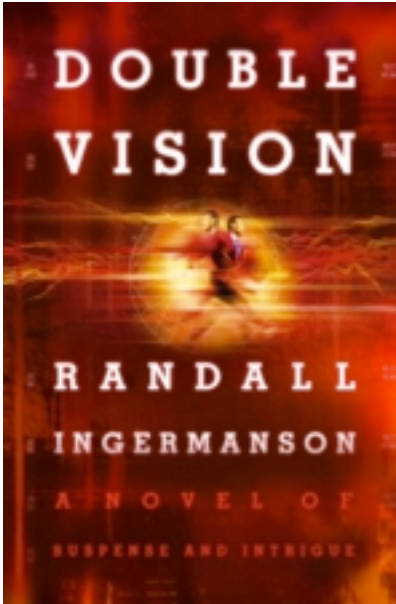


# Double Vision

Randall Ingermanson



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## PART ONE

# Point of Know Return

*“Consequently, the development of a fully operational quantum computer would imperil our personal privacy, destroy electronic commerce and demolish the concept of national security. A quantum computer would jeopardize the stability of the world.”*

**SIMON SINGH, *The Code Book*, p. 331**

# Chapter One

## Keryn

Keryn Wills was in the shower when she figured out how to kill Josh Trenton.

Her best ideas usually came that way, letting the white noise of the pelting spray drown out the outside world. Josh had to die. That was just the way things were. If you were the designated corpse in a Keryn Wills murder mystery, your mission was to die—whether you decided to accept it or not. The only question was how, and now Keryn had the answer.

All that remained was to slam it all down on paper before she lost it, and she had the whole Saturday ahead of her for that. Keryn twisted off the water and shoved back the shower curtain.

Smiley was sitting on the floor watching her, his blue eyes wide and glittery.

“What are you staring at?” Keryn grabbed her towel and began drying off.

Smiley yawned widely.

“You think I’m boring, is that it?” Keryn scowled at him. “Go on, admit it. I won’t be hurt.”

Smiley meowed and scurried out.

Keryn wrapped the towel around herself and dashed through her bedroom into her office. She grabbed a pen and began scribbling ideas on a white pad. *How Josh Dies. Must look like accident.*

The phone rang.

Keryn looked at the number on the caller ID. *Mom and Dad. Not now. Just let it ring.*

Botulism poisoning.

The phone kept ringing. Keryn reached for her copy of *Deadly Doses: A Writer’s Guide to Poisons*.

The answering machine picked up. “Hello, this is Keryn Wills. I’d love to talk to you, but I’m out. Leave a message and I’ll call you back as *soon* as I can.”

A click, and then her mother's voice. "Hi, honey, it's me. Rusty's still asleep. Long story, but just between you and me and the fence post, he got plastered again last night. Anyway, I just wanted to see how your big date went. Come on and pick up the phone, sweetheart. I know you're there. I want details—big, luscious, foaming details. You *are* home, aren't you? I swear, if you shacked up with that man on the first date, I'm going to call your preacher-creature and tell him you're nothing but a hypocrite, so pick *up* the phone or—"

Keryn snatched up the phone. "Hi, Sunflower."

"Sweetheart, I knew you were there. Now spill. Details. Remind me . . . what's his name again?"

Keryn took a deep, calming breath and exhaled slowly. "Dillon."

"I thought it was Rick or something."

"That's his last name. Richard." Keryn tapped her fingers on the desk, itching to grab *Deadly Doses* and start flipping pages.

"Dillon Richard." Sunflower pronounced it like a disease. "Sounds backwards. What kind of parents would name their boy Dillon Richard?"

Keryn ran her fingers through her wet hair and looked at the picture of her parents on her desk. The picture was five years old, and even back then, Sunflower's hippie ponytail had gone a dull and streaky gray. Rusty's hair wasn't rusty anymore. Mostly it just . . . wasn't. Sunflower and Rusty. Locked in a time warp where the sixties were still groovin' and life was free acid and psychedelic VW buses and Grateful Dead concerts.

"So hit me with some details, girlfriend."

Keryn sighed deeply. *Please, please, please grow up, Mom.* "We went to a play in La Jolla."

"That's it? A play? You didn't eat?"

"We ate. We went to a play. Dillon drove me home."

A moment of horrified silence. "And . . . ?"

"It was a first date."

"And you invited him in? Please tell me you had the sense to invite him in for coffee."

Keryn didn't say anything. It had been late, and Dillon said something about going shooting in the morning. *Shooting.*

"What's wrong with him?" Sunflower's voice had a note of desperate resignation.

"Nothing's wrong with him. He's a perfect gentleman."

"He's *how* old? Thirty-five? Got to be something wrong with him if he's never been married."

"He's shy."

"He asked you out, didn't he?"

Keryn hesitated. "Really shy."

"You're telling me *you* asked him out? Not a good sign, girl friend. Looks bad. Like you know your clock is ticking."

"My clock *is* ticking. It's a biological fact. I'm going to get old and die someday. And so are you. Have you . . . read that book I sent you?"

"I don't read books by preacher-creatures."

"Mom!"

Shocked silence.

Keryn regretted it immediately. That was the only way to shut up Sunflower. Hit her with a chunk of her own maternity. That annoyed her even more than her mortality.

Keryn heard a call-waiting blip on her line. She checked the caller ID. "Hey, um, Sunflower? I've got a call incoming from my boss. Can I call you back later?"

Sunflower slammed the phone down.

Keryn clicked the button on her phone to pick up the incoming call. "Hello, Grant. What's up?"

"Bad news." Grant O'Connell's gravelly voice sounded tired. "I know it's Saturday, but can you come in to work for a couple hours? We need to strategize."

Keryn looked at her scribbles on the paper and tried to remember exactly how Josh was going to die. "Um . . . sure." *I guess.* It had to be bad if Grant wasn't out golfing on a Saturday. "Can I ask what it's about?"

"Not on the phone," Grant said.

Keryn felt her pulse quicken. *Not on the phone?* This was starting to sound like one of her mysteries. Or maybe a John LeCarre. “I’m not dressed yet. What time do you need me?”

“Ten-thirty,” Grant said. “I’ve already called the others. Dillon can’t get in any earlier.”

Keryn wondered why she and Dillon would be invited to the same meeting. He was a Senior Engineer and she was Chief Financial Officer, and that didn’t give them a whole lot of common turf. “I’ll be there.”

“Don’t panic,” Grant said. “Everything’s going to be all right.” He hung up.

Keryn stared at the phone in her hand. It hadn’t occurred to her to panic until Grant told her not to. She put the phone down and headed back to her bedroom to get dressed.

She could already see that she wasn’t going to kill Josh Trenton today.

### **Dillon**

Dillon drove carefully into his favorite parking spot. The lot was empty. He stepped out and locked the car, setting the alarm. He walked once around the car and inspected each tire. A knot of anxiety clutched at his stomach. It was highly unusual for Grant to call a meeting on a Saturday. Highly unusual.

Dillon strode across the lot to the bridge. A thin trickle of water ran through the gully. Again, highly unusual. In June the gully should be dry. But this was no ordinary June. It had rained twice already, and it might rain again before the month was over.

“Hey, Dillon!” Clifton Potter leaned out of his SUV and waved at Dillon. “Why’d you park over in the main lot? There’s plenty of spots right here by the building.”

Dillon did not know how to explain, so he shook his head and shrugged. He had parked in his favorite spot because . . . it was his favorite spot. But Clifton was a Normal, and he could not be expected to understand that.

Clifton shoved his door open and hopped out. He slammed the door and turned to Dillon. “Do you know what’s going down?”

“You forgot to lock your door.” Dillon pointed at Clifton’s SUV.

Clifton shook his head. “Chill it, Dillon! There’s nobody here on a Saturday to mess with my car.” His long blond ponytail swished back and forth.

Dillon found this unnerving. He did not know why Clifton wore his hair so long. Nor did he know why Clifton used so much slang. Slang made a person hard to understand. After thinking for a moment, Dillon remembered that *chill* had a secondary meaning—something about relaxing. It made no sense to Dillon, but it made sense to Normals, and therefore he made an effort to learn such things. But he would rather that people said what they meant in the first place.

Dillon put a hand on Clifton’s SUV. “Last year, 23,378 cars were stolen in San Diego County. The most popular makes among thieves are Toyotas and Hondas. Eighty percent of all cars stolen were left unlocked. You should lock your car.”

Clifton studied him and the grin left his face. “Twenty-three thousand?”

“No, 23,378,” Dillon said. “That works out to approximately 8.3 stolen cars per thousand residents.”

“Dude!” Clifton pulled out his keys and pressed a button. The car beeped and the door locks clicked with a satisfying chorus of *thunks*.

Dillon smiled. You could never be too careful about such things.

“So how was your hot date with our famous author last night?” Clifton said.

Dillon paused for a moment, then remembered that *hot* had a secondary meaning that had nothing to do with temperature. “It went very well. We had dinner and saw *The Tragedy of Hamlet, Prince of Denmark*.”

“Spiff!” Clifton said. “‘To be, or not to be,’ huh?”

Dillon often felt off-balance when speaking with Clifton. Clifton used many words that other Normals did not. It made Dillon feel uneasy. Very uneasy. Dillon saw that he could easily change the subject to quantum mechanics, one of his favorite topics. “After the play, we talked about quantum mechanics and multiple universes.”

Clifton’s face took on an expression Dillon could not parse. “Dude! What’s all that have to do with *Hamlet*?”

“‘To be, or not to be,’” Dillon said. “The question Hamlet asks implies that he has a choice, correct? But all choices must be quantum mechanical in nature.”

“Um, Dillon, have you been smoking something?”

“Cigarettes are very unhealthful.” Dillon could not understand why Clifton kept changing the subject. “I explained to Keryn that all of physics is deterministic, with one exception. When you make a quantum measurement, the result is not determined. The only rational conclusion is that, if we truly have free will, it must be because our thought processes are quantum mechanical. Making a choice is equivalent to performing a measurement on our own brains. A decision defines who and what we are.”

“Dude, I bet Keryn thought that was real interesting.”

Dillon nodded. Keryn had found it highly interesting. “She had never heard that making a quantum measurement causes the universe to split into several parallel universes. In each of those universes, the result measured is different. Hamlet poses himself a two-state question: ‘To be, or not to be.’ When he makes his choice, his future splits in two. In one universe, Hamlet chooses to live. In a second universe, he chooses to die.”

Clifton was staring at Dillon with his mouth open.

Dillon felt calm again. The multiverse interpretation of quantum mechanics was logical. It was still not as popular among physicists as the old-fashioned Copenhagen interpretation, but the Copenhagen interpretation was not logical. Soon everyone would believe in the multiverse interpretation.

Clifton’s cell phone rang. He yanked it out of his pocket and pressed a button. “Yo, hello, this is Clif.”

Dillon turned to look at the gully. A mother duck and three ducklings paddled down the thin rivulet.

“Yeah, sure, Kendall’s a buddy of mine,” Clifton said. “You’re the dude who hooked him up with HP? Spiff, man! He had this bogus boss who thought he was God’s gift to lasers but didn’t know his head from a hole in the wave function. Know what I mean?”

Dillon was beginning to feel uncomfortable again. Clifton’s way of speaking grated on him.

“Hold on a sec.” Clifton’s voice had taken on a peculiar tone.

Dillon turned and saw Clifton walking away from him toward the corner of the building. Clifton looked back at Dillon. Then his head jerked around as if he were embarrassed by something.

Dillon put his hands behind his back and thought about the good time talking with Keryn last night. Keryn Wills was a writer. An intelligent woman. He had enjoyed very much talking with her. She was not a physicist or an engineer, but she had been very interested in how quantum mechanics tied in with *The Tragedy of Hamlet, Prince of Denmark*. She had a quiet way of talking that made Dillon feel comfortable. Also, she dressed neatly. She was a very nice person, and he hoped they could have more interesting conversations.

A horn honked. Grant O’Connell’s Lexus appeared at the far end of the building, gleaming in the sunlight. A Lexus was not stolen as frequently as a Toyota, but that was because more people drove a Toyota than a Lexus. Dillon made a mental note to remind Grant to lock his car.

The Lexus pulled up next to Dillon. Grant thumped out, his big ruddy face smiling. He had a bald head with a rim of gray hair around the back of his head. His huge white Santa Claus eyebrows made Dillon a little uneasy, but Grant was a good man and Dillon trusted him. The passenger door opened and a petite young woman sprang out. She had thick frizzy hair of a golden blond color, and she wore a garish pink-and-blue tie-dyed shirt that did not cover her navel. Her faded bell-bottom jeans had a hole in one knee and also did not reach to her navel. Dillon thought that she looked not quite fully dressed, and he felt embarrassed.

Grant came around the car and pounded Dillon on the shoulder. “Dillon, I’d like you to meet our off-site employee, Rachel Meyers. Rachel, this is Dillon Richard. He’s the one I was telling you about—the hotshot in C++ and hardware/software interfaces. Dillon, Rachel just got her Ph.D. from Caltech and eats that multiverse thing for lunch. Believe me, you two are gonna have a *lot* to talk about.”

Dillon looked at Rachel with interest. “You are a physicist?”

“Biophysicist.” She reached out a hand. “Glad to meet you, Dillon. Uncle Grant’s told me how smart you are, and I’m *really* looking forward to working with you.”

Dillon shook her hand and looked at Grant. “Rachel is your niece?”

Grant bellowed with laughter. “Virtual niece. She’s the daughter of the kid brother of my roommate at MIT. I changed Rachel’s diapers when she was a baby and watched her grow up, and she’s every bit as smart as her daddy, who happens to teach particle physics at Rutgers. Anyway, you’re gonna love her, Dillon.”

Another horn honked behind them. Dillon looked over Grant’s shoulder and saw Keryn’s old Honda jouncing over a speed bump. She pulled in next to the Lexus and came scurrying out. “Am I late?”

“Looks like we’re all here,” Grant said. “Let’s get this show on the road. Sorry to make you all come in on a Saturday, especially a great day like today, but let’s get it done.”

Keryn was looking at Rachel with an odd expression on her face.

“You should lock it,” Dillon said.

“What?” Keryn stared at Dillon blankly.

“You should lock your car,” Dillon said. “Hondas are one of the two most commonly stolen cars in San Diego County, and Civics are among the most popular models.”

## Chapter Two

### Keryn

Keryn did not like the way the blonde was looking at Dillon. She couldn't be much over twenty-two. Dressed like an airhead. Probably fresh out of college. Grant's daughter? No, he didn't have any kids. Probably a new receptionist or something. But that was crazy. There wasn't money to hire a new receptionist. Whatever. Keryn didn't like the way the airhead's flirty green eyes were drinking in Dillon.

Grant shot Keryn a huge smile. "Keryn, I'd like you to meet our off-site employee, Rachel Meyers. Rachel, this is Keryn Wills. She joined the team part-time back in March to help with the financials. She's our CFO and a really good one. Remember I told you about her? She's our author—written four or five books."

"Three," Keryn corrected him. "Number four is due in August." *And I'm way behind schedule.*

Rachel extended her hand. "Hi, Keryn. I'd love to read one of your books sometime."

Keryn shook her hand. "Um . . . right." She noticed with dissatisfaction that Rachel was not wearing a bra. It was some consolation that she clearly didn't need one. Keryn shifted slightly to her right and smiled at Dillon. "Good morning, Dillon." He was wearing a cream-colored cotton shirt and dark gray wool pants and a muted blue gray tie. Shiny leather shoes. Every other engineer in the company wore blue jeans and wrinkled T-shirts, but Dillon was . . . different. Not weird different. *Different* different.

Grant was striding away toward the corner of the building. "Hey, Clifton? Ready to go inside? We've got a lot to talk about!"

Keryn edged a little closer to Dillon and smiled at Rachel. "So, um, Rachel, what do you do for CypherQuanta? Marketing?"

Rachel gave her a little-girl smile. "Research."

Keryn nodded. *Market research.* Grant was probably paying her chicken feed to call up banks and brokerages to find out what their data encryption needs were. Which was fine, except for one teensy little detail—CypherQuanta didn't *have* chicken feed.

Keryn had discussed this nicely with Grant twice in the last month, and she had understood that he agreed. Absolutely no more employees until the next round of funding came through. Cash flow right now was tighter than a Tom Clancy story line, and there was not one extra dime. And now there was some new crisis, which was the reason she had come in to work today instead of killing off Josh Trenton.

Grant came steaming back with Clifton in tow. “Okay, now we’re all really here. Rachel, meet Clifton Potter, our Chief Technology Officer. Clifton founded the company with me six years ago, and it’s thanks to him we haven’t folded yet. Clifton, this is Rachel Meyers, girl genius.”

Clifton’s eyes widened and he looked Rachel up and down appreciatively. “*Very* glad to meet you, Rachel. What kind of genius are you, exactly?”

“She’s a biophysicist from Caltech,” Dillon said. “You will like her, Clifton. She knows all about the multiverse.”

Keryn blinked twice, feeling very stupid. *A biophysicist? A girl genius?* A very large lump settled in her throat.

“Let’s get inside, people.” Grant looked around nervously. He leaned close to Clifton. “Rachel’s made a breakthrough, Clifflie baby. A grade-A, gold-plated breakthrough that is gonna save our cookies if it pans out.”

“Spiff!” Clifton said.

Dillon was beaming at Rachel.

Keryn suddenly felt very ill.

### **Dillon**

Dillon sat down at the circular glass table in Grant’s office. He laid out a clean white pad of paper and a black Uni-ball pen. Keryn sat on Dillon’s left. Grant and Rachel sat across from him. Clifton took a seat on his right. The configuration felt asymmetric to Dillon. Better to have Rachel on his right and Clifton across from him. Then it would be—

“Let’s get started.” Grant’s voice sounded like a wheelbarrow crunching over gravel.

Dillon wondered if Grant had been getting enough sleep.

Grant began clicking a ball-point pen in his hand. *Click-click. Click-click.* “Lost Angels met yesterday, and I gave them a presentation.”

Rachel’s eyebrows went up. “Lost Angels?”

“Our angel investors,” Keryn said. “A Los Angeles high-tech investment club. They funded us for another year last December. Right now they own forty-two percent of CypherQuanta.”

“Correction,” Grant said. “They funded us in two tranches, contingent on meeting sales milestones.”

“What’s a tranche?” Rachel said.

“A pile of money.” Grant clicked on his pen. “In our case, not a very big pile.”

Dillon did not like the Lost Angels group. They were abrasive and rude, and they had taken unfair advantage in the negotiations last December. For a week, Dillon had been afraid Grant might have a heart attack.

“We’re ahead of our sales mark,” Keryn said. “We needed to place ten units in Q1 and Q2, and we placed thirteen.”

Grant’s face twisted as if he had just drunk a glassful of vinegar. “Bank of America is returning four units.”

A hiss ran around the table.

Dillon felt as if he had been slapped. He had worked overtime to customize the software on those machines. Speed had been a major issue on that contract, and he had found a clever algorithm to get an extra factor of 2.1 in throughput.

Grant *click-clicked* the pen again. “According to them, the units, quote—do not meet our requirements—unquote.”

“And that means . . .” Keryn sounded like she was being strangled.

Grant slammed his open palm on the table. “Lost Angels is cutting their losses. They’re canceling the second tranche and putting the word out that CypherQuanta is a lost cause.”

Clifton swore loudly.

Dillon felt his stomach tighten. It was a terrible blow to have Lost Angels pull out now. Even so, that did not justify taking the Lord’s name in vain, especially when there

were ladies present. Clifton Potter was a nice enough person, but he ought not to curse in front of ladies.

Keryn was clenching her pen so tightly Dillon could see the whites of her knuckles. “Um, Grant, how are we going to make payroll at the end of the month?”

“That’s . . .” Grant cleared his throat and looked around the table. “That’s why I called this meeting. We’re not getting that second tranche, and we’re also not going to get paid on the invoice from B of A. Plus, we’re out the cost of parts for those four units.”

Clifton leaned back in his chair. “Man, that is so bogus! We met the acceptance criteria on that contract!”

“There was a clause that it had to meet spec for ninety days,” Grant said. “They claim its performance has degraded.”

“Bunch of wallies,” Clifton said. “Let’s send Dillon over there. He’ll get it working.”

Keryn drummed her fingers on the table. “Right, let’s send Dillon.”

Grant shook his head. “It won’t do any good. I’ve heard something, very back-channel, but I think it’s accurate. Somebody on the Lost Angels board has it in for us and is chummy with someone at Bank of America. We’re doornails.”

Dillon did not see how they could possibly be doornails. It must be a metaphor. He did not like metaphors, because they asserted things that were not true. There was often an interesting explanation for a metaphor, but today he did not have time to ask for an explanation. He must focus on solving this problem. This disaster could bankrupt Grant, and that was not acceptable. Grant had spent a fortune of his own money to start the company. Had it not been for the recession, they would have gone public by now and Grant would have earned back his investment. Dillon could find a job somewhere else, but Grant was almost ready to retire, and his only marketable skill was that he knew how to take risks and make money. Now he had taken an enormous risk and might lose all his money.

Keryn sucked in her breath. “Listen, I know this is going to sound harsh, but . . . I think we need to take steps to maintain the financial integrity of the company. Right away.”

“Meaning layoffs,” Clifton said in a glum tone.

“No,” Grant said. “I’ve earned the team’s loyalty, and I’m gonna be loyal to them. No layoffs.”

Keryn sighed deeply. “Grant, I really think we have to worry about keeping our nose above water.”

Dillon remembered that Keryn used this metaphor when she meant that they must stay financially solvent. A nose had nothing to do with money, but it was Keryn’s way of talking.

Grant looked steadily around the table, and there was an odd gleam in his eyes. He smiled. “There may be a way out. I’m pretty sure there’s a way out. Keryn, how long could we stay afloat if we didn’t write paychecks?”

Keryn’s eyes went very wide.

It struck Dillon that her eyes were almost the color of champagne.

Keryn bit her lip. “Probably through the end of August. It depends on if we can sweet-talk the landlord. Remember, our energy bills go up during the summer. But if we miss payroll, we’re dead. CypherQuanta *is* our employees. That’s your company motto, Grant. The minute you miss payroll, our engineers will be e-mailing resumes. The economy’s not on life support anymore. In three weeks, they’ll all be gone.”

Grant *click-clicked* his pen. “How about if we pay everybody in stock for one month? With a bonus—we’ll offer them double their salary-equivalent in stock.”

Clifton shook his head. “That ain’t gonna fly. If we miss payroll, our stock isn’t worth toilet paper.”

Dillon nodded slowly. “Grant, it would not be honest to pay them in stock if the stock has no value. If you intend to miss payroll, you are obligated to notify the employees right away.”

Grant’s eyes narrowed as he looked first at Keryn, then Dillon, then Clifton. “Point taken, people, but before you three bears run off into the woods, Goldilocks here has a little story to tell you.” He pointed a stubby finger at Rachel. “Tell ‘em, girl genius.”

Rachel leaned forward in her chair and her pale green eyes lit up. She pulled Dillon’s tablet across the table and held out her hand for his pen. “May I?”

Dillon gave her the pen. He noticed that she had small, clever hands. The nails were polished a light green that matched her eyes, with golden sprinkles the exact color of her hair.

Rachel drew a triangle on the paper and labeled the three corners. *Fast. Cheap. Good.* She looked straight at Dillon. “This is the classic engineering triangle. Even in the best case, you can only choose two of these three. NASA is wrong when they say faster-better-cheaper. You can never have all three, right?”

All of them nodded.

Rachel tapped her pen on the triangle. “Where does CypherQuanta stand on this triangle?”

“We’re good,” Clifton said. “Our quantum encryption is the spiffest thing out there. Nobody does it better, nowhere, nohow. Even God can’t do better.”

Dillon did not like the way Clifton said this. It was a theorem of quantum mechanics that nobody could do better, but even so, Dillon did not like to place bets on what God could not do.

“And what else are we?” Rachel said.

Nobody said anything.

“We’re not faster, that’s for sure,” Clifton said. “No offense, Dillon. You did the best you could, but we’re still only getting kilobits per second. Conventional RSA encryption gets gigabits.”

“But our encryption is better,” Dillon said.

“Better doesn’t always win,” Rachel said. “If it did, everyone would have a Mac—and Bill Gates would be shining shoes.”

“Which brings us to our other problem,” Grant said. “We aren’t cheaper either. RSA encryption is practically free. Private users get it for free. Businesses have to license it from RSA, but it’s way cheaper than we are.”

“But our encryption is *better*,” Dillon said. “Quantum encryption is unbreakable. You can prove a theorem—“

“Theorem, shmeorem,” Rachel said. “Our competition uses RSA encryption. People *perceive* it to be just as good as ours. *And* it’s faster. *And* it’s cheaper.”

“You’re telling us our business model is majorly biff.” Clifton leaned back in his chair and crossed his arms.

*Biff* was one of Clifton’s special words. Dillon knew it meant *bad*, but he had never understood why Clifton could not simply say things were very bad.

“It’s reality,” Rachel said. “Right, Uncle Grant?”

Grant grunted agreement. Then he exploded in laughter. “All right, stop playing with them, Rachel. Give ‘em the good news.”

Rachel put the pen down in front of Dillon. “In principle, RSA encryption can be broken.”

Dillon stared at her, wondering what her point was. “In principle, yes. Everybody knows that *if* you can factor large numbers, you can break RSA encryption.”

“Not everybody,” Keryn said. “I didn’t know that. Can you give me the *Dummies* explanation of what factoring large numbers has to do with encryption?”

Dillon took the pen and wrote down the number fifteen on his tablet. “Any schoolchild can factor small numbers. Fifteen is *what* times *what*?”

Keryn shrugged. “That’s easy. Fifteen is three times five.”

Dillon nodded. “Correct. But if I give you a ten-digit number, you will find it very much harder to factor.”

“Can’t a computer do that?” Keryn said.

“For ten digits, yes,” Dillon said. “But as you add digits, it gets exponentially harder. For a hundred digits, it takes a long time. And no computer in the world has ever factored an arbitrary two-hundred-digit number.”

Keryn still looked puzzled. “Fine, but what does this have to do with us?”

“Everything.” Dillon wondered how to explain to her about the Euler totient function. “The RSA encryption scheme depends for its security on the fact that it is easy to multiply two large numbers together, but it is extremely hard to factor the resulting product without knowing one of the original two numbers.”

Rachel blew him a kiss. “You get a gold star, Dillon. It boils down to this. If you could factor large numbers, then conventional RSA encryption would be broken. It would still be cheap and fast. But it would be worthless. Which would mean that anyone who needs encryption wouldn’t have a choice. They’d have to buy our machines, because

we'd be the only game in town. *If* we could factor large numbers, every bank, every brokerage, every government—*anyone* who needs to protect their data in transit—would have to buy our quantum encryption system.”

Clifton shook his head. “That’s one very bogus *if*. You can’t factor large numbers. They use two-thousand-bit keys for RSA encryption. Factoring a number that mondo would take like billions of years.”

“Billions of years on a conventional supercomputer.” Rachel leaned forward. “Think different. Think quantum.”

Dillon felt his heart thump. “There *is* a quantum algorithm to factor large numbers. Shor’s algorithm. But . . . you would need a quantum computer with thousands of qubits.”

“Whoa, time out,” Keryn said. “I’m lost. Thousands of what-bits?”

“A quantum bit,” Dillon said. “Q-u-b-i-t, pronounced *cubit*.”

Keryn shook her head. “And what are these qubit things used for?”

“It’s all very simple,” Rachel said. “Our competitors use RSA encryption, which could be broken—if only you could factor very large numbers. In 1994 Peter Shor at AT&T showed that you *can* factor large numbers—if you have a quantum computer with thousands of qubits. In 2001 Isaac Chuang’s team at IBM demonstrated that Shor’s algorithm worked on a quantum computer with seven qubits. In fact, he used it to factor the number fifteen. It was big in the news. So the only remaining glitch is to construct a quantum computer with a few thousand qubits.”

*Glitch?* Dillon did not see how this could be considered a small matter. “That is like saying you can run a mile in four seconds. All you have to do is run nine hundred miles per hour.”

Rachel just smiled at him.

Dillon felt something funny wiggle in his stomach. Rachel had a very nice smile.

Clifton gave a nervous laugh. “Dillon’s right. We had a tough time commercializing quantum encryption, and that only needs *one* qubit. Seven qubits is the record, but IBM had fits making that work sorta-maybe-kinda in a *research* lab. It’ll be like thirty years before anybody gets a thousand qubits to play together.”

Dillon shook his head. “It will not happen in our lifetime.”

Keryn's eyes glittered with a look that Dillon could not decipher.

"Tell 'em, Rachel," Grant said.

Rachel reached inside the fanny pack at her waist and pulled out a sealed tube filled with a greenish liquid. "Here are the qubits."

Dillon stared at it.

"That?" Keryn's voice cracked. "That's a computer?"

Rachel shook her head. "Not the whole computer. Just the hard part. The qubits."

"How can a tube of . . . green goop be a computer?" Keryn said. "That doesn't make any sense."

Rachel's face flushed. "The qubits are the nuclei of certain ions trapped in nanoscale ion traps. You manipulate the qubits by radio signals. It's a standard NMR-based quantum computer, not too different from the one IBM built."

Keryn was looking very lost. "NMR?"

"Nuclear magnetic resonance," Dillon said. "Like in MRI machines."

Keryn did not look at all convinced. "A test tube? That's not a computer."

Rachel gave her an intense look that Dillon could not parse. "Listen, Keryn, you just write the checks, okay?"

Grant put a hand on Rachel's arm. "Keryn's not questioning your work, Rachel. It just doesn't look like a regular computer." He turned to Keryn. "You'll have to take this on faith. I realize this is pretty weird looking, but it really is well-established technology."

Dillon raised his eyebrows. "Seven qubits is established technology. A hundred qubits would be extraordinary technology."

"I've got ten thousand qubits," Rachel said.

A rush of adrenaline shot through Dillon's chest. Suddenly, he could not breathe. "Ten . . . *thousand* qubits?"

"Plus or minus a few hundred." Rachel gave him a dazzling smile. "Impressed?"

Dillon could hardly swallow. Ten thousand qubits was impossible. *Impossible*.

"It's only missing one thing," Rachel said.

"What's that?" Clifton's hands were trembling on top of the table.

Grant cleared his throat. “That is the core of an NMR quantum computer. Rachel finished it quicker than we expected, but now it needs NMR hardware to drive it, and software to drive the hardware. Dillon, you’re the best hardware/software guy we’ve got. We need you.”

Dillon’s tongue felt parched. “New hardware? New software? That could take months of development time. Design reviews. Implementation. Testing.”

“We don’t have months,” Keryn said. “In less than three weeks, we’re going to miss payroll.”

Grant put his hand on top of Dillon’s on the table. “Can you do it?”

Dillon’s heart was thumping very hard in his chest. He had a chance to work on something extraordinary. It would save the company. It would keep his friends employed. And it would save Grant’s investment. If he could make the device work.

“I . . . I need more information,” Dillon stammered. He wanted desperately to think about something calming. The multiverse. Hamlet. Keryn’s soft and quiet voice.

“As of today, I want to reassign you to work with Rachel,” Grant said. “She’s got a bio-lab set up off-site. I want you two working around the clock on this thing. Your first task is to tell me how long it’s going to take. Do you want the assignment or don’t you? Because if you don’t, we’re very dead. Nobody else can write code as fast and clean as you can.”

Dillon swallowed hard.

“Dude, you the man,” Clifton said.

Keryn sat very still.

Rachel gave him an encouraging smile.

Dillon’s heart quivered in a way he had never felt before. Rachel was very intelligent. He did not see how he could do this job in only three weeks, but . . . possibly with Rachel’s help? And they would have many interesting conversations also.

“Will you do it?” Grant asked. “I’m begging you, Dillon.”

Grant was like a father to Dillon. More than a father. The schedule would be almost impossible, but . . . Dillon could not say no to Grant.

Dillon nodded. “I will try.”

## Chapter Three

### Rachel

Fifteen minutes later, as Grant parked outside the bio-lab, Rachel felt a rush of butterflies. She desperately wanted to make a good impression on the others, her new teammates. She'd been working in isolation for six months now, and it was driving her nuts. But Grant had said he couldn't afford to break security by introducing her to the other employees. Until now. If she went splat, it was going to be horrible. Worse than horrible.

All five of them climbed out of Grant's Lexus.

"Whoa, spiff!" Clifton strode over to Rachel's bright red Miata convertible. The top was down and Clifton ran his hands over the leather interior.

"Like it?" Rachel said. "I got it when I came to San Diego."

"It's very nice," Keryn said in that cool and quiet voice of hers.

Rachel liked watching people, trying to dice out their relationships. She had already figured out that Keryn and Dillon were an item, or an almost-item, or . . . something. They were alike in a lot of ways.

And yet different. Dillon had that delicious Pierce Brosnan look, very mysterious and self-contained. Whereas Keryn was so . . . dull. Mouse-brown hair, cut to her shoulders and very eighties. Tall, thirtyish, not quite slim, but nicely proportioned. A pleasant smile. Not too quick on the uptake. What *exactly* did Dillon see in her? Or . . . did he? There was clearly some sort of connection between the two of them, but they weren't married and they weren't living together, and Uncle Grant hadn't said anything about them being a pair. Of course, Uncle Grant missed a lot of that kind of thing, but still.

"Come on, people, we can admire the car later," Grant said. "Dillon, I want you to see the bio-lab."

Dillon was staring at the car, frowning.

"Hey, Dillon, check this out!" Clifton said. He was standing behind the car, pointing at the license plate holder.

Dillon didn't move.

Keryn went around to look. Her eyes widened and she covered her mouth with her hand.

Rachel smiled. The plate holder said, *Sometimes . . . I go topless.*

Dillon leaned inside the car and inspected the flashing red alarm light. "This kind of alarm is simple to defeat."

"People, come on!" Grant stood at the top of the stairs, waiting.

"Relax, I've got LoJack," Rachel said. She leaned in next to Dillon, brushing against his sleeve with her bare arm. "Not to mention, that alarm's a dummy. The real one detects tampering and calls me on my cell phone."

"Miatas have a very low theft rate," Dillon said. "Now I understand why."

Rachel leaned in farther and lost her balance. "Oh!" She grabbed Dillon's arm and caught herself. "I'm sorry."

He helped her stand up. "By the way, your shirt is too short. You should buy the next larger size."

This was so stunningly inappropriate that Rachel stared up at him with her mouth hanging right open. She wanted to laugh, but she didn't dare. There was something not quite . . . right about Dillon.

"People, I hate to interrupt the car festival, but we've got work to do." Grant came down the stairs, wincing each time he put weight on his trick left knee.

"We're coming," Rachel said.

"Right behind ya, Grant," Clifton said. "Great car, Rachel."

Grant turned and hauled himself back up the stairs to the door. He punched in the five-digit security code. "Dillon, I'll give you the code so you can come in anytime. Sorry, Keryn and Clifton, but you don't need to know it, and we're keeping tight security on this place." He turned the knob and pushed the door open dramatically. "Behold . . . the bio-lab! Rachel, go ahead and give us all a tour."

Rachel stepped in past him. The suite was actually two moderately large rooms. In the outer office, she had a desk overflowing with photocopied papers and an empty filing cabinet that was supposed to hold all the papers. A stack of pizza boxes were mounded in the trash can. "Sorry about the mess. I don't eat in the lab because I culture

live cells in there. They're not infectious, but still. There's a bathroom over there." She pointed to the corner. "It's kind of a mess in there too. Sorry. I'm not big on cleaning."

Rachel pointed to a pair of metal double doors. "In through here is the actual bio-lab. We maintain it at a slight negative pressure, relative to this outer room. Not enough so you'll notice, but enough to keep stuff from blowing out. Not that anything could actually blow out. I do all the biology work under a hood, and it's vented."

"Biology?" Dillon said. "What does biology have to do with a quantum computer?" Rachel pushed open one of the doors. "Come on in and I'll explain."

The others trooped in. Rachel led the way to a wet bench. "Okay, here's the deal. The problem people have in making quantum computers is that the qubits are small." She grinned at them all. "I hope that's not a surprise."

Grant gave her a big smile. Keryn was gawking around the room. Clifton was sneaking a peek at Keryn's backside. Dillon was looking at the MagTec NMR machine in the corner.

Rachel joined him. "I guess you're familiar with conventional NMR quantum computers, right?"

Dillon nodded. "You control an ensemble of qubits by radio pulses. It is old technology."

"And the problem with that is . . . ?" She touched his arm.

"The problem is that each qubit requires its own resonant frequency," Dillon said. "So if you want thousands of qubits, you will need thousands of resonant frequencies. But since every ion has a characteristic resonant frequency in a given magnetic field, this means that you require thousands of species of ion, and that is impossible."

"Right," Rachel said. "It's a hard problem. I've solved it."

He gave her a probing look.

Rachel felt a shiver of . . . something. She could get lost in those deep, chocolate brown eyes.

"You have solved it?"

"Um . . . right. I decided that if you can't bring Mohammed to the mountain, then you should bring the mountain to Mohammed."

For an instant, Dillon's eyes went blank. Completely and totally blank. Rachel blinked, astonished. What had caused that response?

Grant stepped in. "Say, Rachel, maybe I better explain something to you before you get lost in metaphor-land. Dillon has kind of a special mind. I told you that, right? He thinks different than anybody else."

Rachel vaguely remembered. She'd been too excited on the way to the meeting this morning to pay much attention. "Uh-huh." She had a sudden urge to turn around and run.

A pained expression crossed Dillon's face. "Grant, Asperger's syndrome is not a disease, and you will please not treat me like a cripple."

Rachel felt her mouth drop open. "Um, what's this all about?"

Dillon's face tightened. "I have a form of autism known as Asperger's syndrome. It is named after Dr. Hans Asperger, an Austrian physician who wrote a paper in 1944 describing—"

"Autism?" Rachel said. "You mean like Dustin Hoffman in *Rain Man*?"

"High-functioning autism," Dillon said. "I do not babble, nor do I slobber, nor do I require institutionalization. I am a contributing member of society with a special kind of brain."

"That is so cool!" Rachel said. "Can you count cards like in *Rain Man*?" She put her hand on his arm. "Dillon, now I get it! Uncle Grant told me you were one in a million, but I thought he was exaggerating."

Dillon looked very pleased. "Every autistic is different. I cannot count cards. Very few can. But I have unusual abilities to concentrate. Like Einstein. Like Newton. Both of whom are thought to have had Asperger's."

Grant put an arm over Dillon's shoulder. "Dillon comes up with some amazing out-of-the-box design solutions. But here's the thing. He tends to take things very literally. When you say 'out-of-the-box,' he thinks you're talking about an actual box."

Rachel giggled. She felt terrible for giggling, but . . . it was *funny*.

"You saw his face go blank when you trotted out that thing about Mohammed and the mountain?" Grant said.

Rachel nodded. “You’re telling me . . . he thought I was talking about a real mountain and a real Mohammed?”

Dillon’s face colored slightly. “My brain is just wired differently. You may think me weird, but in my reference frame, I am being logical and the rest of the world is not.”

“I don’t think you’re weird,” Rachel said.

Dillon’s face relaxed. “Really?”

“Dillon, you’re a stud.”

His eyes flew wide.

Instantly, Rachel caught her mistake. “That’s slang, sorry. It means you’re . . . brilliant. Um, it means you’re really, really smart.”

Dillon smiled. “Thank you. Now please explain to me about how you solved the qubit problem.”

“Um . . . right.” Rachel took a deep cleansing breath and tried to get her mind back on track. “I asked myself why we should worry about making thousands of qubits, all different. Why not make them all the same but change their environment instead?”

“Environment?” Dillon looked puzzled.

“You know,” Rachel said. “Embed each pair of qubits in a little cage with slightly different magnetostatic properties. Just a small change, but enough to change the value of the applied local magnetic field. In MRI, you vary the applied magnetic field spatially and therefore you get out spatial information from the signal. Here, you vary the magnetic field inside each type of cage, and that lets you drive the qubits in each cage independently.”

“Oh.” Dillon’s face lit up. “I see it. It requires a different external frequency to drive each qubit, even though all the qubits are identical.”

“Slow down,” Clifton said. “I’m not getting this.”

Dillon stepped to the whiteboard and wrote down the equation for the resonant frequency in an applied constant magnetic field. Then he added subscripts to each side. Clifton stared at the equation for a few seconds. “Oh yeah. Right. Hey, that’s clever.”

“How do you change the magnetostatic properties for each cage?” Dillon asked. “That is a difficult nanoconstruction problem.”

“Biological cells do nanoconstruction all the time,” Rachel said. “It’s kind of a long story but the bottom line . . . I mean, the summary . . . is that I concocted a string of DNA that encodes the pattern for a particular class of proteins that fold themselves into perfect little ferromagnetic cages. I got the idea from rubredoxin, which occurs naturally. My class has millions of degrees of freedom in one particular string of nucleotides, so in principle I could make millions of qubits. I inserted the DNA as an artificial gene into a cell line and forced the cells to express ten thousand different proteins, each in large quantities.”

Dillon’s face was shining now. “Beautiful. Very, very beautiful.”

Rachel felt her pulse speed up. Coming from Dillon Richard, that was quite a compliment.

“Okay, I’m thinking we need to leave you two to work,” Grant said. “Dillon, you like what you see?”

Dillon’s eyes were looking right at Rachel—or right through her—she couldn’t tell which. “Yes.”

“Great, then. I want you two to report directly to Clifton. Give him a daily update. If you need anything, ask him.” Grant turned to Keryn. “And if they need to spend any money, give it to them. No questions asked.”

Keryn’s eyes were boring like lasers into Dillon’s skull. “Um . . . right, Grant.” Her face colored, and she turned toward the door. “Right, let’s let Rachel and Clifton and Dillon get to work, and I’ve got a couple of questions for you outside.”

Grant went to the door and opened it. “We need to give Clifton a ride back, remember? We all came in my car. Come on, let’s go, Clifton. Rachel, when you lock up for the night, take Dillon back to his car at CypherQuanta, okay?”

“Sure thing, Uncle Grant.”

Grant put a hand on Keryn’s elbow. “Let’s be on our way so the geniuses can work.”

“Of course.” Keryn had a funny look on her face as she went out the door. Clifton followed her out, his long blond ponytail swishing behind him.

Grant threw a last look inside. “Pedal to the metal, Rachel.”

“Vroom, vroom,” she said.

Dillon sat down next to the NMR machine. “Tell me what I need to do. I know very little about NMR quantum computers.”

“All we need to do is drive my bio-computer with this NMR machine,” Rachel said. “This is an off-the-shelf component made by MagTec for biological applications. I’ve tested it on the bio-computer in manual mode, and I verified that my qubits respond to resonant frequencies spaced out roughly every hundred hertz, over a range of a megahertz. The signal is pretty weak, but it’s detectable. That gives us ten thousand qubits. The first thing we need to do is write a calibration program to find the exact resonant frequencies. Then we have to implement Shor’s algorithm.”

“Actually, I believe the first thing I need is the manuals for this machine.” Dillon said this in the same tone of voice that a small boy would use to ask for his dessert first.

Rachel hated manuals and would rather eat crushed glass than read one of the horrid things. She found three thick volumes in the box, tore off the shrink-wrapping, and handed them to Dillon.

Dillon’s eyes lit up. “Thank you.” He opened the top manual and began reading the preface.

Rachel slumped into a chair. Great. What am I going to do while he plows through six inches of manuals?

### **Keryn**

Keryn marched down the steps and leaned against the hood of Grant’s Lexus, folding her arms across her chest. “Grant, I think I’d like an explanation about Rachel.”

“Hey, she’s some kind of chick, isn’t she?” Clifton said. “She’s got the mondo right brain. Dillon’s got the humungofied left brain.” He threw a longing glance at the Miata. “Put ‘em together, you’ve got one well-oiled machine.”

Grant grinned. “That’s about it, Clifton. Between the two of them, they can do anything. *Anything.*”

Keryn wanted to scream, but she didn’t see how that would help. “Grant, my real question is how are you going to pay this girl genius? Last time I checked, Caltech grads were pretty pricey. I’ve been squeezing the jugular of every penny you’ve got. Didn’t we agree to a hiring freeze?”

“Yes, of course.” Grant limped past Keryn to the driver’s side. He turned to look at her. “Ready to head on back?”

No, I am not. Behind my back, you’ve gone and signed on a senior-level scientist, and now you want to go on with business as usual? Keryn wished she dared to yell at him, but she just . . . couldn’t. Instead, she said in a very calm voice, “Really, Grant, I need to know how much you’re paying her.”

Grant shot an uncomfortable look at Clifton. “Keryn, that’s not something I want to—”

“Um, Grant . . .” Clifton was looking very interested. “That is a gonzo good question. I don’t recall you bringing up a new hire to the board.”

Keryn felt her pulse pounding. “More important, you never mentioned her to me, and I’m supposed to be paying the bills. How in the world did you hire her without me knowing? And how much is this costing us that I don’t even know about?”

Grant held up both hands. “Peace, okay?” He wiped his sweating forehead on his sleeve. “Keryn, the answer to your first question is that I didn’t hire her without telling you. She’s been employed by CypherQuanta since last December, and you’ve only been here since March.”

“Oh.” Keryn felt deflated. “And how much are you paying her?”

Grant pulled out a business card and wrote a number on it.

Keryn stared at it. “You’re kidding me. That’s way less than I make, and I only work half-time. That’s less than the going rate for a receptionist. How do you expect her to live on that in San Diego?”

Grant took a deep breath. “That’s not her annual salary.”

Clifton grabbed the card and stared at it. “You’re paying her this much per *month*?” He swore at Grant.

Keryn winced. Unbelievable. If that was her monthly paycheck, Rachel was earning more than Grant and Clifton combined. “Grant, how are you cooking the books to do this? It’s not possible to sneak that much money past me.”

Grant gave them a shrug. “Keryn. Clifton. Listen to me. We *needed* Rachel. She’s brilliant. When I talked to her last December, she was ready to quit her research, give the

whole thing up. So I . . . took out a loan on my house and put her on the payroll, unofficially. I'm paying her out of my own pocket."

Keryn narrowed her eyes and studied Grant. "You hocked your *house*? You must have been pretty confident."

"No, I was desperate," Grant said. "I've been hearing for months that Lost Angels was looking to break us. Somebody in there hates us, and he's picked up enough votes now to take us to the cleaners. I had to preempt that." He stood up to his full height and gave them a defiant look. "Guys, it worked. Rachel broke the whole thing loose. She's hit it big, and we are gonna be the Microsoft of encryption by Christmas. Bigger than Microsoft. Uncle Bill sells his twerpware for a hundred bucks a pop. We sell ours for fifty K, and everybody's gonna need us."

Clifton began pacing back and forth. "Why'd she come to us? If this is so spiff, why didn't she go to IBM? They're deep into quantum computing."

"They're deep in the government's pocket," Grant said. He looked around and then lowered his voice. "Listen, you may have noticed Rachel's a little unconventional."

"She doesn't seem to live with too many restraints," Keryn said.

Grant gave her a puzzled look. "Whatever. She doesn't care for Big Brother. If she worked for IBM or any of those other blue-chippers, anything she created would have wound up at the National Security Agency. And we all know the NSA would use it to spy on us. That's the beauty of CypherQuanta. We make Big Brother impossible. Even God can't break our encryption, much less the NSA sleazeballs. I explained all that to Rachel and . . . gave her a decent offer, and she came here. Now it's paying off."

Clifton was pacing back and forth, his eyes on the Miata.

Keryn still felt furious. She wished she had the guts to yell at Grant. Or quit. Or . . . something. She swallowed her anger. "Grant, you need to keep me apprised of financial matters a little better than that. Okay?" Which was a wimp-out, and she knew it, but she couldn't afford to lose her job right now.

Clifton stopped pacing and came up beside Keryn. "Ditto that on the technical stuff. Rachel's real spiff, but I should have heard about her six months ago."

Grant's eyes glowed with deep inner pain. "Keryn. Clifton. I see things from your point of view and I'm sorry. I just wanted so *bad* to not lose the shirt off my back.

Somebody's trying to wreck my company and I did what I had to do to save it. I kept Rachel secret as a matter of security. It was a gamble, because I didn't know how long it'd take her to grow those qubits. Or if she could do it. If word had gotten out . . . Lost Angels would have panicked and found some way to pull funding on us and grab the whole pie months ago. As it was, we kept them on board all the way till the end."

Keryn didn't put much stock in conspiracy theories. "Oh, be serious, Grant. What would Lost Angels do with our technology? They're *investors*, not techies. If they stole that technology from us, they'd have to find somebody else to commercialize it. Why wouldn't they work with us?"

"All I know is what I hear," Grant said. "This is from a source I can't reveal, and all I can tell you is that somebody on Lost Angels wants CypherQuanta drilled right through the skull. I don't know who it is, but he wants the company dead and wants it to look like a natural death. Even paranoids have enemies, right?"

Keryn shook her head. "You've been reading too many of my novels, Grant."

"Just do me a favor, both of you." Grant's face lost all trace of humor. "We need tight security on this thing until Dillon does his magic and gets that thing working. Clifton, you come over once a day and get a report from them, and give it to me, privately. Keryn, I'll keep you abreast of progress, on a need-to-know basis. But I don't want either one of you talking to anyone else about it, not even the other CypherQuanta employees. Got it?"

"Got it," Clifton said. "Loose lips sink ships. Right, Keryn?"

Keryn nodded. She had just realized something.

Six weeks from now, if this thing worked, CypherQuanta could be big. Bigger than Microsoft. Bigger than IBM. And her eight thousand shares of CypherQuanta stock would be worth . . . lots.

At which point, she could retire. Buy a little cottage by the beach. White picket fence. Drop the day job and write full-time. She could live the life every writer wanted, and all she had to do was stay calm and not yell at Grant.

And make sure Dillon and Rachel worked together like a well-oiled machine.