

Quantum Entanglement

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My father told us about the cat when I was eleven and Emma was six. He said Schrodinger did an experiment: he put a cat in a box with a vial of poison. If the vial broke, the cat was dead. If it didn't break, the cat was alive.

"What was the cat's name?" Emma asked. She twirled Teddy around by his arms. His round ears grazed the edge of the kitchen table where our father sat with his hand holding open a physics text.

I stood next to Emma. The window above the sink was open, and I heard jays calling to each other in the dry grass of our backyard.

"That isn't important," my father said. "The point is that the cat is both alive and dead at the same time." He raised one bushy eyebrow and smiled. His ears moved when he smiled, pulling his thick-framed glasses further up on his nose.

"I'd like a cat," Emma said. She held Teddy close to her chest.

"How can it be both alive and dead?" I asked. I was learning algebra in school, but my father liked to jump ahead. He had already taught me how to count in base two, and about the square root of negative numbers. He said I was the smartest girl in my class.

"Because there's no observer," my father said. "Schrodinger said that as long as there is no observer, the system exists in all its possibilities at once."

"But what about the cat?" Emma said. "Did he die?"

"That's not the point!" My father placed both hands on the table and pushed himself up, his chair scraping backwards over the linoleum. He picked up the book and walked from the kitchen.

We heard the door to his study slam shut.

The corner of Emma's mouth twitched.

"The cat was just fine," I told her. "His name was Bailey."

#

In my dream Bailey is still young, at that awkward stage between kitten and adult cat, paws and ears too large for his skinny frame. He winds around the base of my chair two times, but when I reach down to pet him, he is suddenly lying on his side, not breathing. His mouth opens, and a shrill cry emerges.

I wake from the dream with a start. It takes me a moment to realize the phone is ringing. The dream images recede, and the shadowy lumps on my floor resolve into books and clothes and stacks of journal articles. I pick up the phone.

"Judith," a voice says in my ear.

It takes me a moment to figure out it is Emma's voice on the phone.

"My god," I say. "Where are you?" I sit up and disentangle the blanket that has managed to wrap itself around my feet.

"Back in town. It's Tuesday. Math night." I can almost hear her cringe. "Were you studying?"

"Actually, I was asleep."

"I thought you would be up," she says.

I squint at the clock. Almost two in the morning.

"Not this week," I say. "I have to get enough sleep for my candidacy exam."

"Dad told me you were studying for something."

"You talked to him?" That's a conversation I can't imagine.

"Long enough to get your number."

I realize the line has a periodic hum to it. Voices rise and fall in the background. "Where are you staying?" I ask.

"I'm at the hospital," she says.

I pull the phone closer. "The hospital?" I say. "Are you okay?"

"Sure," she answers, too fast. "It's the impurities that cause problems, you know. This time it was quinine. It tried to stop my heart."

Quinine. A common impurity in heroin. I don't know what to say. I reach over to the window and open it a crack. The city murmurs in its sleep. Cool air tickles the hair at the back of my neck.

I want to ask where she's been in the years she has been gone, what has happened, but I don't know where to start.

"I'm going into a detox program," she says. "They have a good one at the clinic downtown."

"That's great," I say. "Good for you."

"Dad says he's too busy to give me a ride to the clinic tomorrow."

The image comes to me of her standing in our driveway the morning she left. Someone had been with her. "What about your boyfriend?" I ask. "Blake."

"Blake?" She lets out a sound that is somewhere between a laugh and a snort. "He's long gone."

"Oh. I'm sorry."

"No loss," she says, and then is quiet.

I look around my apartment. Through the doorway to the kitchen I can see the silhouettes of plates and bowls protruding from the sink, and the small table that serves as an alternate bookcase. One more day, and then I can get my life in order again. I can't possibly take any time off until after the exam.

"Tomorrow morning I'm practicing with Dad," I say. "And in the afternoon is the exam."

She doesn't answer.

"Emma, this test is everything. It's what determines whether I get my degree or not."

"That's what I thought."

"It's not that I don't want to see you."

"Sure."

"I just can't tomorrow. I'm sorry. I'll come the day after."

"Okay. It's fine. Really. I'll take a bus."

I copy down the number for the clinic on a yellow stick-it. There is a soft click, and the dial tone hums in my ear.

#

We always waited together after school for our father, standing on the strip of grass separating the sidewalk from the street. That day when our father pulled up in his silver Volvo, I touched the front door before Emma, and got dibs on the front seat.

I slid in and pulled the door shut behind me, grinning through the window at Emma.

She pounded a fist on my window, then stopped abruptly when she saw the cardboard box on the back seat. A soft meowling emerged from the box.

I twisted around in my seat to look while she opened the lid.

The kitten fit entirely in her two cupped hands. He was all black except for one tiny white paw. His head wobbled back and forth a little, as if he were dizzy.

"Bailey," my sister whispered. She stroked the top of his head with one finger. He settled down in her hands, his head on his paws.

"You have to make sure he always has fresh water." My father watched Emma in the rear view mirror. "And you have to feed him every day, otherwise I'll take him back to the shelter."

Emma nodded. She held Bailey to her cheek.

"Put him away now," my father said.

She set him carefully back in the box, on top of the wadded paper towels, and we headed home.

#

For the fifth day in a row, I am going through a practice exam with my father. He sits at the back of the conference table and calls out questions while I stand in front of the chalkboard. He cannot, of course, sit on my candidacy committee, but he helped me pick out the members. I am their first female candidate in three years, and the daughter of my father. I must not fail.

"What about the Uncertainty Principle?" he says.

From where I stand I can't see his eyes because of the glare on his glasses. Sunlight streams in through the blinds, leaving horizontal bands across the scratched oak table and tiled floor.

"Heisenberg said you can't measure certain properties of a system simultaneously with the same precision," I say. "Momentum and position, for instance." I write out the equation on the chalkboard.

"And why not?" he says.

"Dad. I got a call from Emma last night."

His lips tighten to a thin line. "Judith, you must concentrate."

"But I'm worried about her."

My father stands up and moves to the front of the room.

"First she flunks out of school," he says, holding up his index finger. "Then she runs off." Another finger. "And now she has appeared out of nowhere, and expects us to drop everything to take care of her." He makes a fist. "You should know better than to play her games."

I look at the chalk in my hand. Maybe I should know better.

"Now," he says. He returns to his seat. "Why can't we measure these properties with precision?"

Heisenberg's analogy was that of trying to measure the position of a chandelier in the dark by swinging a broomstick. You always move the chandelier just by trying to figure out where it is.

"Because the observer is always part of the system," I say. "Whether she wants to be or not."

#

I was watching my father pour hot water from the pan into the sink, the steam rising in puffy clouds around his face. When he turned back to the table, his face was red. I saw little beads of water on his forehead.

He rolled the hotdogs from the pan into the bowl in the middle of the table. I speared one onto my plate.

Bailey took his place behind Emma's chair, eyeing the food on the table.

"Now," my father said. He let himself sink into the chair between me and my sister. "What did we learn in school today?"

Emma was balancing her fork on the tip of her finger. She tapped the tines, making it rock like a see-saw.

"Nothing," she said.

"Nothing?" My father raised his eyebrows in mock surprise. "You mean the fifth grade doesn't teach anything any more? That's a fine use of my tax dollars."

The fork rocked back and forth. I concentrated on squeezing the ketchup onto my plate.

"We played cops and robbers," she said.

My father swept his hand across the table and Emma's fork and plate slid off with a clatter. The plate broke against the linoleum. Bailey dashed from the room.

For a moment, there was nothing but the sound of the clock ticking.

He said, "You will not eat dinner again until this behavior stops."

My sister stared straight ahead. She didn't blink.

"Judith," my father said. "What did you learn in school today?"

I chewed quickly and swallowed. I told him about the Pythagorean theorem, and then about how we had learned to use a quadrant. He told me about the Fibonacci series, how each two numbers adds up to the next one.

#

"You have all your slides?" It's the third time my father has asked the question on our walk through the campus. He rubs his thumb back and forth across his cheek.

I nod. The physics building is an old gray concrete block just beyond the little stream. We pause on the wooden bridge, elbows on the railing. Twenty minutes until the exam. I hold my binder of transparencies to my chest.

"Try to derive what you don't remember. They want to see that you can think things through, not that you can memorize facts."

I nod again. The water beneath us divides around a rock, coming together on the other side again. Waves overlap each other in ripples, an interference pattern.

"They'll ask you about the basics as well as current theory. Wave-particle duality. That sort of thing."

"I better go," I say.

My father squares his shoulders. "You'll do fine," he says.

I start to walk toward the concrete building. I can't stop thinking about Emma. She will leave the hospital soon, head for the clinic. I almost turn to my father to tell him to call her, but I know what he would say. Concentrate. Tell me about wave-particle duality.

I keep walking.

I answer his question in my mind as I walk. Photons can be seen as either particles or waves, I tell him. Two identical photons behave entirely differently depending on how they are looked at.

#

It was Wednesday. Language night.

My sister and I were sitting next to each other on the small couch, facing our father, who was in his leather chair by the bookcase. The hardwood floor of his study smelled of lemon oil, a smell I associated with evening study sessions.

"Judith will start," he said. He opened the dictionary, ran his finger down the tissue-thin page.

"Cobble," he said.

"To repair or make," I said.

He turned the page. "Coddle. Emma?"

My sister sat on the edge of the couch, swinging her legs back and forth. She tucked her chin to her chest and mumbled something.

"What was that?" my father said. "Speak up."

"I don't know." She watched a spot on the carpet intently.

"It means to pamper," he said. "Now you know. Okay?"

"Okay. How did Mom die?"

My father's hands tightened on the edges of the dictionary. "She got very sick."

Her legs stopped swinging and she looked up at the picture on the bookcase behind our father's chair. Our mother smiled out at us from the photograph. I couldn't see her eyes because the upper half of her face was in shadow from a floppy wide-brimmed hat. Dad had already told me it was cancer, and that she decided to take some pills rather than die slowly for years. But we couldn't tell Emma yet because she wouldn't understand.

Our father cleared his throat. He looked at the page. "Judith. Coruscating."

"Sparkling," I said.

"Crass. Emma?"

She started swinging her legs even harder than before, and her heel caught the hem of my new skirt.

"Stop it!" I said.

"Settle down, Emma," my father said.

She jumped up and ran from the room.

My father shook his head. "She'll never learn. She can't sit still." He closed the dictionary. "We'll move on to geometry."

I liked math better than language, anyway. My father said Mom had been a professor of math, and that's how he met her, since the math and physics departments were in the same building at the university. He said I would be a physicist, too. I was twelve, then, but he said I was already thinking like a scientist.

#

I am standing in front of the committee, five men in button-down oxfords and ties around the oak conference table. Equations cover the board behind me. My hands are sweaty in spite of the chalk dust. It makes a white paste on my palms.

"Tell us about quantum entanglement," Prof. Erickson says. He has a semicircle of gray hair around his head, and a huge beard that he smoothes as he speaks.

"It has to do with the way particles are linked," I say. "The properties of particles can be correlated, or entangled. Properties like spin, position, or momentum."

He nods, his face cryptic. He tugs at his beard. "So?" he says. "What is the significance of it?"

They are all watching me silently.

My mouth is dry. I feel an urgent need to use the bathroom, though I was careful to go right before the start of the examination two hours ago. I think of Emma, suddenly, standing in front of my father's chair, parroting what her teachers had said in order to eat dinner.

"Well?" Professor Erickson sits forward.

I force my thoughts on the question.

"It means that two particles that have once interacted are forever linked. They influence each other instantaneously and over large distances." It makes no sense, I almost add, then stop myself. How can one particle's behavior affect another if they are so far apart?

#

I was woken abruptly that night by a brush of cold air across my ankles. Light spilled through my half-open door.

I got up and moved into the hall. The light came from my sister's room. Through her door I could see clothes and shoes and bottles of nail polish strewn across her bed. Emma was just coming in through the window.

She saw me, one leg thrown over the sill. She paused, then pulled the other leg through and jumped into the room. She wore frayed jeans, a tank top, and heavy black eyeliner.

"What the fuck are you looking at?" she said. The word 'fuck' was a recent addition to her vocabulary. She was twelve. Her new boyfriend Georgio put paperclips through his earlobes and gelled his hair so it stuck straight up.

"Nothing," I said. "Where did you go?"

"None of your business." She began to peel off her tank top. She was wearing a bra, though she didn't need one yet. "You planning on telling Daddy?"

The eyeliner and eyeshadow were so dark her eyes looked like bruises when she stood with her back to the light.

I turned and went back to my room. I had just sent out my college applications. I was praying that I got into Stanford, though Cal Tech would be acceptable as well.

#

Indistinct voices rise and fall within the conference room, where the committee is deciding my fate. I stand with my back against the dark wood paneling of the hallway, facing the closed door.

I check my watch. Almost four. If they finish soon, I'll have time to go to the clinic before I call my father.

Footsteps echo from the staircase at the far end of the hall. Jacob, a fifth-year, approaches. His hair is a bush of tangled curls, imitation-Einstein. Rumor has it his advisor changed his dissertation project twice already, and he will never finish. He asked me out when I first started graduate school. Since I said no, he hasn't spoken to me except as necessary at department parties.

"Waiting is the hardest part," he says.

I allow him a small smile.

"Don't worry. You'll pass." He runs a finger down his nose. "It would look pretty bad if they failed the daughter of the chair."

I meet his gaze without comment. I have lots of practice at this sort of thing.

Finally, Jacob smiles and walks on. I rub the palms of my hands on my slacks, leaving long white streaks.

Watching Jacob's retreating back, I get a sudden sense of vertigo, as if he is standing still and I am the one moving away. It is like the twin paradox: according to relativity, you can't tell who is actually moving. The twin on the spaceship sees the earth and all the people on it racing away at near the speed of light.

Each twin thinks the other is abandoning her.

#

I was up late that night, almost through with my calculus homework, when I heard Bailey meowing. I got up and peered down the hallway. The door to my sister's room was closed.

He let out another cry, and I realized it was coming from outside. I went to the front door and

opened it. The damp night air rushed past my face.

Bailey was in his carrier on the driveway. In the moonlight I could see only the glint from his eyes and his one white paw within the carrier. Emma stood next to him, and on the other side was her large duffel bag. She was arguing in low whispers with Blake, her current boyfriend.

I turned on the porch light and stepped onto the front path, the cement cold beneath my bare feet.

Blake watched me approach.

"I told you we should have left already," he said. A bead necklace encircled his throat, and he wore a pullover with sleeves that were too long. The frayed ends came halfway over his wrists.

"What are you doing?" I said.

Emma turned. Her face was flushed, though she clasped her arms across her chest, shivering in her t-shirt. Her pupils were so large I could barely see the rim of brown at the edges.

"We're running away," she told me.

Blake moved to stand behind her, his hands on her shoulders.

"We're in love," she said.

Bailey pawed at the metal bars on the carrier door.

"You're not in love," I said.

"What do you know about love?" she asked.

She had a point. I had only had one boyfriend, and we never even kissed. We held hands a few times. His palms were always clammy, and the soap he used didn't completely cover the smell of something organic underneath, something animal, like the way Bailey's fur smelled when he had been outside in the sun all day. Math was more interesting than boys, anyway. It was clean and predictable, and it always made sense.

"You have to finish school," I said.

"Says who?" A smile stretched her face thin. "Dad? He doesn't care what I do."

Blake picked up the duffel in one hand and the carrier in the other. He held it at an angle, and Bailey slid to the back. I heard his claws scrabbling against the hard plastic.

"Let's go," he said.

"I wanted to say goodbye," Emma said. "But I can see you're in a bad mood."

I wanted to tell her she was wrong, that Dad did care, but I was suddenly not so sure.

She followed Blake to his battered Toyota. They put the duffel and Bailey in the back seat.

I watched the cloud of exhaust burst from the tailpipe, and then they were gone. I went back inside to my homework.

#

The committee is still murmuring within the conference room. It's too hot in the building. I am sweating in my silk blouse and white-streaked slacks. I imagine I can hear my heart beating through my body, marking off the time until the clinic closes.

If I don't leave soon I will miss the visiting hours.

My heart ticks off another minute.

Something catches inside me, and I pick up my binder and walk down the hall. When I push open the doors at the end of the hall, I can see the sky is overcast, a light rain just starting.

The cement path leads from the building toward the small creek that runs through campus. I pass over the small arched bridge and toward the edge of campus. The raindrops collect at the back of my neck and run down beneath the collar of my blouse. I begin to shiver.

I have passed the exam. I have failed. All possibilities exist until I know the result.

My apartment is on the street bordering the north edge of campus, where the tree-lined campus paths give way to noisy city streets. I open the door, nudging back the pile of books that has collapsed behind the door.

My blouse is soaked through, clinging to my shoulder blades.

I find the stick-it under the phone.

"I'm trying to reach Emma Wyman," I say to the woman who answers. "She was supposed to start the detox program today."

I hear fingernails tapping against a keyboard. "Looks like she never showed up," the woman says.

"Never showed up?"

She lets out a sigh. "Half of them never show. More often than not they just head off to the streets again."

Not my sister, I think. She must still be at the hospital. But then the woman says, "It says here she checked out of the hospital this morning at ten."

I hang up.

My head feels very light.

My sister is alive. She is dead. She is lying in a stairwell of an abandoned building on urine-stained steps, neck twisted at an impossible angle. She is walking calmly down Main street, looking for a job. She is sitting on a Greyhound bus, heading off for another city.

The phone rings. Emma.

But it's my father's voice on the line, not Emma's.

"Well?" he says. His question is filled with certainty. He knows I passed the exam. In his world, there is no other possibility.

"I don't know," I say.

"What?" I can hear his disbelief. "Didn't you pass?"

"I left before they told me."

"How could you just leave? I don't understand--"

"Did Emma call you?" I ask.

"Emma? No. Why?"

"She isn't at the hospital anymore. She checked out."

"And what on earth does that have to do with the exam?" His voice grows louder.

Nothing. Everything. I hang up.

The phone immediately rings again and I unplug it.

It is quiet in my apartment, and stuffy. The spider plant above the kitchen sink is beyond help, dead brown leaves sprouting from even drier soil.

I walk into all the rooms, open all the windows. The rain patters in, dotting the books and journal articles, bringing the smell of wet grass. Cars pass with a soft shush against wet pavement.

I realize I never found out what happened to Bailey. Maybe Emma gave him away. Maybe he died. I try to imagine him curled up somewhere on someone's wool blanket, listening to the rain tap against the window. He would be almost fifteen years old now. "I hope you made it," I say.

I walk out into the rain to search for Emma.

END