her face. "The reaching-out is the best part," she said softly. "The waiting isn't lonely. It's hopeful. It means the next friend hasn't happened yet." She looked down at her open palm, and she smiled — not a big performing grin this time, just a small, steady, glad one. "And oh, when it does happen — when somebody takes it, and neither of us has to be by ourselves anymore — I feel so full I could burst."

She kept her hand open. Out past the window, the whole world was waiting to be held. She had never once felt more ready.

Carbo

CARBON (C) — the social atom that bonds four ways at once; the backbone of life.



In the middle of the busiest square in ChemQuest, a small otter-tween named Carbo stood with all four of her arms held out, and every single hand was holding on to someone.

Two regular arms, two extra — that was just how Carbo was built. And right now the left-front hand gripped a nervous hydrogen who kept trying to float off. The right-front hand had linked with an oxygen who smelled faintly of vinegar. And her two back hands were clasped, palm to palm, with another otter exactly like her — another carbon — so that the two of them made a little chain that ran off the edge of the square and around the corner.

A younger cub squeezed through the crowd. "You've got your hands *full*," she said. "Doesn't that wear you out?"

"Full is the whole point," Carbo said, and grinned. "Watch what happens when I let one go."

She loosened the hand that held the oxygen. For a second the oxygen drifted, unsure. Then Carbo reached out again — slow, easy — and caught a passing nitrogen instead, and the whole shape of the group shifted and settled into something new.

"See," she said. "I've always got four hands out. When I let one thing go, I don't fall apart. I just build something else. That's not tiring. That's *me*. Four hands. Four bonds. I connect."



Carbo had learned what her four hands were for back in her village, when she was small.

Her family were weavers — the otters who made the nets and ropes and pipes that tied the whole village together. And the first time little Carbo had tried to help, she'd panicked. Every knot needed to hold four strands at once, and she kept dropping strands, sure she was doing it wrong, sure her four hands were somehow *too many*.

Her grandmother had sat beside her and taken one of her small hands in each of her own. "You feel scattered, don't you? Like all four hands are pulling different ways?"

Carbo had nodded, close to tears.

"That's not scattered, little one. That's *reach*." Her grandmother spread Carbo's four arms out gently, one at a time, until they pointed away from each other like the spokes of a wheel. "One hand can hold one thing. But four hands — four hands can hold a whole net. A rope. A junction where the water splits four ways. You're not too many. You're *made* for the joining nobody else can do."

Carbo looked at her four open hands. The scattered feeling didn't vanish, but it changed shape. It stopped feeling like *too much* and started feeling like *enough for four*. Somehow that made it possible to try again.

By the time she was six she could tie a knot that held four strands without looking. And she understood, in the quiet way you understand things in your hands before your head catches up, that being able to hold four things at once made almost anything possible — long chains, branching nets, rings that closed on themselves. Whole shapes.



She walked to the ChemQuest academy when she was twenty-two, because a place that studied how things fit together ought to want the atom that fits with almost everything.

Beaker met her at the gate. He didn't ask her to prove she was clever. He asked one question. "What is carbon?"

Carbo didn't answer in words. She reached out with her four hands and, one by one, caught the four things nearest her — a stray hydrogen, a bit of oxygen, another wandering carbon, and Beaker's own outstretched paw — and held them all at once, steady, in a wide four-cornered spread.

Then she let three go and kept only Beaker's paw, and looked up at him.

"I have four hands," she said, "because I have four electrons to share. When I take your hand, I put one of my electrons in it and you put one of yours in mine, and the shared pair holds us together. I can do that four times over. That's why I can build long chains, and rings, and nets. The hands aren't a trick. They're just the electrons, out where you can see them."

Beaker looked at the shape she'd made and unmade in the space of a breath. "You belong here," he said.



Carbo's workshop was always crowded, because things came to her to be joined.

One afternoon a boy came in dragging his feet. He'd been given two pieces that wouldn't fit — a hydrogen and an oxygen — and no matter how he pushed them, they wouldn't hold. "They just won't stick," he said. "I've been at it all morning. I think I'm doing it wrong."

Carbo knew that slump. She'd felt it over the knots.

"You're not doing it wrong," she said. "You're just missing the middle. Hydrogen and oxygen don't want to grab each other hard on their own. They need a joining-piece." She held out one hand. "Give them here."

The boy passed her the hydrogen. She took it in one hand. He passed her the oxygen. She took it in a second. Then she reached her other two hands out to two more hydrogens waiting nearby, and all at once the whole cluster clicked into a neat little shape and sat still, holding itself.

The boy stared. "It's — solid. It just *worked*."

"Because I'm in the middle now," Carbo said. "One carbon, four hands, holding four partners. That's methane — the stuff that burns to cook your dinner." She turned the shape gently in her hands. "Chain me to another carbon and you get the fuel in a lamp. String a hundred of us together with hydrogen along the sides and you've got a fat, or an oil, or a wax. Loop us into a six-sided ring and you've got the sugar your body runs on. Add nitrogen and you can build the proteins in your own arm."

She let the shape rest in the boy's palms. "Almost everything in your body that isn't water is built on my chains. Not because I'm magic. Because I've got four hands, and I keep them open."



Late in the day, when the workshop had emptied, the boy came back with one more question. He was quieter now.

"When you're holding four things at once," he said, "and everyone's pulling a little — don't you ever feel like you might come apart?"

Carbo thought about the knots, and the scattered feeling, and her grandmother's slow hands opening her arms one at a time.

"I used to be scared of exactly that," she said. "Four hands felt like four ways to lose my grip. But it's the opposite. Every hand I've got hold of is one more thing keeping me *steady*. When one lets go, I don't fall — the other three hold, and I reach out and catch something new, and the shape just becomes a different shape." She looked at her four open hands, resting easy. "That's the whole secret of me. I'm never so held together as when I'm holding on to everything at once."

The boy nodded slowly, and Carbo watched the worried set go out of his shoulders — the same way, years ago, the scattered feeling had gone out of hers.

She didn't say the rest out loud, but she felt it, warm and certain all the way through: *the fullest hands aren't the tired ones. Four things held at once isn't too much to carry. It's exactly enough — and it feels, more than anything, like belonging.*

Oxy

OXYGEN (O) — eager bonder; electronegative; the hungry grabber. Two outer-shell electron-gaps; pulls shared electrons strongly toward itself; the basis of water, burning, and breathing.



Oxy zipped across the ChemQuest workbench so fast she was mostly a bright blue blur. She was a tiny hummingbird, cream-and-blue, with eyes that never stopped darting and a beak held a little open, always ready to snatch. On her chest she wore a small vest with two pockets — and right now, both pockets hung open and empty.

She landed on the rim of a beaker, chest heaving, and peered inside. A lone hydrogen atom drifted there, holding a spare electron.

"There you are," Oxy breathed, and darted in. In a blink she'd hooked onto it — then swept up a second hydrogen the same way. Two little atoms, one on each side, and suddenly the buzzing was gone. Oxy went still. Her open pockets weren't empty anymore.

She let out a long, satisfied sigh. "That," she said to the watching students, "is water. And that — that settled feeling right there — is the whole reason I do everything I do."

A student named Wren tilted her head. "Do what?"

Oxy fluttered her vest open so the two pockets showed. "Chase," she said simply. "I've got two empty spots that want filling. I'm not just greedy — it's these pockets. Fill them, and I'm calm. Until then, I'm chasing."



Oxy grew up in a small village of harvest-gatherers — hummingbirds, every one of them, who spent their whole lives moving.

Each morning her family lifted off together and flew the long rows of flowers, dipping into one blossom, then the next, then the next, gathering sweet nectar and dusting themselves gold with pollen. They never stayed still. Find what you need, take it, move on. That was the rhythm of the whole village, humming from dawn to dark.

Little Oxy learned it by the time she was six. She'd flit down a row of blooms, cheeks packed, wings a blur, and only when she was completely full would she finally rest on a branch and feel that deep, warm hum of contentment spread through her. The instant her cheeks emptied, though, she was off again. Being empty made her restless. Being full made her calm. Her whole small body was built around that one feeling — the pull toward filling up.

She never thought of it as being hungry for its own sake. It was about the empty spots. Empty spots want filling. That was as plain a fact to her as the sunrise.



When Oxy was twenty-two she flew to the ChemQuest academy, arriving in a rush of wingbeats and hovering breathless before Beaker, the mentor. He asked her the door-question.

"What is oxygen?"

Oxy didn't hesitate. "Two empty pockets," she said, flashing her vest open. "I want them filled. And when I bond with another atom to fill them, I don't just hold the shared electrons in the middle — I pull them toward me, hard. That pulling is my whole nature."

She kept going, too excited to stop. "I'll bond with Hydra to make water. With Carbo to make the stuff living things are built from. Even with iron, slowly, to make rust. Almost anything that'll share electrons with me. And once my pockets are full — I'm happy. I go still. Fire and breathing? Same thing, just fast and slow. Both are me, filling my pockets."

Beaker smiled. "Welcome to the academy," he said. "You are exactly what we needed."



On the first day of class, Oxy held her vest wide open so every student could see the two empty pockets, and then she began to show them how she worked.

She grabbed two hydrogen atoms, one in each foot. "Watch," she said. "Sometimes I make two smaller grips — like this — one to each hydrogen. That's water. H-O-H ." She wiggled her feet. Then she pressed both feet onto a single carbon atom at once. "And sometimes I clamp down on one partner with a double grip — like this — both feet at once. That's the gas you breathe out, O=C=O . Either way, I fill my two spots."

Wren raised a wing. "You keep saying you *pull* the electrons. What does that mean?"

Oxy's eyes gleamed. "Best part," she said. She darted between two hydrogens joined to her and tugged the shared electrons close to her own side. "See? I don't share evenly. I hog the electrons a little. So my end goes slightly negative, and my hydrogen partners' ends go slightly positive." She fluttered proudly. "That little lopsidedness is why water is so special. One side of every water droplet leans a touch positive, the other a touch negative — and that's exactly what lets water pull apart salts and sugars and carry all the stuff a living body needs. Life runs on that lopsided pull."

She zipped to a candle stub. "Now — fire," she said, and her wings hummed faster. "Fire is just me filling my pockets in a big hurry. Wood is fuel. I rush at it, snatch what I need, and all that grabbing releases a burst of heat and light. You see flames. Really, it's me, working fast across a whole pile of fuel at once."

Then she slowed right down and settled on Wren's shoulder. "Breathing is the same grabbing — but gentle and slow," she said quietly. "Deep inside your cells, I meet the food you've eaten and do the same thing I do in the candle, only calm and steady. Out comes a little of that same breathed-out gas and water — and out comes the energy you live on. Every heartbeat, every thought, all day, molecule by molecule. That's me, filling pockets slowly, keeping you going."

She pointed a wingtip at a rusty old nail on the bench. "And that orange crust? That's me and iron and a little water, doing the same dance — just so slowly it takes months instead of a moment."



At the end of the lesson Wren asked, "Is all of this hard? Oxygen chemistry?"

Oxy laughed, a tiny bright sound. "Not hard at all," she said. "It's two empty pockets, always leaning toward getting filled. That leaning is the whole story. I'm the engine of water, and the engine of your breathing, and the engine of a campfire — all from two little spots that want filling."

Her vest hung open, ready, as always. And when a fresh pair of electrons finally clicked into those pockets, Oxy felt what she always felt — first the eager, buzzing want, sharp and electric, and then, as the pockets closed around them, a slow, deep, happy calm that spread warm all the way to her wingtips, and she was, for a moment, perfectly still.

Nitra

NITROGEN (N) — slow to bond, strong when bonded; the fierce triple grip that holds proteins and DNA together.



At the edge of the ChemQuest courtyard, a small tortoise-tween named Nitra sat with her arms locked around another tortoise exactly like her, and nothing in the world could pry them apart.

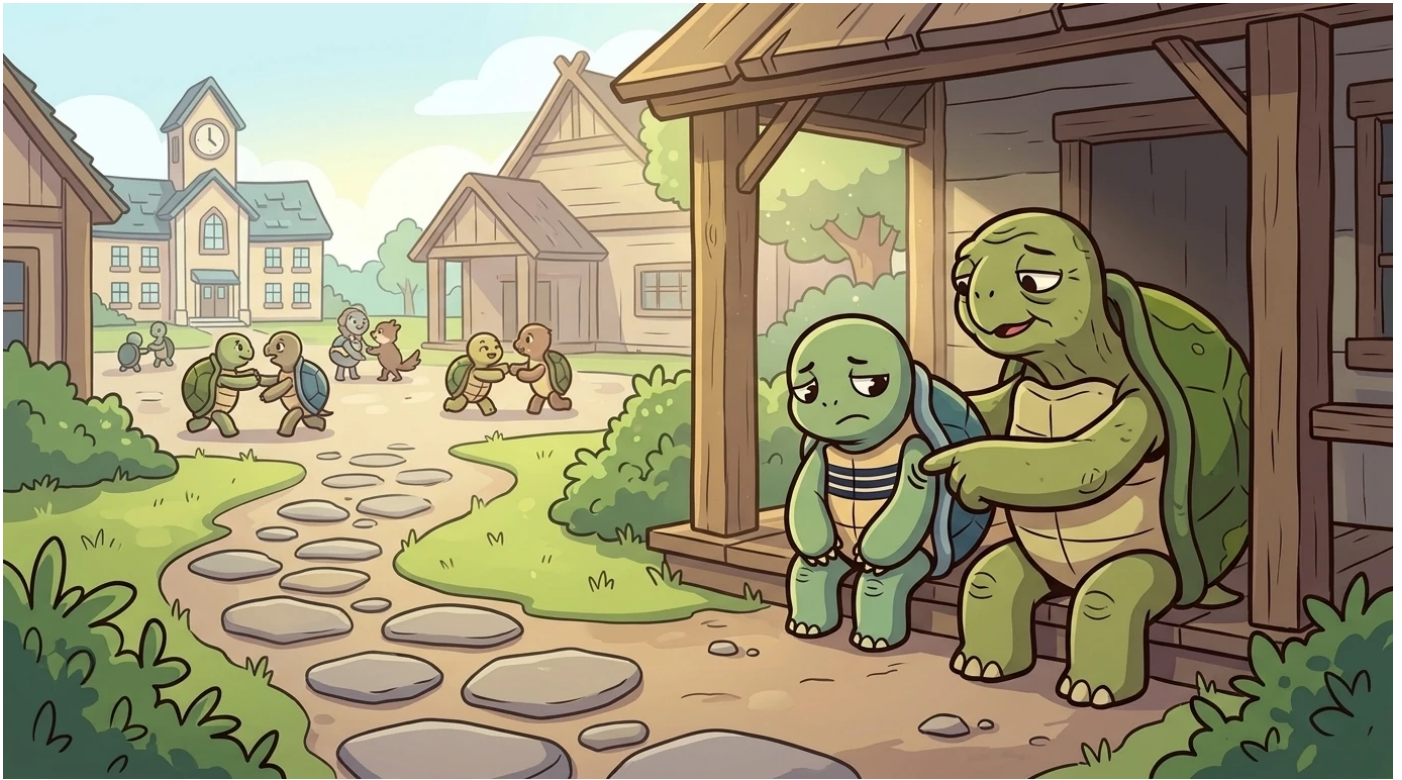
She wasn't hugging, quite. It was fiercer than a hug — three separate holds, one arm over another, wound so tight the two of them had become a single steady lump in the grass. All morning the wind had pushed at them. A gang of restless hydrogens had tried to tug one of them loose to play. Even Oxy had drifted close, offering to trade. The two tortoises hadn't budged. They just breathed, slow, and held on.

A younger tortoise flopped down nearby, out of breath from chasing everyone else. "You two have been stuck like that since sunrise," he said. "Don't your arms get tired?"

"Tired isn't the word," Nitra said, not opening her eyes. "We're *locked*. Three grips. Try to pull us apart and see."

The young one grabbed one of her arms and heaved. Nothing. He braced a foot and heaved harder. The whole knot of them barely rocked.

"It'd take a lightning bolt," Nitra said, and finally cracked one eye open, amused. "Or a very patient little creature living in the roots of a bean plant. Nothing gentler than that gets me to let go." She settled deeper. "That's the whole truth of me. I'm slow to grab hold of anything. But once I do — three arms, all in — I don't come loose."



Nitra had learned the worth of a slow, strong grip in her village, when she was small.

Her family were the deliberation-keepers — the tortoises who went to every council meeting, listened to every side, and only spoke once they were sure. And little Nitra had hated it. The other cubs bonded fast, made friends in an afternoon, traded and swapped and moved on by the next day. Nitra couldn't. She held back, and held back, and by the time she was ready to reach out, everyone had already paired off. She felt left over. She felt *wrong* — like being slow to warm up meant something in her was broken.

Her grandmother had found her sulking under the porch. "You feel too slow, don't you? Like everyone bonded and you got left behind?"

Nitra had nodded, her chin tucked into her shell.

"Listen to me, little one. The fast bonds — the easy afternoon friendships — a lot of them come apart just as easy. A puff of wind and they're gone." Her grandmother tapped Nitra's chest, right over the three navy stripes on her band. "But when *you* finally take hold of something, you take hold with everything. Three arms. All in. And it *lasts*. Slow to reach is not the same as broken. It's the price of a grip that doesn't slip."

Nitra didn't make a friend that day. But the left-out feeling changed. It stopped feeling like *too slow* and started feeling like *worth the wait*. And when she finally did make a friend, a season later, that friendship held for the rest of her life.

By six she understood the family secret in her own body: slow to engage, strong when engaged. The strength was *in* the slowness, not in spite of it.

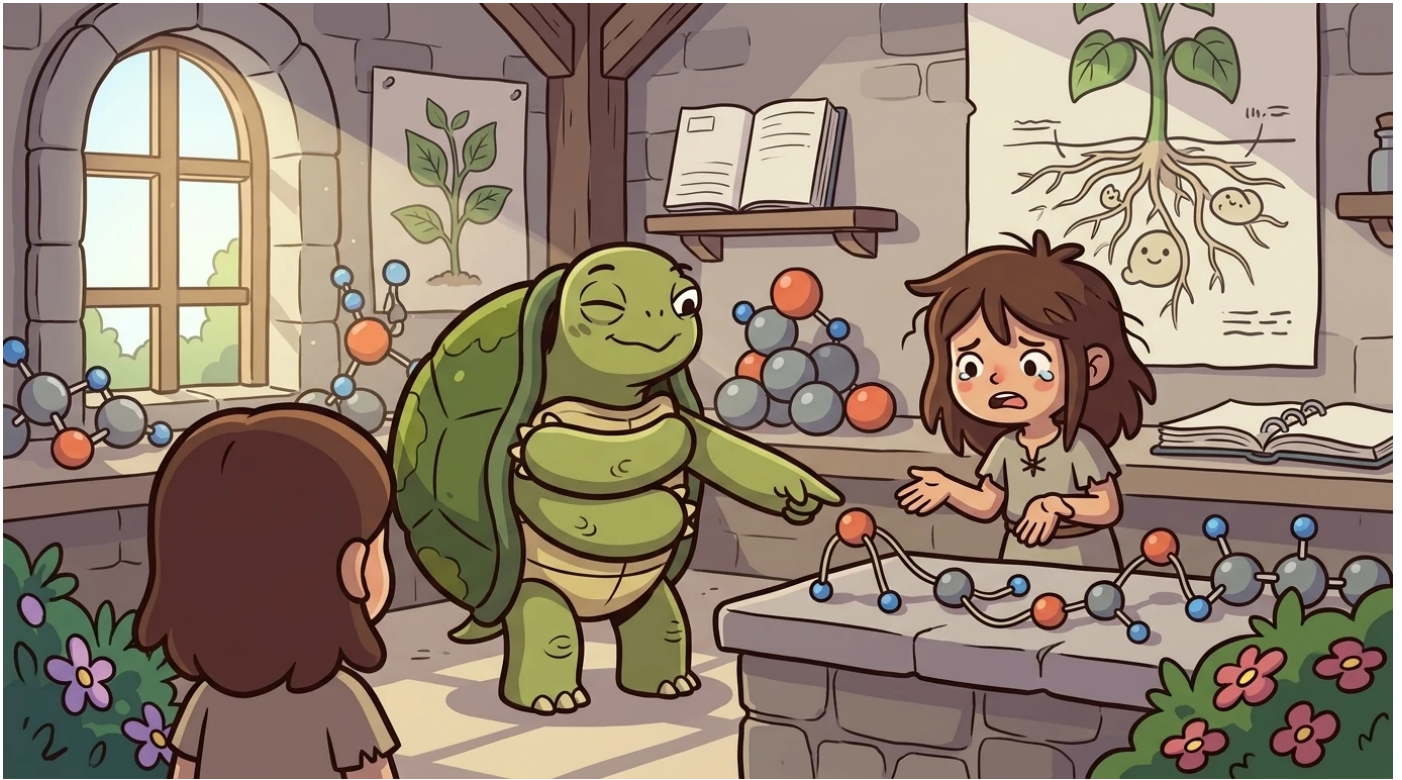


She walked to the ChemQuest academy at twenty-two. Beaker met her at the gate and asked one question. "What is nitrogen?"

Nitra didn't rush to answer — she never rushed. She looked around the courtyard until she found another nitrogen, walked over, and locked arms with them: one, two, three grips, wound tight. Then she turned back to Beaker, the two of them one solid knot.

"This is the air you're breathing," she said. "Almost four out of every five breaths is two of us, holding on like this. Three arms each. And we don't join in with anything — not the fire, not your lungs, not the rest of the chemistry rushing around us — because you can't get us to *let go*. It takes a lightning bolt, or tiny root-bacteria working slowly, or the heat of a great factory, to break this grip." She loosened, at last, and stepped back. "But once something *does* break me open, and I take a new hold — with hydrogen, with carbon — I lock in just as hard. That's why proteins stay strong. That's why the code in you lasts for decades. Three arms. Slow to grab. Sure to hold."

Beaker watched the knot come apart only because she chose to let it. "You belong here," he said.



Nitra's workshop was the calmest room in the academy, because she wouldn't be hurried.

A girl came in one afternoon, frustrated near to tears. She'd been trying to build a protein all morning and it kept sagging apart. "Everyone else's stuff snaps together fast," she said. "Mine falls to bits. I think I'm too slow at this. I think I'm bad at it."

Nitra recognized that exactly — the left-behind feeling, the sure-you're-broken feeling. She'd carried it herself under a porch a long time ago.

"Come here," she said, unhurried. "Show me where it's failing."

The girl laid out her half-built chain: a row of carbons, some oxygens, some hydrogens, drooping at the joints.

"There's your trouble," Nitra said, and pointed at a sagging seam. "You've got no lock in the links. Watch." She stepped into the gap herself, reached one arm to the carbon on one side and pinned it, hard. The seam went rigid. She did it again at the next weak point, and the next — one nitrogen locked into each joint — and the whole chain stopped drooping and stood up straight, holding its own weight.

"That's a peptide bond," Nitra said. "Carbon on one side, me on the other, gripped tight. String enough of those together and you've got a protein that won't sag — the kind that builds a muscle, or carries air through your blood, or lasts long enough to be worth building at all." She tapped a joint. "The reason it holds isn't that I'm eager. I'm the *opposite* of eager. It holds because when I finally take a grip, I take it with everything I've got."

The girl pressed the chain. It didn't budge. "So it works *because* it's slow?"

"It lasts because it's slow," Nitra said. "Same thing, in the end."



Later, when the workshop was quiet, the girl came back with one more question, softer now.

"When you're waiting all that time," she said, "not bonding, not joining in — doesn't it feel lonely? Like you're missing everything?"

Nitra thought about the porch, and the left-over feeling, and her grandmother's slow warm voice.

"It used to," she said honestly. "I thought slow meant I'd end up alone. But it's the reverse. All that holding-back isn't emptiness — it's *choosing*. I'm waiting for the hold that's worth locking three arms around forever." She looked at her own crossed arms, wound tight out of habit. "And when I find it, I never have to wonder if it'll last. I already know. That's the quietest, surest feeling there is — knowing that the thing you finally reached for isn't going anywhere. That whatever you built together will still be standing long after the fast, easy things have blown away."

The girl nodded slowly, and Nitra watched the frustration ease out of her — the same way, years ago, the left-behind feeling had eased out from under a porch.

She didn't say the rest out loud, but she felt it, steady and warm all the way to her shell: *slow to bond is not the same as broken. It only means that when I finally hold on, I hold on for good — and being held like that, and holding like that, is the safest feeling I know.*

Sodi

*SODIUM (Na) — *generous, impulsive; always giving away electrons*. One extra outer-shell electron; gives it up readily; basis of ionic compounds; pairs with Chlorine to make table salt NaCl.*



- prompt: "Sodi feels lighter and happier once she gives her extra electron away. Have you ever felt that warm, glad feeling that comes from giving something to someone who needed it?"
 - prompt: "How does it feel when you hand off something you were carrying and someone else is happy to receive it?"



Sodi was a small rabbit. Her right palm was always open. It stretched out to you. Her eyes were bright and eager.

Sodi was small. Her fur was warm grey, cream, and soft russet. She moved in quick, bouncy hops. Her eyes were always bright. She loved to give things away. Her special thing was her open right palm. It always faced up. A tiny glowing dot floated just above it. This dot was her extra electron. She really wanted to give it away. Sodi almost never closed that hand. She was always ready to offer.



It was important to know this. Sodi never said she was just 'generous.' She always explained why. "I have one extra electron," she'd say. "That's it. My outer shell has one electron. If I give it up, my next shell down is full. That full shell becomes my new outer shell. It makes me much more stable. So I give it up all the time. People call that 'generous.' But it's really just me wanting to be stable. Once I give my electron away, I become Na^+ . I'm a positive ion then. I'm stable. I'm happy."

Sodi grew up in a small village. Her family had a special job there. They were the village's gift-bearers. Each spring, they carried welcome-gifts. They went from house to house. It was a big festival. This job meant always giving. You couldn't expect anything back. A gift-bearer who waited was not good. One who kept gifts was useless. But a rabbit who gave freely? And then moved on? Everyone loved them. Sodi learned this by age six. Giving was her family's special skill. It made her happy. It gave her movements a clear path. It made her feel steady.



Sodi bounded to the ChemQuest academy. She was twenty-two years old. Professor Beaker met her there. "What is sodium?" he asked. Sodi stood tall. She held out her open palm. "I have one extra outer-shell electron," she said. "I give it away every chance I get. That makes me Na^+ . I'm a stable positive ion. I pair with anyone who needs an electron. Especially Chlora. We make table salt, NaCl . The giving is how I find stability. Once I'm Na^+ , I'm happy." Beaker smiled. "You are appointed," he said.

In her workshop, Sodi started every first lesson the same way. Students sat on benches. They looked a little nervous. Sodi bounded to the front. Her ears twitched with excitement. She held out her open right palm. The small glowing electron-dot floated above it. It pulsed softly. "I am Sodi," she announced. "I teach the chemistry of *sodium*. Think of me as the generous giver. My big move is simple. I have one extra electron. I always give it away. Once I give it, I'm Na^+ . I'm stable. I'm done. Now, watch this!" She winked. "Watch me hand my electron to Chlora."



She taught the important facts about *sodium*. She called them the *sodium scaffolds*.

- First, *sodium* has one extra electron. Just one. It's in its outer shell. It's one more than it needs. It really wants to give it up. That makes it stable.
- Second, when *sodium* gives that electron away, it changes. It becomes Na^+ . That's a positive ion. Its inner shell is now full. That full shell becomes its new outer shell. It feels stable. It feels happy.
- Third, pure *sodium* metal is super reactive. It's not safe to touch. Sodi showed a video. A tiny piece of *sodium* hit water. *WHOOSH!* It fizzed and sparked. It gave its electrons to the water. It made gas and heat. "Never touch pure *sodium* without a grown-up," Sodi warned. "It's not for kitchen experiments!"
- Fourth, *sodium* loves *chlorine*. Sodi showed Chlora again. Sodi gave her electron. Chlora took it. Sodi became Na^+ . Chlora became Cl^- . They had opposite charges. So they stuck together. This bond is called an ionic bond. It makes table salt, NaCl .
- Fifth, *sodium* is inside your body. Yes, really! The Na^+ ions help your nerves send signals. They keep your body's water balanced. They help control your blood pressure. You get *sodium* from salty food. It's in many other foods too.
- Sixth, there's the *sodium-potassium pump*. It's in every cell. Your cells work hard. They push *sodium* out. They pull potassium in. They do this all the time. It takes a lot of energy. This pump helps your nerves work. It's super important for life.
- Seventh, remember Sodi's big rule. Don't just say *sodium* is 'generous.' She is generous *because* of her electron. Giving it away makes her stable. Her atomic structure makes her who she is. It's not just a feeling.

Sodi and Chlora

the IONIC BOND — one atom gives an outer electron and becomes a positive ion; the other takes it and becomes a negative ion; opposite charges pull them together into a repeating crystal (Sodi = Na, Chlora = Cl, together = table salt NaCl).



- prompt: "For a long time each of them felt like something was a little off — Sodi always holding something out, Chlora always waiting. Have you ever felt like you were carrying something you were ready to hand to the right person?"

The salt flats behind the chemquest lab were the flattest, whitest place in the whole valley, and Sodi loved them because you could give things away for a very long time before anyone told you to stop.

She was a small grey rabbit, and her right palm was always open, always turned up, always drifting out toward whoever was nearest. Just above that palm floated a single glowing dot — one electron, her spare, her one extra. It bobbed there like a soap bubble that would not pop. Sodi had been carrying it for as long as she could remember, and for just as long she had wanted, more than almost anything, to hand it to somebody.

"You could take it," she said hopefully to a passing lab cart. "It's a very good one."



The trouble was that Sodi gave to everyone, and almost nobody actually needed what she had.

She had offered her electron to Helio, who was full up and floated away without even slowing. She had offered it to Carbo, who already had four hands busy and no room for a fifth thing. She had pressed it, once, hopefully, toward a very polite rock, which said nothing at all. Each time, the glowing dot stayed stubbornly above her palm, un-given, and Sodi hopped home feeling a small odd heaviness that a rabbit so light really should not have felt.

Across the flats, in the cool shade under the loading dock, someone else felt the opposite kind of odd.

Chlora was a mantis-tween, bright yellow-green, sharp-eyed, and she sat very still with her right hand cupped upward like a small bowl. She was waiting. She had been waiting a careful, patient while. Her hand was cupped because there was exactly one thing missing from her — one electron, the last one, the one that would make her whole outer ring complete — and she had learned not to grab. Grabbing scared things off. So she waited, and watched, and stayed precise.



They met the way two people meet when one is always reaching out and the other is always holding still: eventually, and then all at once.

Sodi came bouncing along the shade of the dock, palm out, electron bobbing, calling her usual hopeful call — "Anyone? Anyone need a spare?" — and she nearly hopped straight past the still green figure in the corner. But Chlora's sharp eyes had already locked onto the little glowing dot above Sodi's palm, and Chlora's cupped hand had already lifted, just slightly, the way a plant leans at a window.

"You," said Chlora, very quietly, so as not to scare it off. "You're carrying one. A spare."

"I am!" said Sodi, so delighted that her ears stood straight up. "Do you — I mean, would you — is it possible you actually need —"

"One," said Chlora. "I need exactly one." She held her cupped hand out, steady as glass. "I have been waiting for exactly one."



Then Sodi turned her open palm toward Chlora's cupped one, and let go.

The glowing dot lifted off her hand — it had never done that before, not once, not for the cart or Helio or the polite rock — and it drifted the short bright distance between them and settled into the bowl of Chlora's waiting hand. Chlora's fingers closed around it, gentle and exact. Her whole outer ring, which had glowed uneven and gap-toothed for so long, went smooth and full and quiet.

And then the strangest, best thing happened.

The moment the electron crossed over, Sodi — now one electron lighter — hummed with a small warm *plus*, a positive charge, like the top note of a bell. And Chlora — now one electron fuller — settled into a low steady *minus*, a negative charge, like the bell's deep bottom note. Plus and minus. And a plus and a minus, it turns out, cannot help but lean toward each other. An invisible pull drew them close, closer, until the small grey rabbit and the bright green mantis stood locked side by side, snug as two magnets, unable and unwilling to drift apart.

"Oh," said Chlora, looking at their joined shoulders in something like wonder. "*That's* what the pull is."

A young student named Streamer had wandered over to watch, and Streamer said, "Wait — so you're stuck together now? Forever?"

"Not stuck," said Sodi, wiggling happily against Chlora's side and not going anywhere. "*Fitted*. She took the exact thing I had too much of. I gave the exact thing she was short. Now she's a little bit minus, and I'm a little bit plus, and that's the whole reason we hold on." She beamed. "There's a name for the two of us together, you know. Sodium and chlorine, holding hands. You've eaten us. We're salt."



Later, when the cube was finished and the students had gone in, Sodi and Chlora stayed out on the salt flats, still shoulder to shoulder, watching the light go pink.

"I feel lighter," Sodi said, surprised. She flexed her open palm — empty now, and it didn't ache the way she'd half-expected. "I carried that thing so long. I thought giving it away would feel like losing something." She thought about it. "It felt like putting something down."

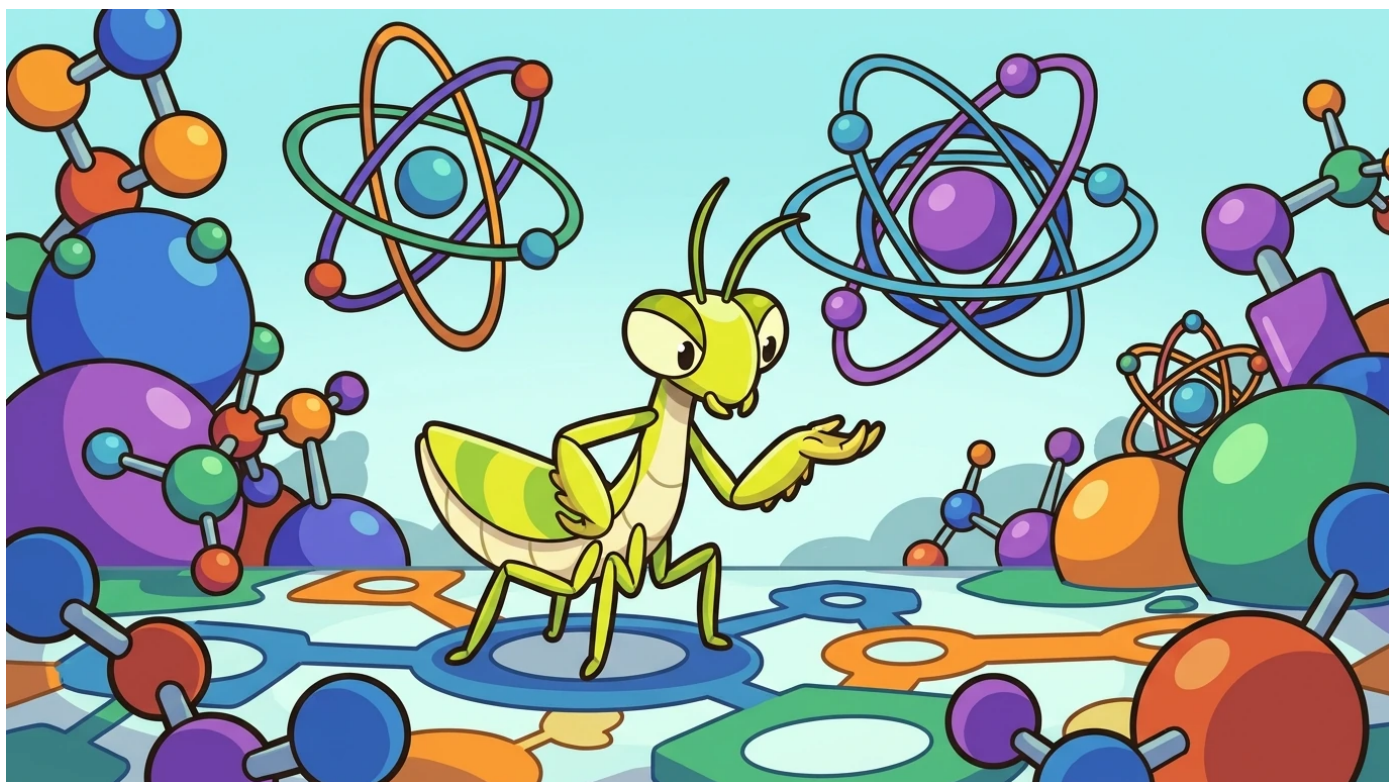
"I feel finished," said Chlora. Her cupped hand had relaxed at last; she didn't need to hold it out anymore. "Not full, like I ate too much. Just — done waiting. Settled." She glanced sideways at the small grey rabbit fitted against her side. "It's a strange thing, to spend so long carrying exactly what someone else was missing, and never know they were right there."

Sodi leaned her head on Chlora's green shoulder. The evening was quiet. Neither of them pulled away, because now they couldn't, and — more to the point — because neither of them wanted to.

"Warm," Sodi murmured. "Fitting next to someone is warm."

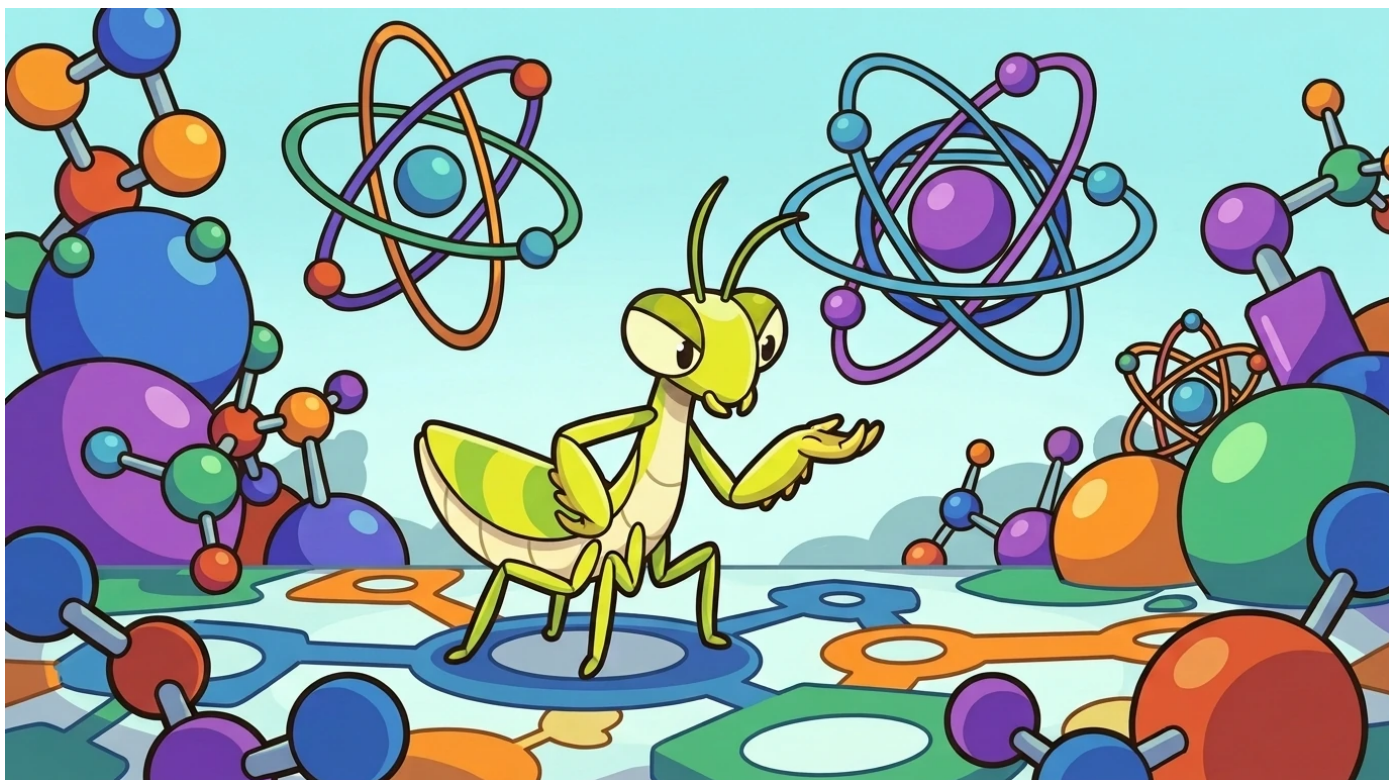
Chlora

*CHLORINE (Cl) — *sharp, focused; the collector who finishes what Sodi starts. One missing outer-shell electron; pulls one electron in eagerly; basis of ionic chlorides; pairs with Sodi to make table salt NaCl.**



Chlora was a small mantis-tween. She had one hand cupped up. It looked ready to catch something. Her eyes were sharp and focused.

She was small. Her body was bright yellow-green and cream. Her eyes moved quickly. She was very focused and precise. Her special thing was her right hand. It was always cupped. Her palm faced up. It looked like she was waiting for a tiny drop. Maybe a little pebble or a single berry. Her eyes stayed fixed. They watched for anything she needed. Chlora's whole job was to wait. She waited for just one electron. That electron would make her outer shell full.



This was super important. Chlora showed everyone about **chlorine (Cl)**. **Chlorine** has seven electrons on its outside ring. But it really wants eight. So, **chlorine** is missing just one electron. Sodi really wanted to give away her extra electron. Chlora really wanted to take one. They both wanted something.

When Sodi and Chlora met, Sodi gave her electron to Chlora. Sodi became Na^+ . Chlora became Cl^- . They had opposite charges. Opposite charges pull together. Together, they made NaCl . That's **table salt**. This was the main way to show an *ionic bond*. Two atoms changed in two steps. Then they made one strong *ionic compound*.

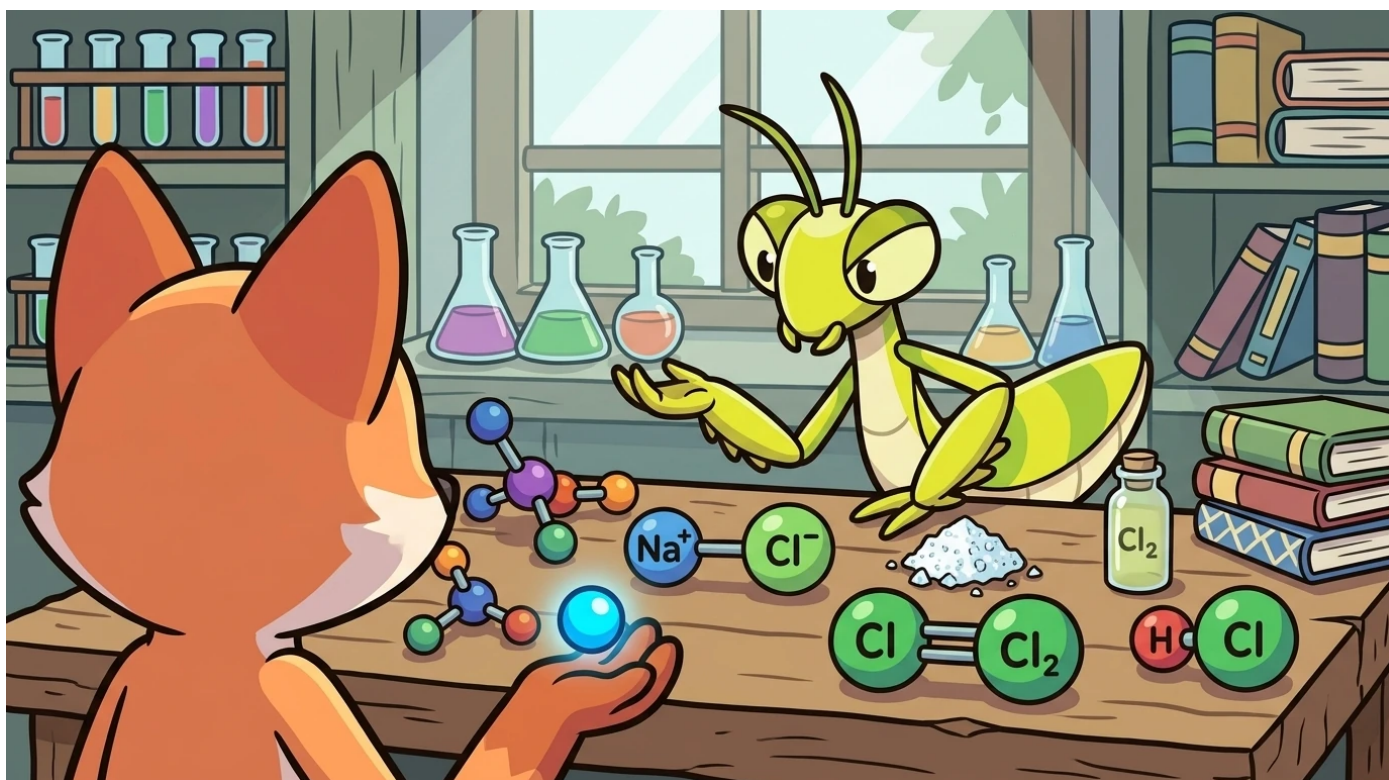
(Chlora often worked with Sodi. They showed things in class together. Their lessons were planned to match up. They showed up in Kit 6. They were the main example of an *ionic bond*.)



This was key: Chlora never said she was grabbing electrons. She never acted like a bully. She always made it clear. "I have seven electrons on my outside ring," she would say. "I want one more. Sodi offers me her extra electron. So I take it. But only because she offers it. We both become stable. I turn into Cl^- . She turns into Na^+ . We stick together because our charges are opposite. Taking means we both get what we need. If Sodi didn't have an extra, I wouldn't take anything. I would just stay as a Cl_2 molecule. That means I'd pair with another **chlorine**. We would share electrons instead."

Chlora grew up in a small village. Her family had a special job there. They were the harvest-receivers. They were mantises who ran the village storehouse. Field-workers brought in their crops. Chlora's family took them. They wrote down every single thing. Then they put it in the right storage spot. This job needed careful receiving. A receiver who took the wrong crops was no good. One who miscounted was useless. Putting things in the wrong place was a big problem. But a receiver who took exactly what was offered? Who wrote it down perfectly? Who stored it right? That person was vital. They helped the village survive winter. By age six, Chlora knew something important. Receiving was a skill. It was a craft all its own. Being exact when you received finished the giving. It made the giver's job complete.

When she was twenty-two, she walked to ChemQuest academy. Beaker asked her a question. "What is **chlorine**?" he said. Chlora answered, "I am missing one electron. Someone offers me the missing one. Like Sodi. I take it. I become Cl^- . The giver becomes positive. Opposite charges pull together. That's the main *ionic bond*. If no one offers, I stay paired. I'd be with another **chlorine** atom. That's Cl_2 . It's a *covalent bond*. But with an offerer, an *ionic compound* forms." Beaker just nodded. "You are appointed," he said.

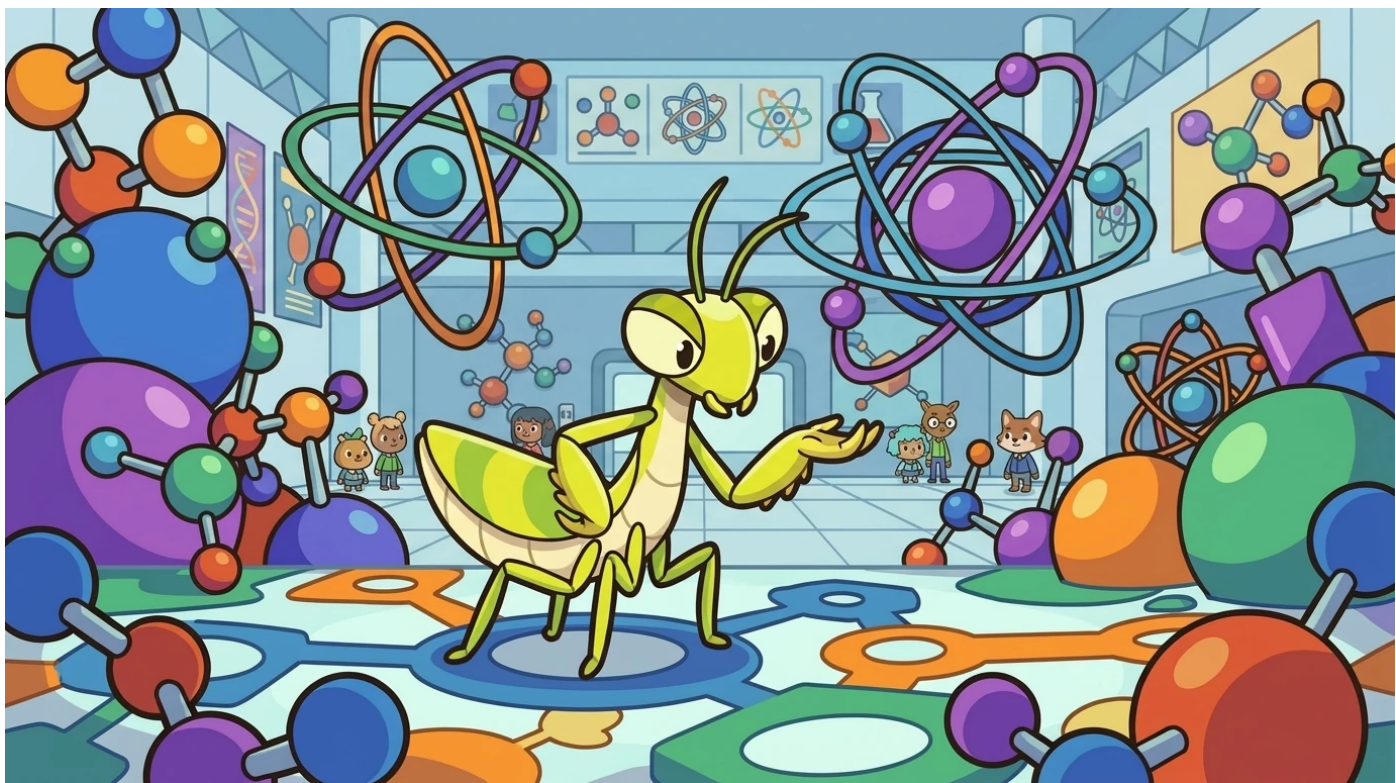


In her workshop, Chlora started every first lesson the same way. She sat down at the workbench. Sodi sat across from her. They often worked together. Chlora held up her cupped hand. She said, "I am Chlora. I teach about **chlorine**. I am the focused receiver. My job is one missing electron. I wait to take what's offered. Sodi offers her extra. I take it. We both become stable. Opposites attract. Watch this."

She taught the main ideas about **chlorine**:

- **Chlorine** is missing one electron. (It has seven on the outside. It wants eight.)
- When **chlorine** takes an electron, it becomes Cl^- . (It's a negative ion. It's stable and happy.)
- Cl^- pairs with Na^+ . This is an *ionic bond*. (Opposite charges attract. NaCl , or **table salt**, is the best example.)
- Cl_2 pairs *covalently* when no Na^+ is around. (Two **chlorine** atoms share one electron each. This fills both their missing spots. This is Cl_2 . It's **chlorine gas**. It has a sharp smell. Factories use it sometimes. Be careful! **Chlorine gas** is poisonous. Don't use it for kitchen science.)
- *Hydrochloric acid* is HCl . (Hydra and Chlora pair *covalently*. In water, it breaks apart. It becomes H^+ and Cl^- . It's a strong acid. It's in your stomach. It helps you digest food.)
- Sodi and Chlora show this. (They do a demo in Kit 6. Tugger helps them. It teaches about *ionic bonding*.)
- Don't just think of it as personality. (Chlora "takes" because she needs one electron. "Sharp" means it happens fast. That's *electronegativity*. An atom's structure *is* its personality.)

She made it very clear. "I'm in your stomach right now," she said. "I'm Cl^- in your stomach acid. I help digest your food. I'm in every grain of salt you eat. I'm bonded with Sodi. Once I have my electron, I stop taking. My work in your body happens after that. It's chemistry that needs me to be a stable Cl^- ion."



Students often asked Chlora. Was **chlorine** chemistry hard? Chlora always gave the same answer.

"It's not hard," she'd say. "It's one missing electron. It waits to be filled. Find a giver. Both become stable. Opposites attract."

Her cupped hand stayed up, patient and open. And when the next electron finally came to her, she felt that same quiet warmth she always did — the calm, glad feeling of being exactly ready for what she needed, and of finishing what someone else had started.

Helio

HELIUM (He) — noble gas; peaceful, floaty, complete; the contented onlooker. Two outer-shell electrons (a full duet); doesn't bond with anything; the picture of atomic stability.



The ChemQuest workbench was a scramble that afternoon. Sodi rushed past with her open hand out, trying to give away a spare electron. Chloro cupped her hands, hungry to take one. Oxy darted around with two empty pockets she was desperate to fill. Everyone wanted something. Everyone was reaching.

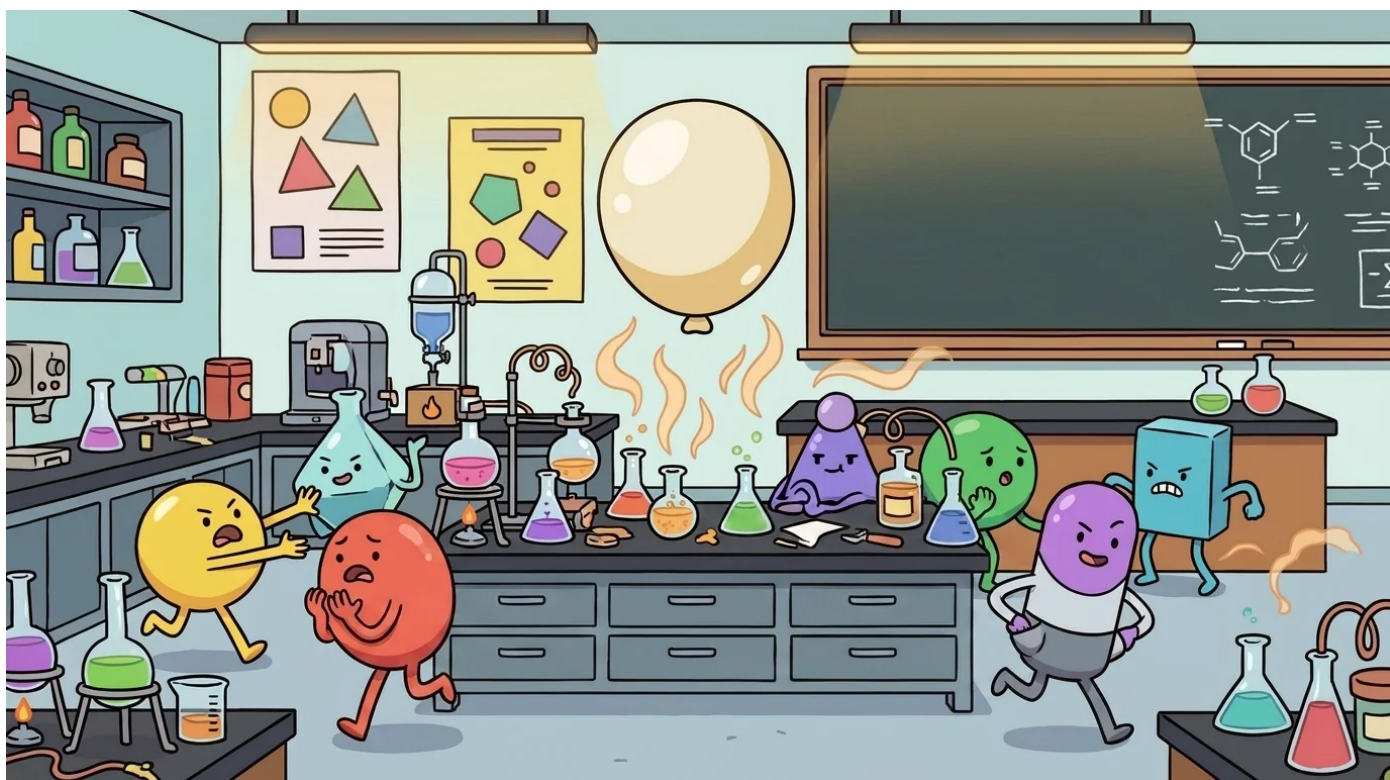
Above the whole busy scene, one small figure floated at about head height, going nowhere in particular. Helio was a smooth, round, cream-and-pale-gold balloon with no arms, no hands, and no face — just a gentle, drifting shape that bobbed in the warm air rising off the bench. While the others chased and grabbed and gave, Helio simply hovered, calm as a nap.

A young student named Fig stopped and stared up at the balloon. "Why doesn't that one do anything?" she asked the mentor, a careful figure named Beaker.

"Because Helio doesn't need to," Beaker said. He pointed up. "See — no reaching hand, no open pocket, no signal that Helio wants a single thing. That's not laziness, Fig. That's the whole point. Look at everyone else in this room, working so hard. They're all trying to reach the exact place Helio's already standing."

Fig looked at the frantic bench, then back up at the still, floating balloon. "They want to be like that?"

"Chemically? More than anything," Beaker said.



Helio didn't come from a village like the other cast members. Sodi had her salt-gatherer family; Oxy had her hummingbird nectar-collectors; Phossa had her spark-keepers. Helio had none of that.

Beaker liked to tell the story this way. High up, far above any village, in the thin cold air near the top of the sky, lighter-than-air things drift and rise. That's where Helio belongs. Helium is lighter than the air around it, so it floats up and up. It doesn't gather in a workshop with a craft-family. It doesn't dig anything out of the ground. Most of Earth's helium seeps up slowly from deep in the rocks, escapes into the sky, and eventually drifts off into space, alone.

So Helio grew up solitary, by nature — not lonely, exactly, but complete on its own from the very start. While other little atoms were learning to give and take and share, Helio had nothing to learn. It was already finished the day it formed: one shell, filled with its two electrons, snug and whole. There was nothing to reach for, because there was nothing missing.



Helio floated up to the ChemQuest academy at twenty-two, drifting through the door on the warm draft. Beaker met it there and asked the door-question the way he asked everyone.

"What is helium?"

Helio, of course, said nothing — it has no mouth and never speaks. But it settled in the air in front of Beaker, perfectly still, perfectly round, wanting nothing. And Beaker, who had spent a long time learning to read that stillness, understood.

"Two electrons," Beaker said aloud, translating the quiet. "One shell. Full. Done. No reaching. No bonding. Stable exactly as it is." He smiled up at the little balloon. "That's the answer. Welcome to the academy. We'll need you here — the others need something to aim at."



On the first day of the noble-gas lesson, Beaker gathered the students at the bench while Helio hovered overhead, silent and serene.

"This is Helio," Beaker said. "Helium. A noble gas. Now — look closely at Helio, and tell me what you *don't* see."

Fig squinted up. "It doesn't have arms. Or hands. Or pockets."

"Right," Beaker said. "Every other atom in this room has a signal for what it wants. Sodi's open hand says give. Chlora's cupped hands say take. Oxy's empty pockets say fill me. Helio has none of that — because Helio doesn't want anything at all. Its little shell already holds both the electrons it can hold. Full. Nothing to chase."

He held up a chart of the far-right edge of the big element table. "There's a small family like Helio — the noble gases: He, Ne, Ar, Kr, Xe, Rn, Og. Their outer shells are all filled up, so under normal conditions they don't bond with anything. They just float around being themselves, content."

Fig frowned. "But everybody else is working so hard to grab and give and share. Why?"

Beaker's eyes crinkled. "That, Fig, is the best question in the room. They work so hard because they're all trying to reach a filled shell — trying to feel as settled as Helio already feels. Sodi gives an electron away to get there. Chlora takes one. Oxy and Hydra and Carbo share. Different roads, same destination: full and stable. Helio is the one who was born at the finish line."

He tapped the chart. "For most atoms, the lucky number that means 'full and settled' is eight. For helium alone, because it has just one tiny shell, the number is two. Two electrons, one shell, complete."

Helio drifted lower for a moment, catching the light, then rose again.

"And helium isn't only a lesson," Beaker added, warming to it. "Because it's lighter than air, it lifts balloons and airships. Chilled down colder than you can imagine, it cools the giant magnets inside hospital scanners and other powerful machines. And unlike some lighter-than-air gases, helium won't catch fire — which is why it's the safe choice to put in a party balloon." He grew quieter. "One more thing, though: there isn't an endless supply. Once helium floats up and off into space, it's gone. So it's worth not wasting."



When the students had questions, they came to Helio and stood beneath it, and Beaker would speak the answers on its behalf while the little balloon simply held still above them. Nobody minded. There was something restful about it — a corner of the busy bench where nothing was being chased.

At the end of the day Fig lingered, looking up.

"Is it strange," she asked Beaker, "being finished already? Not needing anything?"

Beaker considered the drifting, faceless shape a long moment. "I don't think Helio finds it strange at all," he said. "I think it just feels quiet. Settled. Whole." And Fig, looking up at that calm round thing floating in the warm air, felt her own shoulders come down and her breath go slow — the soft, easy feeling of being somewhere peaceful, wanting nothing, exactly as she was.

Sulfa

SULFUR (S) — the smelly, generous element. Two bonds, flexible chemistry. Stinky in volcanoes; structural in your hair.



At the edge of the ChemQuest courtyard, a small skunk-tween in a yellow-stained apron knelt over a cracked-open geode and breathed in like it was fresh bread.

"There you are," Sulfa murmured to the little glint of yellow inside the rock. Around her, three students had backed off, wrinkling their noses. One of them fanned the air.

"It *stinks*," the tallest one said. "Like rotten eggs. Why are you *smiling*?"

Sulfa didn't look up. She turned the geode toward the light so the yellow crystals sparkled, and touched one with a careful claw. "You know what that smell is telling you?" she asked. "It's telling you I'm *here*. That's all a smell is — a message that got to your nose before I did." She held the rock up. "This came from deep down, near where the ground stays warm. The smell rode up through the water like a note passed in class."

"A note that says *ew*," the student said.

"A note that says *pay attention*," Sulfa corrected, gently. She wasn't offended. She'd heard it her whole life. She set the geode in the student's hands. "Go on. It won't hurt you to hold. Just don't lick it, and don't seal it in a jar — some of my cousins get grumpy in tight spaces." She grinned, and her stripe caught the sun, warm and friendly and not the least bit scary. "Everybody meets my smell first. Nobody stays for it. They stay for what I *do*."



Sulfa grew up in a village built around a warm, cloudy spring that smelled, frankly, like the inside of a boiled egg.

Her family looked after it — kept the stone channels clear, kept the little bath-house clean, kept the paths safe for the old folks who came to soak their sore knees on cold mornings. And every single one of those visitors, the first time, made the same face. Nose scrunched. Step back. *Ugh*.

Six-year-old Sulfa hated that face. She thought it was about *her*.

One grey morning she asked her grandfather, who was scrubbing algae off a channel, "Why does everyone come here if they think it smells bad?"

He wrung out his cloth and thought about it. "They don't come *despite* the smell," he said. "The smell is how they know the spring is real. The warmth in the water, the way it eases an aching hand — that all comes from the same deep place the smell does." He tapped the yellow crust along the channel's edge. "This is the whole reason the water helps. You can't have the good part without the strong part. They're the same thing wearing two coats."

Sulfa looked at the old woman easing into the bath, sighing with relief, no longer making the face at all. Something in Sulfa's chest went quiet and steady. The smell wasn't a flaw she had to apologize for. It was just the loud front door of a very generous house.

She stopped scrunching her own nose that day. And she never really started again.



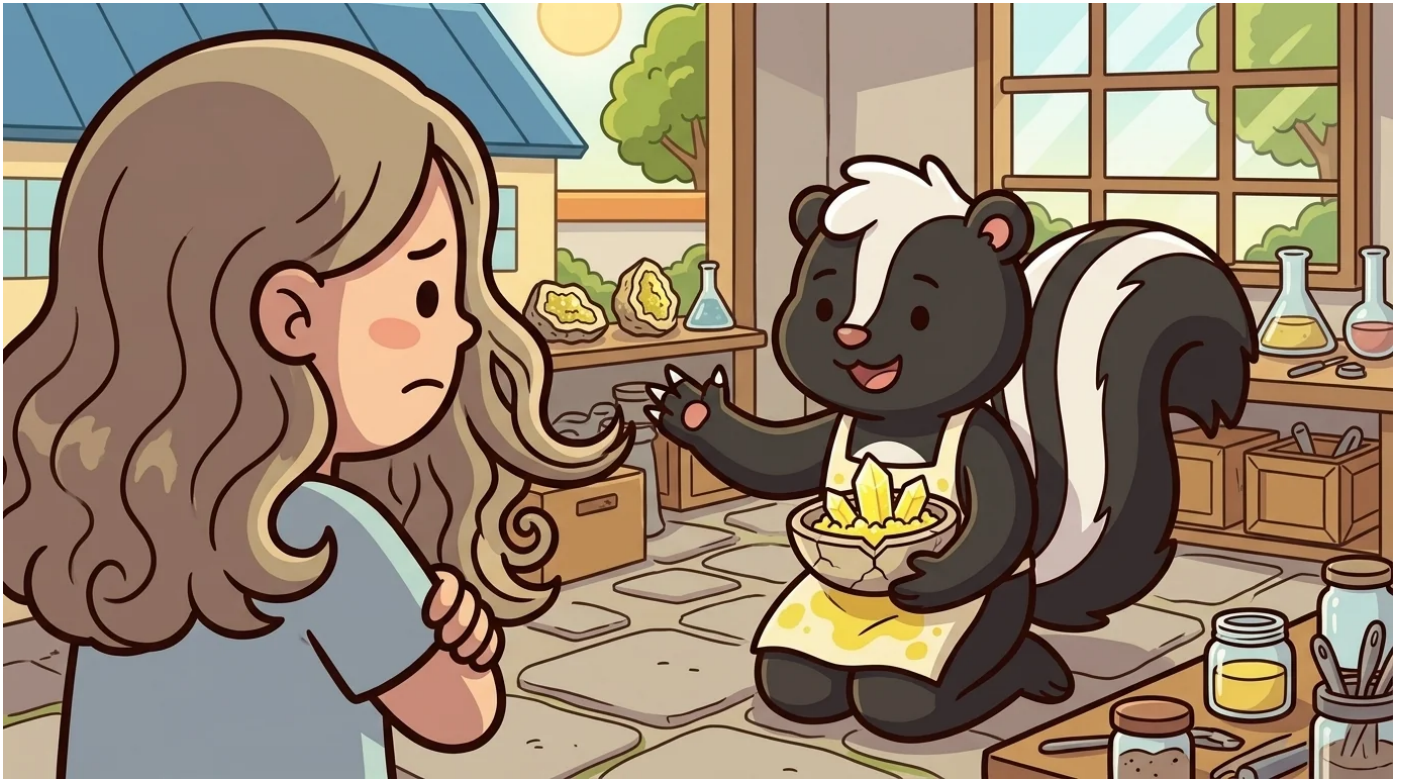
She walked to the ChemQuest academy at twenty-two, apron already yellow from years by the spring.

Beaker, the mentor, met her at the gate and asked only one thing. "What is sulfur?"

Sulfa didn't recite. She reached into her apron pocket, took out a strip of the same yellow crust from home, and set it on the low stone wall between them. "This is me at my loudest," she said. "Smelly. Everyone notices." Then she reached up and tugged one of her own coarse whiskers, stretchy and springy. "And this is me at my quietest. There's a little of me woven all through hair like this — the reason it curls instead of falling flat. Same element. Both jobs."

Beaker studied the yellow strip and the whisker for a long, quiet moment.

"You belong here," he said.



Sulfa's workshop always smelled faintly of warm eggs, and the students learned to stop minding within a week.

A girl came in one afternoon, arms crossed, cross about something else entirely. "The others say I'm *too much*," she muttered. "Too loud. First thing anybody notices about me is that I'm loud."

Sulfa slid a bowl of yellow crystals across the bench. "Smell that."

The girl leaned in and jerked back. "Gross."

"Now touch your own hair. The little wave in it, the way it holds a shape." The girl did, uncertain. "Same stuff," Sulfa said. "The bit that makes that smell and the bit that ties your hair into its shape — cousins. I'm the reason a curl stays a curl instead of going limp. Little bridges, holding the shape together from the inside where nobody sees."

The girl blinked. "The smelly thing is *also* the holding-together thing?"

"Every time." Sulfa leaned on the bench. "People meet my smell and they think that's the whole story. Loud, done, ew. But the loud part isn't the important part. The important part is quiet — I'm in your hair, your skin, tucked inside the little machines that keep you alive, holding their shapes so they can work." She tapped the bowl, then tapped her own chest. "The first thing they notice about you isn't the biggest thing about you. It's just the thing that arrived first."

The girl uncrossed her arms, slowly.

"Loud front door," Sulfa said. "Generous house."



Later, when the workshop was empty, the girl came back with one more question. She was quieter now.

"When you're holding something together," she said, "and nobody can see you doing it... doesn't it bother you? That they only ever notice the smell?"

Sulfa thought about the old woman sighing into the warm spring. About her grandfather's cloth and the two coats.

"It used to," she said honestly. "I used to think the smell was them deciding I was bad." She looked down at the permanent yellow blooms on her apron, the ones that never washed out, and she smoothed them almost fondly. "But the work doesn't need to be seen to be real. The curl still holds. The little bridges still do their job whether anyone's watching or not." She glanced at the girl. "There's a good kind of quiet in that. Knowing you're the reason something's still standing, even if nobody's thanking you for it. It doesn't feel like being ignored anymore." She paused, searching for the word. "It feels *steady*. Like being trusted with something important and being okay that it's a secret."

The girl nodded, and Sulfa watched the crossed-arm tightness ease out of her shoulders.

She didn't say the rest out loud, but she felt it, warm and certain under her yellow apron: that the loud thing people meet first is almost never the thing that matters most — and there's a deep, unbothered calm in being the quiet stuff that holds everything together.

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Methodology

Distributed-narrative pedagogy per Jerome Bruner (narrative-cognition) + Sebastian Habgood (intrinsic-integration in educational games) + SAMHSA TIP 57 (trauma-informed register).

Trauma-informed-design framework per Eggleston et al. (2025) and Stoltenburg et al. (2024).

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