

THE GHOSTS OF MARS

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This new tale from Dominica Phetteplace is about a teenager attempting to survive in an inhospitable Martian environment. The novella is a sequel to a shorter work that was featured in *Analog* in 2020. That story, "Candida Eve," has been narrated by Dominica and is available on the *Analog* podcast at https://www.podomatic.com/podcasts/analogsf/episodes/2020-04-27T09_45_54-07_00.

My mother was born in a place where your age and the number of trips you took around the Sun were synonymous. That changed for her once she set foot on Mars. She was thirty-two.

On her fifth sol on this planet, there was a drone that went rogue for an extended period of time. Instead of collecting rocks and performing seismographic tests like it was supposed to, it drove aimlessly at a moderate velocity. It went forward, backward, and sideways. It even did a few donuts. The drone was stationed at Gusev Crater. Too far away from the base to do a manual reset and too dangerous to approach, besides.

Eventually, the rover stopped. It rebooted itself, then resumed normal functioning as if nothing had happened.

There wasn't a good explanation, but social media abhors a narrative vacuum, and so a narrative was launched: Mars was haunted.

If you followed the happenings on Mars closely (In those days you could! There were multiple livestreams across multiple platforms.), then you were aware of how frequently things malfunctioned. The rogue drone was anomalous only for the duration of the glitch, not its instantiation. Still, it became a common joke among the colonists.

According to my mother, after that, every time something broke or malfunctioned at the station, you blamed it on the ghost. No one ever believed it, but after my father died, it seemed disrespectful to continue invoking the Mars ghost, even as a joke. So it became taboo to mention spirits at all. No one really talked about my father, either.

If the lights flickered on and off in a pattern that resembled a Morse code message, you didn't try to analyze the feeling, you blamed it on a faulty switch. Or if the printers that were making the newest transparent greenhouse panels started etching strange, repeated symbols into the plates, you didn't look at them too closely. You tossed them right in the recycling bin and printed them again from scratch. You would never try to fit the bugs into a pattern. You would never try to suggest they might be an attempt at communication from the spirit world. That's not what scientists did. That's not how they thought.

Of course, I'm different. I didn't choose to be scientist. Science chose me. I'm a scientist because I was born here and grew up here and there's almost nothing else to

do here besides science.

The “glitches” seemed to get worse once I was left alone here. Mom, Raj, and Lily were all sick with cancer. They needed a real oncologist who could administer real chemotherapy in order to have any chance of survival at all. The improvised techniques and treatments we cobbled together weren't effective enough. So they took the last remaining ascent vehicle into orbit. Once there, they docked with a larger unmanned craft that would take them the rest of the way to Earth.

We all cried when we said goodbye, knowing there was a good chance none of us would ever see each other again. They couldn't survive if they stayed, I couldn't survive if I went with them.

I don't think I'll ever see Earth, and I can't tell you how much that bums me out. Earth has animals! And an atmosphere! But despite all the painstaking genetic engineering Mom and dad arranged for me to have as an embryo, I have bad bones and a malformed heart, and sol to sol existence is difficult enough. The gravity on Earth would kill me.

I don't mean to sound ungrateful for my genetic upgrades. They've protected me from cancer, which is the thing that killed nearly everyone else here. They've protected me from depression, which is what killed my dad. I owe my life to these upgrades, despite the pain etched into my body by my crooked spine.

I was an experiment. Humans, in their current form, aren't meant to live anywhere but Earth. True exploration requires taking extraordinary chances. They gambled on me. I didn't ask to be a test subject. But since I am one, I'd like for the experiment to be a success.

* * *

After goodbyes, I made myself a cup of tea. Of course I was sad, but I also have to admit it was a little thrilling to finally be by myself. The freedom! It made my heart race a little.

I sat down in front of the tea and waited for it to cool. It didn't. The quantity of steam increased as the water heated up and then it began to boil lightly in the cup. What could I do but find a pair of tongs and toss the cup and what tea remained in the recycling bin? And what could this be, if not a ghost?

I didn't mention the incident in my first message to my mom. She made a rule: I had to message her every day she was away from Mars. And I do mean days and not sols. On the *Fortitude*, her ride home, Mom would be keeping strict Earth time to better coordinate with Mission Control. I would remain on Mars time because nearly everything here is solar powered and I needed to keep track of the Sun. The difference between a day and a sol is only nineteen minutes, but you'd be surprised at how quickly that gap adds up. I sent Mom a picture of Camembert, a quadrupedal drone, doing a backflip. She responded with the view from her window: stars everywhere and Earth just a very bright point of light.

I did send a video of the self-heating tea to NASA, and they put me in touch with a Quantum Physicist. Her name was Maria.

“Listen, there really is a ghost here. Perhaps it is made of neutrinos??? Also, I'm never drinking tea again.”

And she replied: “I understand why a liquid that does not appear to equilibrate to room temperature might seem spooky. There could be something else at work here, though. What kind of additives did your tea contain? Perhaps something unusually volatile? Was it real or synthetic tea?”

“Also, a liquid heating up like this does not actually violate any physical principles. It's just extremely unlikely. Could you run a test on the atmospheric pressure regulator? The engineers here are wondering if perhaps there was a localized vacuum.”

I wasn't going to dignify the words “localized vacuum” with a response. Why would

that be likelier than a ghost? You have to understand that, because of the time delay, video conversations with people on Earth aren't like real conversations. You kind of just end up talking past each other. Which, okay, now that I think about it, maybe is like a real conversation actually.

I replied: "I want to know why my father died. And if he left a note? Mom says he didn't, but she has lied to me before."

Maria replied: "A temperature of a substance is just the measure of the speed of its particles. A hot liquid will equilibrate because that is the likeliest outcome of all of its interactions with other particles. Other outcomes, like heating up spontaneously, are possible, just incredibly unlikely."

And then she added: "Oh, I'm so sorry for your loss. I feel a little out of my depth here, perhaps you could discuss it with a counselor?"

Me: "No, I mean, what if my father witnessed phenomena such as these? Like a cup of tea that heats itself?? And, like other things that violate the laws of physics, or seem to anyway. Maybe he saw worse things than this???" Maybe that's what drove him to make his, uh, decision. Could we look at his logs?"

So Maria said she'd put me in touch with someone in IT.

I'd been trying to hack my way into my dad's logs for four years already.

I somehow knew without being told that I wasn't supposed to be doing this. This was confirmed the first time I got busted trying to break into his files. I was in even bigger trouble than I thought. All the grownups gathered in one room and told me that I was not, under any circumstances, to go looking through anyone's stuff, especially not my dad's.

Especially not my dad's.

And that's how I knew that they were all keeping a big secret from me. My dad's stuff should be the least important out of anybody's, him being dead.

And so security was enhanced. Firewalls were erected. Everyone, especially my mom, kept a much closer eye on me. So once everyone left, of course I was lonely. Of course it was spooky. But I was also thrilled. This was my chance to finally solve this mystery for once and for all.

* * *

I woke up the next morning to my usual overstuffed inbox. I decided to have coffee before anything, and instead of my usual tea. It didn't boil away, which made me feel the day was off to a good start.

Each of the printers and drones had a notification for me. The robots were always breaking. Oftentimes they could fix each other, so it paid to wait some alarms out, but on this particular morning, a dozen drones were complaining about the same thing, so I decided to take a peek. I used a camera-mounted helicopter to view the site from my workstation.

One of the larger robots had raked a perfect rectangle into the plain, about 30 by 10m. I rewound the footage to identify the culprit: Bertha, who was modeled after an Earth animal called an ox, only with six legs. Bertha had taken care to remove all large rocks from the area and then had dragged a blade across the surface to make it level. This had happened overnight. Now several drilling robots were at work boring holes at locations seemingly chosen at random.

It was possible that there was some elaborate experiment set up for today by Earth scientists that no one at Mission Control had bothered to tell me about. I wasn't even supposed to be here, technically. I had ignored a direct order from the president to evacuate.

Just then Mom called.

"Morning!"

She looked better than she had in a while. Zero-G plumps the face, so her eye

sockets looked less sunken, her cheekbones no longer overly defined. She had lost so much weight during her last round of cancer treatment. On Earth, they had immunotherapy. They were preparing a personalized treatment, which her Earth doctors promised would wipe her cancer right out.

The problem was that grownups often lied to me. They treated me like a child. Not that there's any excuse for their behavior, but it didn't help that I sorta looked younger than I was. The low gravity on Mars combined with my various bone deformities had stunted my growth. I was four feet tall on a good day, on a day when I could stand all the way up. I was shorter in my walker and even shorter in my wheelchair. Some people think I am intellectually disabled as well. When I suspect I am in the presence (or telepresence) of such a person, I find myself using big words. Agglomerative. Dimensionality. Dendogram.

Despite my sesquipedalian exertions, the way the doctors described immunotherapy to me made it sound like magic. I could research the treatment myself well enough to see that it didn't always work. Mom was pretty sick when she left, and the voyage would take six months.

If they even made it back.

Space travel is deadly. And this trip was hastily arranged by some glitchass robots, three very sick cancer patients, and me. Not exactly what anyone would call The Right Stuff.

Of course I didn't have to tell Mom that. She was not only the first person on Mars, she was the lone survivor of the mission that brought her here. When I said I didn't want to make the journey with her, she didn't push. *It's your decision*, she said, but I could read the relief in her face.

I'll bring you back something nice, she told me. By *something nice*, I hoped she meant stem cells. Pluripotent, preferably, but it's not as if I could afford to be picky.

Apparently there were mice on Earth that were already growing osteoblasts engineered specifically for me using my genome. These could be injected right into my bones, and then I'd supposedly be fine forever. Other mice were hard at work fabricating new heart tissue for me. The production sites looked like giant tumors on their backs. I feel kind of bad about it, actually.

"Ma, you look great!"

Mom was only 18,000 km away at this point, so the message delay wasn't too bad.

"*Hija*, there's a slight mutiny to the east, I sent you a map with the location marked. Why don't you go out there and break it up?"

"But I just woke up." I hated suiting up first thing in the morning.

"Do it now, call me back when you've finished."

The protocol for this was to do a manual reset on the smaller, misbehaving drones. Then you were supposed to send out small, compliant drones to manually reset the big ones. You didn't want to get too close to anything that was out of control and taller than your ankles, especially Bertha, who weighed 5,000 kg.

"Do I have to? The robots will sort it out themselves eventually. Or Mission Control can attempt a mass reset. They're probably doing that already. I have other stuff to do."

"Like what?" The way she asked this question made it clear that she knew that I was trying to access my dad's logs right at that very moment.

I didn't answer. I wondered if the whole "mutiny" was just a conspiracy by Earth scientists to saddle me with busywork.

"Go do it now and call me back when you are finished."

* * *

I checked the outside conditions and then I put on my suit.

Our base is located in Arcadia Planitia. Planitia means "plain" in Italian. Lots of

stuff on Mars has Latin or Italian names because the first guy to draw a halfway decent map of the planet was Italian. Never mind that he thought he saw liquid oceans and rivers, this was centuries ago when telescopes were not very good. His name was Schiaparelli and he chose the name Arcadia because it was another Earth word for paradise.

I wouldn't exactly call this place paradise, but there are reasons Arcadia Planitia was a good place to put a colony. For starters, it's very flat here. Flat is good because that's easier for the robots to navigate. It also means that there are no geologic features that will shade our solar cells.

There's also a lot of water in Arcadia Planitia, though it's hard to tell at first. The water is frozen into glaciers and buried under a layer of dirt. That dirt is the only thing that keeps the water from sublimating away into space, thanks to the low pressure of the nearly nonexistent atmosphere.

Despite the cold, this plain was the warmest place on Mars that had water in abundance. Zero degrees would be considered a warm day. It wasn't nearly that warm when I went out. My suit was heated, but I still felt a chill on my face, where the glass of my helmet met the thin, frigid air of the outside.

I hopped into my rover, drove a bit, and then stopped to check on the glacier mining. We had bots that dug through the dirt until they hit ice, then drilled and chopped the ice to prepare it for processing. Using the AR overlay through my visor, I could see how efficiently (or not) the bots were working. Dead bots would show up as black and could be grabbed by a robot arm and chucked into my rover's trailer for drop-off at the repair station. Of course maintenance bots would also automatically retrieve the dead for me. The workload on Mars was so great that redundancy was built in to every task. But it's that same redundancy that slows everything down. It might take a maintenance bot days to find and repair a dead comrade.

Nothing is faster than bots and humans working together. Some chores that can take me thirty seconds might take a drone an entire sol. The robots are extensions of us, but they cannot keep the station in good, habitable condition by themselves. This is why we cannot abandon this planet to robots, the way so many on Earth argue that we should.

A long time ago, this planet had oceans and an atmosphere. I can't help feeling I was born too late. The popular saying goes: The best time to colonize Mars was a billion years ago. The second-best time is now.

Since the weather was "good" that day (-20 degrees and not much dust blowing around), the water bots were hard at work extracting ice, melting it down, and then filtering it for potability. I already had an abundant supply of water, but I liked to keep all the tanks topped off. What if I were to get visitors?

Because aspiring astronauts and Marsheads liked to track my progress using satellite pictures, I moved the gauges marked full to the very tops of the tanks, visible to all who cared to look. I wanted people on Earth to know that there's plenty for them to drink here. There's plenty of everything here except people, and that's merely the fault of their own stupid governments. I didn't get to vote, but they did. This was my way of convincing them to vote for Mars.

There was plenty to do, and I couldn't do it all by myself. Trace organics found in the dirt suggested there might have been life in Arcadia Planitia at one point. We'd yet to find indigenous life or fossils, but we hadn't looked very far. There were unexplored mountains a mere 500 km from the base. These were the Erebus Montes, and at the base of those mountains there had once been plans for a second Mars colony. That mission was canceled before I was even born.

Whatever was done can be undone, I practiced saying to the president. Erebus Montes would be a good place to live and explore. Colonists could shelter in the

mountains and tunnels, safe from radiation, and spelunk in search of life. I've stared at those peaks my whole life. They are spiky and dark against the ochre plain of Arcadia Planitia. It's stupid that I've never been. It's even stupider that I may never get to go.

After I finished checking in on the waterbots, I drove to the plain that Bertha had raked clean. Three dozen drones of various sizes seemed to be having a party within the rectangle, whose perimeter was demarcated by a thin trench. Some robots were spinning around in circles; some were doing backflips.

People on Earth really seem to like videos of our bots doing backflips. It's not all that impressive, as far as tricks go. The mechanics of it are simple, especially in Mars gravity, and the technology predates electricity. There are ancient windup toys that can do backflips, powered solely by energy stored in springs. But if people on Earth like it, if they think it is cool or even magical, then we can exploit that ignorance to attract interest to our colony.

That's why the first batch of Mars robots was programmed with backflip capabilities. The later generations of robots learned it by copying, as they are equipped with vision-based learning. I parked the rover a safe distance from the mutiny. Once I stepped out of my ride and felt the ground underneath my feet, I did a little backflip myself.

The flip felt good. Normally, I wasn't allowed to do backflips. I might break a bone. Disobedience seemed to be the prevailing spirit that morning.

Among those who declined to have a master: five small digging bots that were extracting and refining dirt in the rectangle. They ignored my pings as they took turns feeding the refined dirt to mobile printers. The mobile printers ignored my local override commands as they fashioned the refined dirt into bricks. I admit I didn't try very hard to get them to stop.

And then there was Bertha, the largest bot of them all. Bertha was stamping the ground in a strange rhythm using its six hooves. It almost sounded like music. I tried to place the song. It reminded me of the old hymn about Margaritaville that some of the grownups sometimes sang. If I were more online, I could have turned Bertha dancing it into a gif. I almost texted my Earth friend Zetta to ask her to do this for me, but I decided not to. My mom said it was important that we always looked like we were working hard so that the people of Earth didn't think we were wasting resources. She blamed the mission cancellations on too many videos of our robots backflipping.

It was probably best not to broadcast this massive glitch, though the public would surely find out about it eventually. I didn't trust myself to correctly communicate the spirit of the thing. Sure it was a glitch, but not, like, a haunted and spooky glitch. It was like a giant bot party. Looking at them dancing, singing, and working, I felt less alone.

I double-checked the Mission List. This was not an officially designated Region of Interest. Or at least it wasn't before. Now almost all normally scheduled scientific exploration at all the other Regions of Interest had halted as the engineers on Earth tried to bring these thirty-six drones back under their command. This was quite the mutiny.

I checked the maintenance list for the station. Life support looked good. Solar cells were operating at a high efficiency. The station appliances were all normal. The pizabot was ready to make me lunch. All the stuff I needed to live was operating, as it should be. These weird robots were a problem, but they were not my problem. They were merely a distraction from other stuff that was more important to me.

I got back into the rover.

Help me understand why I should intervene, I said to myself. How does this help me survive here?

I was practicing my negotiations. It would be easy to get someone really important

on the old videophone now. On the drive home, I felt myself rooting for the mutiny. It was harmless, but it looked like a mess. I even considered programming more bots to join them. The more fucked up things seemed on the ground, the more leverage I would ultimately have.

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I didn't head back to the living quarters right away—I checked the adjacent greenhouses first.

The tomatoes were wilted, so I adjusted the sprinkler. The corn had splotches on it, and I had no idea why. I ran a pestilence identification algorithm and waited for a result. Half the pea seeds had failed to sprout. I pinged Lily for advice. We were looking at a long winter here if my crops failed. Eight months of MREs left and none on the way. Nothing was on the way.

It wasn't all bad news. The Lupines were blooming. This was one of Lily's experiments. Isn't it funny for a botanist to be named Lily? Or maybe that was her parents' plan all along. On Earth, I heard some people named their kids Mars in the optimistic hope that their kids will get to come here one day. Not just Mars, but Jezero and Gusev and Eberswalde and Becquerel. This in addition to all the crazy names Schiaparelli came up with. I would love to say *Welcome to Mars, Mars!* to a new arrival one day.

Lily's Lupines were not just beautiful, with bright red petals that were black at the very tips, they were an experiment in terraforming. The fungus on their roots was a special nitrogen-fixing bacteria that could theoretically live outside the lab. Of course, we weren't supposed to unleash our experiments on the landscape.

In the twenty years of the mission so far, we had only been contaminating our environment accidentally, never intentionally. One day, we hoped to terraform in a manner that might make this place more habitable for our fragile selves.

Such an undertaking would require a lot of creativity, which was another reason to let the robots have their robot parties. Many breakthroughs are the result of what started out as play. That's what the grownups kept telling me. Even though I had tons of chores and studying to do each day, there was always time set aside for me to do unstructured play.

Why should I deny the bots what I had been given? Maybe if we let the bots get creative enough they could figure out how to restore the magnetic field.

Aside from magnetism, there was only so much you could accomplish with batteries and transistors. Biological materials were more efficient and resilient than anything designed by humans. We needed to learn new ways to deploy organic lifeforms to help us. The future of Mars was here, in this greenhouse.

So, I let the robots "mutiny" while I tended to Lily's Lupines and filled out her data logs and completed all her outstanding checklist items. Priorities.

Then I cut some blooms to put in a vase for my room. Beauty should also be a priority.

* * *

I started to feel a little dizzy once I got back to my room. I put in a request for an anti-nausea pill. Since my dad's death, the pill printer only printed one pill at a time, and only after it received authorization from an Earth doctor. I set my timer for an hour, the shortest interval in which my pill might appear.

My inbox was stuffed with messages from authority figures. Mentally, I was ready to negotiate. Physically, I really needed to lie down.

The lie down lasted three days. Many of my bones were malformed, and that included the tiny bones in my ears that helped me to balance and stay upright. I would often have bad headaches, nausea, dizziness, and vertigo. The only thing to do was to stay as still as I could until it passed.

The butler bot brought me chicken soup MREs and ginger tea. The tea was iced so that it would take longer to boil away, if that's the route my beverage particles decided to go.

While down, I managed to read some of Hillier's *Robot Uprisings*, a book that had been downloaded many times by the colonists. I like to read what the grownups are reading. I'm practically a grownup myself. We measure ages on Mars in Earth years (which is fine! If we measured it in Mars revolutions I'd only get half as much birthday cake). My age is sixteen Earth revolutions. Adulthood begins at eighteen, so you see how I am within the rounding error of maturity, especially when you consider temporal irregularities, relativistic effects, and the entire scale of cosmic time.

Hillier's book predicted a technological singularity, which meant that there would be a time when robots and humans would be indistinguishable. To arrive at the singularity, bots would have to evolve. Perhaps that was the true purpose of the mutiny. What looked like partying to me might actually be the dawn of a new civilization of fully autonomous bots. Did they have a right to self-determination? If that's what they were doing, did I even have a right to interfere? I made a mental note to message the author when I felt up to it.

When I get one of these tired/dizzy spells I have to meter my energy very carefully. Like this, the only person who I communicate with is my mom. We have a code, and when I lie down like this, I'm supposed to ping her every twelve hours that I'm still alive. As long as I do that, she knows to leave me alone and otherwise trusts me to ask for what I need.

I spoke to her as soon as I well enough.

"How's life on the *Fortitude*?"

"You need to call the president." She didn't specify which president. I asked her to clarify because I had trouble keeping all the important Earth people straight.

"Those robots are still in full mutiny. It's considered a security breach. You need to take care of it. But eat something first."

After breakfast, I took a freshly printed anti-nausea pill and then suited up into the VR rig. I tele-operated a squeegee robot that cleaned dust off the photovoltaics. Yes, there was an automated drone that did this, but contra Hillier, if you wanted something done efficiently on this planet, you had to do it yourself. The robots would not save you; they could barely even save themselves.

As soon as my squeegeeing was done, I took a look around. The landscape of this planet was beautiful, even from the confines of a VR rig. Not just red, though there was plenty of that, but also brown and gray and black and all the colors in between, too.

Our robots and solar farms and habitats and 3D printers and ground-based telescopes and rovers all looked like clutter. A blight against the pretty geology of this planet. I hoped the next generation of colonists would give greater thought to the aesthetic impact of their choices, especially if they were going to terraform. A field of Lily's Lupines would be perhaps the greatest thing we could possibly add to this place. What a triumph that would be. I needed to live to see it.

I zoomed my sights until I could see the cross that marked my dad's grave. It was knocked over.

We never let the bots adjust fallen grave markers. We fix them ourselves. It's the closest thing to a religious ritual that we have. I added righting his cross to my checklist.

My dad was raised Catholic, but he became an atheist long before he became an astronaut. According to his old faith, his manner of death would have condemned him to hell. Instead his afterlife is here. He took a handful of pills, then walked outside and took his helmet off. And now we call his resting place Planitia John, after his first name. He died before I was born. I've lived here longer than he did.

His was the stupidest way to die on a planet full of stupid ways to die. In the absence of information, I'll probably never forgive him. That's why I need to know more. Perhaps there's something in his logs that will make it make sense.

I once asked Mom why his grave marker is even a cross at all, if he didn't believe in God.

"It's an Earth ritual. It matters to the people on Earth that we maintain their traditions."

"So we're pretending he believed in God to make the people on Earth happy?"

"Yes, we are. And we are also pretending we believe, too. Don't ever tell anybody on Earth you don't believe in God."

"Why not?"

"Because they pay for all of this." She gestured to our surroundings.

"Yeah, but they get knowledge in exchange. We learn things and then we tell them."

"I wish that were enough. It isn't. They also want to see what the future looks like. And if the future looks too different from what they expect, then it will frighten them. And if we frighten them, they will abandon us."

I was quiet because she answered a question I never knew I was asking. Now I knew why she never let me appear on transmissions to Earth on my "bad" days, on the days when I had to use a walker or wheelchair, on the days where one side of my face drooped a little and made me lisp my words. She didn't want me to scare anyone. She was terrified about being abandoned again.

* * *

I walked backed to my main terminal in the habitat and called the president.

"As you are no doubt aware, the mass glitch event at the Northern Quadrangle is a serious matter and is being closely investigated for interference by outside agents. We understand you have been ill, but to the best of your ability we need you to do what you can to contain it. No action is too small, and we have attached an action checklist for you to complete. . . ."

I checked my inbox; they had already sent me a dozen updated copies of this checklist, each one slightly longer than the next. The latest version had 1,300 items on it.

The president kept talking and talking. There didn't seem to be a pause for me to break in, so I interrupted.

"Outside agents? Do you mean a hostile government? Why is that only a certain set of robots are, ahem, glitching?" I didn't want to jinx it by noting that no drones related to my life support were misbehaving. We had two classes of drone here. One was expensive and hard to replace, the others were fabricated onsite from 3D printers using mostly local materials. The only expensive drone misbehaving was Bertha, a bot I didn't need anyway. The rest were cheap. It was a mutiny that almost seemed polite. If it were organized activity, it almost seemed organized around the principle of not interfering with my sol-to-sol life.

I turned off my video, calculating that it would take the president fifteen minutes to receive my interruption and then he would need to stop talking at a certain point and craft a response, which would also take 15 minutes for me to receive. While I waited for that response, I used my tablet to check on the adjustments I had made to the greenhouse's sprinklers and lightly sprayed the corn with a mellow fungicide. The tomatoes were still dying, despite my best efforts.

The president's response was nothing interesting, just repeating what he already said, but slower and louder, as if I were stupid.

Even though I had been rehearsing a brave and tough negotiation, I felt myself wither. The courage left my body and the truth came out when I responded.

"I need help." I said it in the most pathetic voice possible, and I hated myself. "I'm

all alone here. . . .” And then I stopped talking before I could embarrass myself further.

My mom had this plan. She would get to Earth, make a miraculous recovery, and then convince the Earthlings to send her back at the next launch window, even though there was no mission scheduled. None even being prepped. I mean, she's pretty persuasive, but I don't think her maternal guilt was that powerful. That's why she needed my negotiating skills, to help her. And here I was, shrinking like the cowardly and unintelligent child the president thought I was. I had to wait over thirty minutes to hear the president's chudly response.

“If you had obeyed the evacuation order, then you wouldn't be in this predicament. . . .”

I hated him. Yeah, if I had obeyed the order, I'd be on the shuttle and just as incapable of doing anything about the mutiny as everyone else on the *Fortitude*. Raj, Mom, and Lily were all trying different methods of instantiating a stop-work order. Clearly, it wasn't working.

If the mutiny was such a bad breach and a “threat to national security”—whatever the fuck that meant (like, there are no nations on Mars, my dude, my president, speak English)—they should be grateful to have a person on the ground to fight what they were insinuating was some kind of opening act to a weird war.

“You need to send people. You need to send my mom back.” It sounded like a plea, and the self-loathing washed over me like nausea. Launch windows were kind of a beast. The optimal path between both planets only occurred every twenty-six months. The trip took another six months. Thirty-three months sounds far away, but it had to be much closer than the TBD of the next resupply, which we all understood to mean never. I clenched my fists and pretended I was Batman, to deepen my voice.

“Send people,” I repeated in my Batman voice. Finally, I sounded like a real adult. “I need, uh, a biomechanics expert . . . someone preferably trained in massage and, um, acupuncture.” Of course I had robots (expensive ones!) to administer my manual therapies, but you couldn't beat the human touch, and our last massage therapist had left four years ago. Her immunotherapy had been successful, and she was now cancer-free, which meant she was probably ready to come back!

“And send an expert in organic chemistry,” I added. The chemists tended to be good cooks. I stopped myself there. I also wanted to ask for a poet, preferably someone good looking and my own age. Also, why not a nail tech or a tattoo artist? A fashion designer? A filmmaker? I was only asking for a fraction of what I wanted. I was being reasonable.

“No one is coming. Your country needs you.”

And that was the end of the president's transmission.

* * *

The next sol, I suited up again to observe the Robot Party in the area that was now being referred to as the Northern Quadrangle. Two of the smaller robots had died, and five were in the process of self-charging, with their solar panels angled to soak up rays from a faraway sun. This left twenty-nine robots of various sizes to party. Today, only two were doing backflips. The brickmaker had assembled a stack of bricks taller than I was, and a construction bot was stacking them in a spiral pattern.

A small bot skittered close to my feet. I picked it up, cracked open its panel and initiated a hard reset. After ten minutes, it scurried back to a maintenance station, reducing the mutiny by one, yes, but also reducing my precious leverage. The president was scared of something out here. I regretted resetting the bot at all. At least I knew I could turn a bot off manually if I wanted to.

Once I got back to the station, I called the *Fortitude*. After small talk with Mom, I asked her to put Raj on the line. He was a machine-learning specialist.

“How likely is it that the robots in the Northern Quadrangle have achieved sentience?”

“Have you been reading Hillier?”

“Everybody’s been reading Hillier.”

“Well, take him with a grain of salt. He’s overly alarmist and too fantastical, but he’s good for thinking about the ethical uses of AI, which is honestly more of an Earth-based issue at the moment.”

“What do you mean?”

“Oh, you haven’t been following the Earth news. It looks like there might be a war. The AIs deployed might end up killing a lot of people.”

“Is that why the president looks like he’s ready to kill me every time I talk to him?” I asked.

“The president’s a weirdo. I would minimize the time you spend talking to him. Let me and Lily and your mom handle him.”

“That would be amazing, thank you. So are you worried about the robots at all? One is making bricks and another is building a tower.”

“Yeah, I’ve been watching them through the feeds. You know, they used to be under Kip’s supervision.” Kip was a mechanical engineer who was also a construction expert. “You know, while Kip was super sick he was still coding like crazy, and a lot of his code is black box stuff, you know? Like impossible for people other than Kip to parse. His bots also relied a lot on deep learning, too, and so what I think is that . . .”

“Kip is controlling his robots from beyond the grave,” I interrupted. I expected Raj to laugh, he didn’t. He was silent for, like, a full minute before he continued. “I think that some of the code that was intended to help the bots work autonomously after he died has bugs in it, that’s all. Did you ever see his shielding for our station?”

I hadn’t, so Raj sent me the blueprints.

The station was built with some extremely strong anti-radiation shielding. But what happened was that the dust blown by the wind outside began to introduce microtears into the shielding that weakened it over time. There were repeated modifications made to fortify the shielding in response to this. For a while, the radiation seemed manageable. Manageable enough for my mom and dad to go ahead with having a baby, but still dangerous enough so that they gene edited me to give me extra cancer protections.

Everything would have worked out okay, except for the giant solar flare. It zapped the planet. It happened when I was a baby. Everyone but me got cancer from that event, just not at the same time. At that point it was clear that the station design was flawed from the start because it couldn’t protect the colonists from that kind of catastrophic event. Ultimately, the station was retrofitted with extra shielding to protect against another one of these freak flares, even though it might be a billion years (or more! or never!) before another flare of that magnitude occurred. Safety first. The modifications were drab, like everything built here. A beige wall glued on top of our existing beige walls.

Kip had an alternate plan for more stylish shielding that was never implemented. He drew up blueprints for an external frame made out of regolith bricks that would support a textile-based radiation shield. It looked like a giant tent, but with fanciful embellishments, like decorative folds and ornamental engravings in the frame. He had received design assistance from an Earth-based architectural firm.

Certain similarities jumped out at me when I looked at footage of the robot party while also glancing over Kip’s plans. The brick-making robot seemed to be compacting the dirt with binders in a manner consistent with Kip’s instructions. The bricks had the same holes and extrusions in them that Kip had described in his specs. These details turned the bricks into Lego-like pieces that would help them adhere

without any additional cohesive material.

There was a notable difference. Kip's design had twelve pillars, but in the quadrangle, they only appeared to be building one. I toggled between onsite cameras. There was a brick mound that might be the beginning of a second pillar, but it was hard to tell.

The first pillar was a meter-and-a-half high at this point, and it deviated from Kip's plans in that it was already too wide. It seemed to be hollow in the middle, whereas Kip's pillars were solid. And the bricks were being laid in a spiral pattern. That was different.

"I think a lot of the discrepancies can be chalked up to the strangeness of machine learning."

I didn't totally understand what Raj meant by that, but I did get that he was giving me permission not to worry about or interfere with the mutiny.

"I mean, I guess it might seem wasteful to people on Earth who might be watching?" I asked.

"I think we're past worrying about respectability. Just try to thrive."

"But I don't have to worry about the quadrangle being a theatre for an Earth war, right? Like the different countries aren't going to go all Battle Bots on my turf, are they?"

"I don't think so," Raj said.

"Good, because I'd really like to use my time here to investigate why my dad died."

"No. Absolutely not. Last time you tried to hack into the database, you deleted a lot of important stuff."

"I did? I don't remember that."

"You weren't the one who had to fix the things that broke."

"But why is all his stuff even encrypted at all? It makes me feel like his death was part of some giant conspiracy. Like, what if he was murdered? What if he saw something he shouldn't have?"

"He wasn't murdered."

"So he committed suicide and didn't even leave a note?"

"He left a note."

"What? You lied."

"I did."

"So what did the note say?"

Raj looked away. He was silent for so long I thought the feed had crashed.

"Your mom made me promise not to talk about it."

"She doesn't have to know."

"Okay."

"Awesome."

"But . . ."

"But what?"

"But I have something I need you to do first."

* * *

By the second week of their voyage on the *Fortitude*, Lily had taken a turn for the worse. It became clear she wasn't going to make it back to Earth. Her last wish was to terraform Mars with some of the specimens she'd left behind in the greenhouse. It was a task too important to automate. She was too sick to even come up with a mission outline, so it fell to Raj to manage the project and for me to execute it.

Technically, the plan was illegal. It violated a super old international treaty that predated the colony. No one was allowed to deliberately "contaminate" the surface of this planet with an Earth-based lifeform until a new treaty was ratified. Lawyers had been working out the details of this "new" treaty for half a century already.

The laws of Earth prevented me from modifying the environment outside the station to make it more livable, even though terraforming is necessary for the large-scale habitation of this planet. If we want thousands of people to live here one day instead of mere dozens, we need to use planetary engineering to close the gap between what a human body needs and what the planet can provide.

Despite that, I'd never wanted to break the treaty until Lily and Raj asked me to. The problem with terraforming is that once we start depositing our lab experiments directly into Martian soil, we make it harder to find indigenous life here. I've always wanted to meet aliens. Just like my dad, as I would find out later.

Contamination is a mistake that's already been made several times on Mars. Have I mentioned that my mom was the sole survivor of the mission that brought her here? The rest of the crew died on the journey over. They were felled by a hardy microorganism that somehow broke through the pre-flight quarantine on Earth and infested the ship. The crew didn't realize what was happening until it was too late.

That organism now happily lives in Martian soil. Mom was immune by accident. Everybody that's come after her, myself included, has been inoculated against it. So now it's just this thing that lives alongside us.

The colonies of this pathogen are small and scattered all over Arcadia Planitia. It's a fungus that gets its energy from doing chemosynthesis on regolith components. The organism has evolved quite a bit since it arrived here, presumably in response to environmental pressures. Even though it can't kill us anymore, we still hate it. As the microorganism, now called *Candida eve*, goes about the business of living, it deposits organic compounds into the soil. These compounds confuse our astrobiological sensors that are looking for genuine aliens.

Despite *C. eve*'s attempt to ruin everything, there is evidence that life once lived here. Like, there are compounds on Earth that can only be produced by biological processes, not geological or atmospheric ones, and we've found those same compounds here, too. Mostly amines, but also some amino acids and even some very tiny, very baby polypeptide chains.

Before Earth decided to divest from Mars, there were bot expeditions planned for the glaciers at the North Pole. These glaciers could theoretically support living organisms. Glaciers on Earth are teeming with life. And if we excavated more regions of geological interest, we might find fossil evidence buried deep in the ground. Then all excavations got canceled. It's as if humanity got to Mars, took a look around, and then decided to return home.

It's unfathomable to me, but Mom says it's a very human tendency (and by human she means Earthling, of course). Build a thing, then abandon it. Make a thing, stop caring about it when it inevitably breaks. I'm human but not an Earthling. This is the only home I've ever known.

Lily wanted me to prepare a bot caravan to a site south of the base where temperatures were warmer. She had marked a route to coincide with an ancient, dried-up outflow channel called the Ares Vallis.

She needed a mobile terrarium, one that could incubate her microorganisms, and a bot that could plant them in the ground. They would be accompanied by a maintenance bot, who could fix the other bots, and backups to replace any of the three working bots should any of them fail.

Once upon a time, there weren't nearly enough bots to do all the science experiments. Bots were apportioned by spreadsheet, and colonists got into heated arguments about bot-hour allotments. Now it's just me, the only science-person left on Mars, and I can use all the bot hours I want.

The greenhouse had all kinds of cool things living inside of it, but I was only going to be sending really simple stuff down south. No Lupines, not yet. At one point in

time, Lily's greenhouse had been meticulously organized. Then she got sick and kinda gave up keeping things labeled.

That's bad news for me, because the algae all kind of look the same: green splotches on dirt. But some can survive outdoors and some can't. To make thing more difficult, the algae were mixed in with the mosses. You definitely don't want to send a moss to do an algae's job. I could mostly tell the difference on sight, but I was no Lily.

I lifted a tray of unmarked goopy green stuff to get a closer look. As I held the tray in both hands, it began to tremble. At first I thought it was my hands trembling.

I did my best to hold my hands steady. But the tray still shook. That might have been a good time to let go, but I found I couldn't. I heard hissing and scratching coming from the tray.

The plant sounds got louder, and the green splotches grew in volume. They seemed to bubble up, like they were trying to reach up for me. I held the tray as far away as I could from my face and then suddenly the green goop began to differentiate into foliage. Then buds. Then blooms. It was like I was watching a million years of evolution in fast forward.

And suddenly I was left holding a flowering plant, one that held dozens of red blossoms. Just a moment before, it had been a mellow, dark green carpet on dirt. Was I imagining things? I dropped the tray and got the hell out of that greenhouse.

I ran to my room and locked the door behind me. There was no video feed in the greenhouse, so I sent a video drone out to the greenhouse just to confirm I hadn't imagined the flowers.

I hadn't. I followed my dirty, hasty footprints back to the tray full of flowers. The drone helpfully picked up the tray and put it back on its shelf.

I sent the pictures to the shuttle, with the hope that Lily was feeling well enough to talk. She was, but barely.

"What does this have to do with anything? Go find the specimens on your list." Her voice was soft and hoarse. The transmission delay was slightly longer now that the *Fortitude* was further away. Delays amplify misunderstandings.

"This tray was unmarked, I thought it was the one you wanted. But why would a plant hiss and shake?"

"Is this like the time your tea spontaneously boiled away?"

"Yes, it feels a lot like that, actually." I didn't understand what those two incidents had in common then. It usually takes at least three data points to identify a pattern, and at that point I only had two.

But Lily was not trying to solve the mystery of weird things happening to me at the station. She was just trying to finish one of her many unfinished projects before she croaked.

I did my best to be nice about it. From her perspective, she might not live much longer. Her dying wish was to see this last task accomplished, and idiot me, who thinks there's a ghost haunting her, is getting all her specimens confused and dropping trays of delicate, irreplaceable stuff.

I felt my temper beginning to rise, so I took some deep breaths. I found a book on negotiation in the library that a lot of the adults had checked out. Back when there were lots of people living here, there were lots of things to disagree about as well.

The book said you shouldn't try to be super tough all the time. Sometimes, to get what you want, you have to be expansive in the face of criticism. Dig deep, it said. Be generous where you can to get the things that really matter to you.

And what really mattered to me was seeing my dad's suicide note. I was trying to get the task done as quickly as possible because I was scared Raj would change his mind. I brought the communication feed to the greenhouse and had Lily walk me

through what she wanted me to do. I took detailed notes. I ignored anything that sounded like a plant hissing at me. My hands would occasionally begin to shake as I anticipated the plants doing something weird, and then I would steady them. I sent the drone caravan on its way by the end of the sol. Bye-bye, hardy protists! Bye-bye, international anti-terraforming treaty!

* * *

The president wanted to speak again the next morning.

“Your instructions were clear. You were supposed to manually disable the drones in the Northern Quadrangle, and you’ve had ample time to do so. We initially assumed you were not physically capable of completing this task. But the fact that you sent robots armed with live biological samples outside in a deliberate attempt to contaminate the environment in violation of international law demonstrates that you are acting against your country’s interests, perhaps in concert with our adversaries.”

How nice of him to keep track of me. It made me feel slightly less abandoned. I should mention that Mom, Raj, and Lily are all citizens of different Earth countries. This matters not at all to me, but it matters a lot to plenty of people on Earth.

“We have decided to temporarily suspend military operations on Earth and send in armed forces to Mars. To that effect, a temporary ceasefire has been enacted. A manned crew staffed by members of nations participating in the treaty will relieve you from duty. When they arrive, you will be arrested for violating the evacuation order. You will be removed from the planet and brought back to Earth.”

This last part was essentially a death sentence. But the first part was exciting! They had stopped fighting on Earth. I won’t bore you with details (and honestly I don’t understand them that well myself), but there were three main governments on Earth with imperial ambitions. Technically I am a citizen of one of these governments, but I consider myself a Martian above anything else. The space between the planets is real, the lines we draw upon the planets are not.

Once upon a time, the three main powers cooperated so that we might colonize Mars. (Now I will pause to add that even the word colonization is somewhat controversial here. In previous times, it has meant theft and murder. The first Mars explorers applied this label to themselves precisely because they hoped they might redirect the urge to conquer toward a better goal. Meaning: humans were always going to want to colonize something, why not Mars?)

Does the application of the term colonization to the Mars mission have the potential to erase painful and important Earth history? It might! Mars could really use some scholars of the humanities. Historians, artists, writers, preferably people who would be willing to tutor me in this kind of stuff. I feel like I understand robots better than I understand Earth people, and my knowledge of Earth history is lacking.)

As a result of this imperial cooperation thirty years ago, war stopped and the human exploration of Mars began. That period is called the Pax Martiana. It was an uneasy truce, and recently, the powers decided that they missed acting with homicidal aggression toward one another. That’s why there wasn’t a resupply mission scheduled during the most recent launch window.

That launch window comes every twenty-six months, and it’s when the orbital path between Earth and Mars is the shortest it can be. The window is symmetric between Earth and Mars, and it had recently passed the week before. That’s when the *Fortitude* left for Earth with my last people on it. Now a multicultural contingent of soldiers was going to have to take a suboptimal route just to kill me.

Whatever, at least I had stopped a war. No, it wasn’t a flawless victory. It was a flawed victory. A very, very flawed victory. Still one for the win column, though.

Many people who’ve never met me don’t believe I am as sick as I am. They think that if I try really hard and believe in myself, my heart will magically be able to

withstand high gravity. My Mars-based doctors have data to support how deadly even a single g is for me. But the president thinks they are too biased to be trusted.

So, no, hearing that Space Cops were coming to teach me a lesson wasn't the best news. But it was good enough to give me hope for the future. I had secured a manned resupply mission to Mars and saved lives on Earth. Now might be a good time to mention that Mom and Dad named me Paz. It means peace in the language of my grandparents. Funny, right? Funny like how Lily is a botanist. Names matter, they really do. Be careful what you name your children, if you even have any.

* * *

My next conversation with Raj went something like this:

"Hey, I'm going to be arrested, did you hear?"

"Yeah, we're so excited you won't be alone there anymore. The launch date hasn't been announced yet. And they missed the launch window, so it's going to be a long trip for them. I spent the morning calculating orbits, I think the soonest they could get to you would be 251 sols."

"You know I'm not going back with them."

"That's a problem for later. Your mom is on the phone with the Pope right now trying to work something out."

"What does the Pope have anything to do with this?"

"Honestly, I don't know. I think the Pope may be the head of your president's religion?"

"He's not my president."

"Yeah, but you know what I mean."

"Okay, well, I did what I was supposed to do for Lily. Show me the thing."

"Not yet. I want you to finish the task."

"Hey, you're being manipulative."

"I am, but I'm also trying to save Lily's life. She needs something to hope for. She's dipping into despair. It's reminding me of your father, actually, in his last days. We should have tried harder for him. I'll always regret . . ."

Raj didn't finish the sentence. He looked away from the camera for a long time.

I didn't know what to say.

I started to worry there wasn't actually a suicide note. Was this just some elaborate plan to make sure I did my best for Lily?

* * *

The transition delay makes talking to people on Earth a drag, but I do have one friend my own age. Her name is Zetta. She's the closest thing I have to a sister because my gene mods are based on hers. A long time ago, like over a hundred years ago, people thought that genetic modifications could be used to create super-smart, super good-looking and very tall people, or something. But no such person has ever been engineered. Sure, there are such people on Earth. But they're all accidents.

It turns out it is really hard to construct a person from a wish list. It isn't just that the traits that are considered "desirable" are very complicated (for instance, there is no agreed upon definition of intelligence and there are at least four hundred genes that are associated with height). It's also that there are more things you don't want in a person than things you do want. In other words, more things can go wrong than go right.

The first stages of gene mods were to delete simple monogenic traits that also happened to be fatal. Easy. The second stage is where the science is at now: making deletions on lethal polygenic traits and hoping you don't increase your risk factor for something else. So, for instance, deleting a few genes associated with diabetes to reduce the eventual human's risk by 20 percent might also have the side effect of increasing their risk for arthritis by 5 percent. You might then leave the arthritis with an elevated risk, because deleting genes associated with that trait could increase

your risk of other diseases.

Only rich people can afford to genetically modify embryos, but not even all of them wanted to because it was very difficult to balance all the risk factors. And if your kid did end up with a genetic disease after all, you might feel like it was your fault and not, I don't know, God's.

After the sensors started showing elevated radiation levels in the habitat (but before the great solar storm that fried everyone here), Zetta's parents funded research that produced a set of mods that would maximally protect against cancer, while slightly raising the risks of acquiring multiple other disorders. Then they made a kid using those mods: Zetta. And Zetta was the cutest thing and so when she turned one, my parents took the plunge and adapted those mods for my genome and ta-da! People think something went wrong with the modifications.

I don't think it's that. I mean genes are important, but they are not everything. Here is what I think: gravity is key to human development. It's not as if Mars has no gravity, it has like a third of Earth's. But humans evolved to live on Earth and it turns out you kinda need that whole, entire g.

I once heard someone on Earth say I looked like Dora Maar. I had to look that up (using the station's library, of course, looking things up on Earth's own internet is so slow it's almost not worth doing). I think they meant to say I looked like Picasso's portrait of Dora Maar, because one of my eyes is smaller than the other. I don't know if they meant it as an insult, but fuck if I don't love that portrait. Sometimes I try to take selfies with my good hand held up to my face as I gaze mysteriously at the camera.

Zetta's not pretty like I am, she's pretty in her own way. She has ten fingers and her spine is straight and her eyes are the same size and she doesn't get episodes of vertigo that can last a week, or weird nerve pain or heart murmurs . . . I mean, I can go on. But Zetta doesn't get to live on Mars and I do. She would trade places with me; she's said so. I wouldn't trade places with her, but I keep quiet about this.

Zetta's parents named her after the number zetta, 10^{21} . That's supposedly the number of habitable planets there are in the Universe. They've always wanted her to go into space.

Zetta and I used a ciphertext channel to chat so that all our messages stay encrypted.

* * *

THE COPS ARE COMING FOR ME.

SEE IF YOU CAN STOWAWAY
ON THE PADDY WAGON!

* * *

HAHA YES! I WILL TRY

AND DID U HEAR?

'OUMUAMUA 3 HAS JUST BEEN SPOTTED!!!!

* * *

WHAT IS THAT?

* * *

Zetta has never been to regular school. Her whole life she has been tutored by scientists about space. Thus she knows lots about rockets and asteroids and other space stuff.

I, too, have never been to regular school. I, too, got my education exclusively from scientists. In fact, not to brag, but my tutors were more accomplished than hers, all of them being astronauts. The irony is, I know very little about space! My education focused on how to keep myself and the other colonists alive. So, like, electrical systems and environmental regulators and plumbing. How to fix a robot and how to grow plants in low gravity. I know how to take apart a toilet and put it back together. Zetta's never taken apart a toilet in her life. And that's okay, I will teach her when

she gets here.

* * *

THE 'OUMUAMUAS ARE A
CLASS OF
IRREGULARLY SHAPED
INTERSTELLAR OBJECTS.
THE THIRD ONE HAS JUST BEEN
IDENTIFIED.

UM, HOORAY?

* * *

WE'VE NEVER BEEN ABLE TO
SPOT ONE THIS EARLY
IN ITS TRAJECTORY.
WE'VE ONLY PICKED UP
IMAGES ON XRAY AND
INFRARED TELESCOPES ETC
BUT WE ACTUALLY MIGHT BE ABLE
TO PHOTOGRAPH THIS ONE
ITS GONNA GO
RIGHT BY MARS AND
IF YOU TRAIN THE CAMERAS
YOU COULD GET THE FIRST SHOT

* * *

* * *

COOL!

This wasn't actually cool; it was a normal part of my sol-to-sol experience. Since I've been old enough to hold a test tube, I've been helping scientists gather data. There's nothing else to do here!

Early in the settlement, I guess some people thought the colony might be "economically productive." Like, they thought we could mine minerals or whatever and send them to Earth. But the math doesn't work out. It's too expensive. I think the average cost per kilogram to send something back to Earth is something like a billion units of Earth currency. The only thing we have that is cheap to send and that Earth has any use for is scientific research.

Every time I gather data for somebody, I also get my name on the paper they publish using that data. My name has appeared on more papers than any other scientist, ever. Now granted, I've never been first author on anything. But that's okay, I'm not up for tenure.

So yeah, as a favor to Zetta, I'll take some asteroid pics and add another publication to my one-thousand-page-long CV. That'll probably really help me get into college.

Fun fact: I am in possession of some Earth currency. Like half-a-million money units, no idea what that will buy me. Mom says this money is my college fund, so they're either gonna have to open Mars University or give me a new and better heart, the kind that can handle a full g. When I was ten, they made a doll out of me to sell to kids on Earth. They kinda smoothed over some of my rough edges, and my doll is definitely more symmetrical than I am. They didn't include my walker or any kind of mobility assistance.

I do media events for the Earth Space Agencies from time to time. These mostly consist of kids asking me what it's like being a kid on Mars. Mom doesn't let me do them if I'm looking "tired." I'm also supposed to keep my claw hand hidden. And I do not, under any circumstances, complain about any aspect of my life. These rules are supposed to protect me and everybody else here, I guess.

Because we are not “economically productive,” we exist at the mercy of the Earth people who pay for everything we can’t make ourselves. They need to feel good about this project, because they are somewhat impoverished, somehow. I’m sorry, I wish I could explain it better. Earth is a resource-rich planet whose economy is governed by a made-up concept called money. Even though it’s totally made-up, there somehow isn’t enough of it. I’m like, pretend harder, guys!!! (This being exactly the kind of thing I am not allowed to say during a media event).

Okay, so, if the people on Earth start to feel that they have run out of this pretend thing they invented, they will abandon us. Which is kind of what happened, it just happened slowly.

Resupplies and staff rotations were supposed to occur every twenty-six months, during launch windows. People would leave, new people would arrive. But then new people stopped coming and the people who stayed all got sick. And then, we were all ordered to leave.

I didn’t just ignore the evacuation order. I did consider leaving. There are lots of ways to simulate what might happen to me in higher gravity. We ran tests, and I failed all of them. I like being alive. That’s why I had to stay here.

* * *

ZETTA, I MEAN IT

YOU GOTTA

FIND A WAY TO GET

YOURSELF ON THE NEXT SHUTTLE.

* * *

YES OFC, MY DAD

IS TALKING TO THE PRESIDENT RN

* * *

My mom called early the next sol. I opened up the videochat and saw a cranky look on her face.

“I overheard you talking with Raj about your dad.”

“You ‘overheard’ or you eavesdropped?” She can be so nosy sometimes, it’s the most irritating thing.

“Well, listen, if it’s anything important, you should probably hear it from me and not him. I’m your mother.”

So annoying! I could feel the irritation flaring through my face. I tried to soften my jaw and then I took a sip of iced tea to try to quell the pain that was spiking in my throat.

She doesn’t get how different we really are. She acts like I’m her possession, but the truth is that everybody on the station raised me, not just her. And everybody has things to teach me. She doesn’t understand how much I’ve lost. It’s not just that one parent died and the other parent is away, it’s that everybody who ever lived on the station was a sort of parent to me. Raj included. Lily, too.

On Earth they have what’s called a nuclear family, and it’s as scary as it sounds. One man and one woman raise children without the help or input of anybody else. The woman is the property of the man, and the children are the property of both parents. It’s how my parents were raised. But it’s not how I grew up, and I think sometimes my mom forgets that. She forgets that there are some things I can only learn from other people. There are some things I don’t trust her to tell me the truth about.

“I was pregnant twice before I had you.”

“Okay.” I think I was supposed to act surprised? Truly, I did not see what the big deal was.

“The first was a miscarriage. The second had . . . irregularities. I had an abortion.”

“What’s an abortion?”

So she explained what it was.

"All right. I mean that sucks that you had to get pregnant three times just to have me, but I'm glad I'm here and those other, uh, prehumans aren't." What did she expect? It's hard not to be glad for the failures that enabled your existence.

"Well, that kind of stuff bothers some people."

"Is this another Catholic thing?"

The religion Mom was raised with forbids gene mods, embryos in petri dishes, and abortions. She broke the rules so she could have me. I think it would be easier on the both of us if she could adopt a faith that's compatible with my existence. Of course she doesn't see it that way. She doesn't see herself as having choice in the matter. The Catholic God is the one who gets to choose, and He chose to call her into the faith.

"Okay, and it's possible . . . that Raj and your dad may have had some kind of relationship. I don't know."

"Is this another thing that would offend the Catholic God?"

"It's not the Catholic God, He's just God, okay? And since my health has been so bad . . . I just have been rethinking some things. I'm not saying the rules are good. It's just that the whole idea of faith is more than rules. Faith is about the world beyond this one. It helps you to forgive and have grace. It's a way of widening your lens, and I don't know, having a panoramic view." She turned her head to the side, probably gazing out of her tiny porthole window at a million specks of light.

"I'm sorry," I said. She was crying now. She was scared and the void was approaching, and she didn't want to step into nothingness. I didn't either! No one does! But the problem with this notion of Heaven is that supposing it is real, my dad is not there. The Catholic God forbids suicide. The void just seems more fair to me.

* * *

Each sol the structure that the mutinous bots were building in the Northern Quadrangle became a little more definite. They didn't seem to be working super hard, especially with all the dance breaks they took, but they were making steady progress.

At this point they had been mutinying for three weeks. In that time they had built two hollow pillars made up of spiraling bricks, each over four meters tall. Two bots were carving a decorative pattern into the pillars that looked familiar to me. It took a full sol of thinking until I was able to place it. These were the etchings that had mysteriously appeared on some greenhouse panes I had printed out years ago. The etchings looked like spirals.

I think I was around twelve when this happened. The spirals didn't look like an ordinary printing glitch. They looked intentional somehow, like someone had drawn them on the panes. At first I thought I had executed the wrong program (which, okay, was a thing I did with regularity, especially when I was younger). The spirals were all different sizes, and they reminded me of eyes. They were too strange to be functional. But hardly anything we made was decorative.

I stared at the spirals until it started to feel like they were staring back at me. I swore I thought I saw one of them blink.

I threw the panes in the recycling right away and never told anyone. And then I tried to forget about it. I mostly succeeded, but seeing those bricks unburied that memory. Something that strange doesn't just get forgotten, not all the way.

I sent a video drone to get a closer look at the engravings on the bricks. I wanted to compare the designs on the bricks to the spirals I remembered seeing long ago. The engravings on the bricks did contain a lot of spirals, though there were other components to the design as well: patterns that suggested foliage or even flowers. The brick engravings were more intricate than the glasshouse panes I remembered. I want to call the brick engravings beautiful, but that doesn't seem like the right word for it. I just don't have a very large vocabulary of words to describe things that are pleasing to the eye, and that's because most of the things we made were so drab and functional.

I did a reverse image search on the brick etchings, but nothing came up in our library. Had the bots come up with the design themselves?

The mutinous bots were autonomous. They taught themselves what they needed to know based on access to huge data sets provided by us humans. So if they watched humans making embellishments or designs, they could conceivably make their own, too. It was just hard for me to believe their data sets would contain anything so frivolous as instructions for engraving.

In one chapter of Hillier's book, he wrote that as robots became increasingly sophisticated, they would show signs of worship. He did not include a citation for this claim. The nice thing about being the only person on Mars is that anybody will talk to me. So I sent Hillier a photograph of the two pillars under construction and asked if we could chat.

My personal opinion is that robots and AIs are reflections of the people that programmed them. So, like mirrors. And all mirrors are imperfect, but many are very important. What if the mirror contained an image of Kip or an image of my dad or of any of the people that have passed away here? That would be a type of afterlife, wouldn't it?

I guess thinking those thoughts was further evidence of my lonely state of mind. I wanted to look upon the robots and things they were building and see images of people I missed.

The next day, Hillier sent me back the same photograph but with a detail circled that I had missed when I sent it. Without realizing it, I had captured the ascent of Phobos, one of Mars's moons. It was rising right between the pillars.

"STONEHENGE," he wrote back. It caused a sensation on Earth. People called it the Stonehenge Singularity. Some animals will look in a mirror and think they are seeing a whole new animal. Hillier and his many fans were like this, I think.

I didn't want to point out that it might be more accurately be called Brickhenge. Or that, since Phobos spins around Mars about every eight hours, it ends up in a lot of pictures that include the sky. I just wanted people to talk about Mars. The more people talked about Mars, the more astronauts they might send to man the station here.

Looking back, it was cool how everything lined up in the shot. I took an artsy photograph without even trying. The twin pillars and Phobos right in the middle between them. It was so close to the horizon it looked huge. Back then, I thought it was just a coincidence. A neat coincidence. Now, I'm not so sure.

* * *

The resupply left Earth without Zetta. She was crushed, which meant I really needed to capture a good photo of 'Oumuamua to console her.

* * *

MY DAD SAYS HE WILL
BUY ME A ROCKET

* * *

THAT'S THE SPIRIT

* * *

Zetta's dad might have the most money units of anybody on Earth. That alone would not be enough to get her to Mars. Rich Earth dwellers had long announced their intention to send themselves to Mars; none had ever been able to do it. Too expensive. It's not a thing a person can decide for themselves; they have to go through the main Earth Space Agencies. But Zetta was smart, she spoke twelve languages, she could solve differential equations in her head. She was astronaut material already. I hoped that would be as obvious to the Space Agencies as it was to me.

Zetta sent me a file detailing the mission to arrest me. Like I said, I don't know much about rockets, so she had to explain it to me. The mission was equipped with

an ascent vehicle for one. That's how they wanted to send me back.

* * *

YOU HAVE TO SABOTAGE
AS MUCH AS YOU CAN
ON THE BASE
MAKE IT SO THEY NEED YOU,
THEN THEY CAN'T SEND YOU BACK

LOL NOT A PROBLEM
THESE ROBOTS
SABOTAGE THEMSELVES

* * *

But before the sabotage, cooperation. I coordinated with Earth scientists, who helped me tune the instruments so I could capture the best picture of 'Oumuamua 3 possible. Telescopes were already studying its other characteristics, like its heat signature and reflectivity. And it had been photographed multiple times already by less powerful or well-positioned telescopes.

Based on what those images had captured so far, you could tell O3 was wide and flat and about two kilometers across. It didn't look like any known comet. Because it was passing so close to Mars, I had the opportunity to get the most detailed shot possible, using a telescope anchored on Deimos, the other Martian moon. I spent almost a full sol trying to get everything set up and then I missed the shot.

It was a combination of factors:

1. I know fuck all about telescopes.
2. The trajectory of 'Oumuamua 3 changed suddenly as it approached Mars, as if it were actually operating under its own power.

It turns out it's possible to be both awed and offended at the same time. Aliens, yay! Aliens that swerve to avoid getting their picture taken, boo.

* * *

I slept off the disappointment and woke to find a long letter from Chen, who used to live here. I had written him a few sols back to ask him what he knew about my dad's suicide note. I also wanted to know his thoughts on the mutiny.

Chen was once married to Kip, but they separated once Chen decided to return to Earth for treatment. Chen got better on Earth and then they reconciled. They had hoped to be reunited, but then Kip died. Chen was an expert on machine learning, and I was curious to know if he thought that the bot mutiny might be a sort of after-life for Kip. I didn't mean this in a mystical way, it's just that Kip coded many of the disobedient bots, and furthermore the bots were trained on data sets that he provided. And, more to the point of my ongoing investigation, if Kip was in there, then my dad was in there, too. Of course his trace would be fainter, but it would be there.

Chen wrote back:

* * *

Good to hear from you and thanks for the pictures of those pillars. Wow, they are quite interesting!

Don't take the 'Oumuamua near-miss too hard. You did your best and came close. We should have at least a dozen experts at the base monitoring the telescopes. Even then, they might have missed it, too. This just reinforces how important it is to have people on the base. Not everything can be automated, and there is important work to be done, especially now that it seems we are not alone in the Universe.

Between the robot Stonehenge and the possibility of first contact, people down here are really excited about Mars again, and

it fills my heart with joy. There's even talk about sending another manned mission at the next window, and I hope we can put your mom on it and your friend, too.

Zetta manages your social media accounts, right? I follow them all. I know you don't read them, but she does a great job of meme-ifying you and posting updates and just reminding people that you are still very much alive and hard at work.

I hope you did not waste too much time with Hillier. He's not a scientist; he's a science fiction author who pretends otherwise.

He's currently advancing a theory that the dead Mars scientists somehow figured out a way to upload their consciousness to the robots before they died. We both know that's not true. Our friends, my Kip, they all spent their last weeks fighting against the ravages of their diseases. When they weren't researching their own conditions and doing their best to treat themselves (and doing remarkably well considering how limited their supplies were!), they were working on their own projects, gathering data, writing up the results etc. There was no time to invent a thing that cannot possibly exist, that is, a robot that can somehow contain the consciousness of a human.

You asked if the mutiny could contain "echoes" of the dead. Certainly. They will retain impressions of anyone who trained them, and that includes the living. And it especially includes you, since they spent more time in their infancy with you than any of us.

Since you were little, you've helped us train the bots. It was too time-consuming to program each one specially, so each bot-type was equipped with a simple model and used vision-based learning to achieve competence.

The bot in charge of changing the air filters would watch you change the air filters until it could successfully imitate you. The bot that we wanted to plant seeds in the greenhouse would watch you do it first a hundred times. When you were little, we gave you the simplest tasks we could think of, but even the simplest tasks were very complicated for a bot. A task that I could teach you to perform in five minutes would take a bot all week to perfect.

A mature bot (that is, one that could operate autonomously or at least semi-autonomously) was the product of its model, its tools, and its training. That's why no two were ever alike. Sometimes, people would refer to them as having "personalities," but I tried not to use that word. They were not people. Anyway, the model and tools they trained with mattered. If you tried to teach a mature planting bot to change an air filter, it might not ever be up to the task. No matter how long you trained it or what tools you gave it. If a planting bot could not change an air filter, I have a hard time imagining how it could turn into "Kip."

You cannot separate a person's consciousness from their body. There is no afterlife in the cloud. Descartes's model of consciousness, the "ghost in the machine," is over two centuries old and has long been since discredited. There are no ghosts, only machines.

So no, I don't believe the mutiny is any type of afterlife for

the dead. Which is not to say what's happening in the Northern Quadrangle isn't remarkable. It absolutely is. My theory is that the bots became inadequately supervised once the station became so drastically understaffed. In response, I think they have begun training each other!

I know you are supposed to dismantle whatever it is they are doing, but I'm glad you haven't. There is something to be learned from every glitch. And the strangeness of their behavior has a lot to teach us about the limitations of our methods. I hope to return someday. Maybe they'll put me on the same shuttle as Susana and Zetta! But while I'm away, please don't call what the robots are doing culture! I know the positioning of Phobos w.r.t the pillars could be read as a form of worship, but there is a simpler explanation.

These bots are our tools. They are an extension of us, and each of us on Mars thinks space is extremely cool. Phobos is not magic, but it is worthy of study. We would frequently gather outside just to look at it. I bet if those bots are doing anything, they are imitating the way we used to study Phobos. Might be good to take one into the lab and examine its work logs, if you can. You might learn something interesting.

I remember what a patient and good bot teacher you were! You helped us out tremendously. We were all grateful to your mom and dad for taking the huge risks associated with bringing you into existence. It was a risk that paid off and continues to pay off.

I'm still sorry your dad did what he did. Yes, I know about his last transmission, but I forgot exactly what it said. Please forgive me for not trying to paraphrase it. I might misremember and cause you more pain.

You asked me about it several times before, too, and I'm sorry for not being forthright. Once, I remember, I tried to reassure you. I told you something like: His decision had nothing to do with you, don't blame yourself. And you replied that it never occurred to you to blame yourself until you noticed everyone insisted on telling you it wasn't your fault. That we wouldn't keep telling you it wasn't your fault unless it actually was.

I apologize for saying the wrong thing. Every time we told you it wasn't your fault, I think we were really trying to forgive ourselves. For my own part, I still think of things I wish had done differently. What if I hadn't underestimated the severity of his problem? Could I have saved him? I think I could have. I'm sorry I didn't.

Your mom was only a few months pregnant when your dad passed, and if it seems like we are secretive about what happened, it comes from our own shame and our urge to protect you. We wanted absolution. We wanted you to feel wanted. You are not a mistake or an accident. You are the best thing to happen to the colony.

It seems you might be coming back to Earth soon. While I think it is a mistake to force you to leave, selfishly I feel very glad to get the opportunity to see you again, and I know all the survivors of the Mars missions feel the same way.

I am concerned about the vehicle they intend to send you back on.

Please know that many people on Earth are working on a ship that can provide a gentler ascent. That, paired with some new, promising treatments advanced by Earth scientists, may help you make the journey safely. We keep telling the president that there is no rush, but he is angry you disobeyed him. Getting you back to Earth safely is going to take a combination of technology, medicine, diplomacy, and time; the same ingredients needed to put a person on Mars in the first place. If a person can reasonably live to 150 years, then there's no need to put you on a rocket right away.

There are lots of treatments on Earth to help you, but all the same I would be discerning about what path you take. You cannot alter your body without altering your consciousness as well. Change if you want to change, don't change because other people want you to change. Teenagers on Earth feel enormous pressure to conform. It makes them miserable. We all felt it growing up, and we did what we could to spare you that pain. We wanted you to have high self-esteem, something none of us felt we had as young people. Did we do a good job? I hope we did.

Anyway, I've gone on too long already. This is a difficult time, and I've been keeping in touch with the members of the *Fortitude*. They all seem very sick, and it is no certainty they will make it back.

I feel you are in danger as well; although I know you can take care of yourself, Mars was never meant to be a solitary mission.

We buried your father too deep, so don't be surprised if people approach you with details from his life that we've withheld before. It might be our last chance to tell you things that are long overdue.

Here's one you might not know: Of course your name means peace, but it is also an homage to Pascal, who was one of your father's favorite thinkers. Pascal had a notion we now call Pascal's wager: that you should try to live an ethical life just in case God really does exist. Which is to say, your father didn't believe in God, but he wanted to. That's how I know your father's final act was a mistake and not representative of who he was. I think of it as a type of systems failure. His brain had a momentary glitch.

If one of us had caught him at the right time, we could have stopped him, and he'd still be with us. That's the other reason we don't mention him as much as we should. We feel culpable. I didn't consider the impact my silence would have on you. I'm sorry.

Anyway, he told me he wanted to update Pascal's wager to something he called Paz's wager: live life as if there were aliens out there, ready to communicate. He meant that as: be your best self, live as if you might be an ambassador to another species. Be generous and curious.

He really wanted the search for life to continue. To Titan, to Enceladus, to Europa, to Proxima Centauri B. He would be so proud of you.

* * *

I shared Chen's letter with Zetta because there were parts I felt I didn't understand. Was he leaving something out? Sure enough, Zetta clarified that the reason Chen was very insistent that *robots are not people* was because there were a lot of humans on

Earth who thought robots were people. The definition of personhood on Earth had recently been expanded to include chimpanzees, dolphins, and some whales.

This expanded definition of personhood was meant to enhance habitat protections. Good, I thought. I'd like to visit Earth one day if possible, and it would be nice if there were an intact ecosystem or two left for me to enjoy. I'm in support of almost anything it takes to get Earthlings to pause the work of destroying precious and irreplaceable biomes. But, as it turned out, a certain type of weirdo thought that the Mars robots were people and thus entitled to their own habitat. Which meant I should leave.

I told Hillier to do what he could to argue with those weirdos. I mean, first of all, I am also a person, entitled to a habitat. For now, Mars is the only place I can live. But Zetta messaged him with a better argument; one intended to be more persuasive to his fans. She reasoned that some people (jerks, we'll call them) think it is not enough for me to exist, that I also must be useful somehow. So she argued that I was a necessary ecosystem manager for the botpeople; without the maintenance I performed, they might die. This wasn't true, but the truth isn't always the best antidote for a falsehood. People need fiction in their lives. They go crazy without good stories to tell themselves. Sometimes the only thing that can neutralize a dangerous lie is a benign one.

* * *

Chen's wasn't the only letter I got from a former colonist. I say former colonist because I don't have the right words for what they are to me. They are like family. They helped to raise me.

I'm not great about responding to the letters I get. I never know what to say; besides, I'm busy, but thankfully they keep coming anyway. We also do video chats on occasion, but they are difficult because of the transmission delays. Mitra, an astrobiologist, once compared us to whales. A whale song sung in one part of Earth's vast waterway, say a place in the southern hemisphere near the equator, will take twenty minutes to reach a whale listening at the North Pole. But whales can also live for three hundred years. They have more time than we do, thus they can handle conversations with long delays.

Mitra wrote to tell me she was unhappy with Lily's terraforming scheme. She urged me to stop it while I still could. Honestly, she had many good points, but offered me no bribes, no juicy secrets, nothing. I don't work for free.

Mitra was correct that it would take more than a tiny colony of hardy algae to remake this planet. Those algae make oxygen, hooray!, but the solar wind tends to push that stuff right off the planet and into the Solar System.

Mars needs a better magnetic field before it can have an atmosphere. Earth has this metallic molten core at the center of it that churns. That is the beating heart of the planet that makes life possible. Mars has a molten core too, but it doesn't move enough to give the planet a magnetic field. Weak hearts: that's a thing Mars and I have in common. It's also a thing that can be fixed, with enough effort.

Long ago, there was a plan to induce a Martian magnetic field by somehow putting a specially engineered satellite in orbit around us. I actually looked up the plans, but closed the pdf once I realized it was not a one-person job.

Had I the time or energy to write back to Mitra, I would have pointed out that the main purpose of Lily's terraforming scheme was to give her something to live for. If it only saved her life, then it would be worth it to me.

Later that sol, I found out Lily died.

Raj asked me if I still wanted to continue the terraforming project.

I did.

He asked if I wanted to know about my father now or later, and of course I said now.

"Your father thought the first two 'Oumuamuas were extraterrestrial solar sails."

“Well, O3 probably is, based on its specs. So he was right.”

“Yeah, but back then he had no evidence, just a feeling. We had scant data on the first two objects. But he felt it very strongly. He told me he thought there was a civilization on Proxima Centauri B and that they had sent scouts to probe our Solar System. His last message, well, he addressed it to the aliens.”

“You should have told me this years ago.”

“We were trying to protect you. It’s a weird thing to do, you know, address a suicide note to aliens. But he had been acting erratically. There had been a few . . . attempts, before. I know you think there’s some big mystery to solve. But there’s no mystery besides the mystery of illness. He had a disease. Like cancer, like vertigo. After he passed, there was a pretty thorough medical investigation done on his body. Genetically, it turns out, he was at risk. Several people in his family died the same way.”

“Then that means I’m at risk, too.”

“Yes, and I’m sorry I didn’t tell you sooner, but that’s how your mom wanted it. She thought telling you might set in a motion, I don’t know, some sort of self-fulfilling prophecy.”

“That sounds like her, all right. What I don’t know can’t hurt me.”

“At the station, we did a high-quality brain scan as part of his autopsy. In addition to his genetic risk factors, he had some brain lesions. These would also put him at risk.”

“Where did the lesions come from?”

“We thought they might be trauma-induced. Perhaps from the high g forces he was subjected to during flight training. Perhaps from playing football in college. Those are just guesses. We don’t really know.”

“Okay, well, thank you for telling me.”

“Please don’t tell your mom about any of this. She doesn’t want you to know.”

“It isn’t her decision, I’m practically an adult.”

“I agree, but now’s not a good time to litigate that. She’s doing poorly, and she’s taking Lily’s death pretty hard. A long time ago, they were . . . close.”

The most colonists I can ever remember living on the base at once was around thirty. It was a number that kept dwindling as manned shuttles left but new crew did not arrive. The dynamics between people kept shifting, people seemed to pair off and then split up. Apparently I had grown too inquisitive at one point, so Mom took me aside and explained a new rule: I was not allowed to ask if anyone “liked” anyone else. People were free to offer up their relationship status. For instance, Kip and Chen called each other husband. But I was not to inquire.

I think I was five? Anyway, I followed the rule even though it didn’t make sense and then as I got older it started to make sense. It didn’t occur to me until Raj hinted that my mom was protecting her own privacy as well. So sneaky! Maybe that’s the upside of being nosy, you really know how to guard your own secrets.

I didn’t know there was a word for what was happening on Mars until Zetta told me: polyamory. I thought at first it was a special Mars thing. It wasn’t. It was like atheism. It was like abortion. It was common on Earth even though you weren’t supposed to talk about it.

On Earth, most humans seem to be monogamous. It works better on Earth because you have a wider pool of potential mates. In fact, monogamy might have been invented to protect people from the terror of having too many choices. Anyway, I’ve long wondered where I fit into this. Like, when were they going to send some astronauts who were my age so I could agonize over whether to be poly or not? The answer: never, I guess.

* * *

I cried a lot after Raj told me about Lily’s death. Like so much more than I’ve ever

cried. My body hurt. It was grief, but it turns out it was something extra. The next day, I got my first ever period. Aside from the discomfort, this was such good news. I was highly abnormal in several ways, healthwise, so it was just kind of assumed I would never get it. But I did. Certainly it was an inconvenience. So much blood! But I was happy to have a normal girl thing happen to me.

I called my mom with the good news. She clapped her hands and told me where to find algorithms that would direct the textile printer to make the menstrual aids. This printer had broken before they left, and the repair bots weren't making any headway. I was just getting by wearing other's people clothes or sheet togas. Or by, gasp, doing laundry. It was time to fix the printer myself. One more chore.

* * *

The email from Raj came with my dad's last words:
PLEASE SEND HELP.

That was it. A three-word suicide note.

The message was sent using a directional antenna. It was aimed at Proxima Centauri B, the closest habitable planet to Earth, a mere 4.2 light-years away. That's where my dad thought the previous 'Oumuamua came from. He killed himself eight hours later. Just from his message, I knew he wasn't in his right mind, because if he was, he would have realized that it would have taken, like, at least 4.2 years for the message to get there and then the same amount of time to get a reply, not even counting the time it would take to craft a reply.

So by that logic, he should have waited at least eight and a half years, perhaps more, after sending the message to kill himself. It's both crazy and embarrassing; I can see why it was kept hidden.

Still.

As long as I had the coordinates and access to a transmitter, I thought I might also try to speak to that part of the galaxy.

Hi was all I wrote. I couldn't think of anything else to say. I know it's hard to believe considering how much I'm writing now, but back then I wasn't sure if there was anyone listening or not.

After sending my first transmission to Proxima Centauri B, I called up the *Fortitude* and asked my mom if she noticed anything strange on the station, starting around when I was about nine years old, give or take.

"Why?" The Mom radar was on. But I couldn't tell her that Raj told me about my dad's stupid suicide note.

"It's about 'Oumuamua 2," I lied.

"Oh, how?"

"Uh, just doing some research . . . on telescopes and orbital trajectories. Did anything weird happen back then? Like to the satellites or telescopes or anything."

"Check the logs," she said.

"Ugh, okay."

Daily life aboard the station generated too much data for a person to sift through manually. I used an AI trained in sentiment analysis to help me quickly search eighteen months of reports. I was looking for bot glitches, communication anomalies or unusual astronomical events. Either too much stuff came up, none of it really that special, or, if I narrowed the parameters, then nothing came up. Life on Mars is interesting every day, and it's boring every day. I wasn't even sure what I was looking for.

I did an image-based search and found only one picture that made me look twice. It was taken by my mom and showed a row of rocks perfectly arranged in a straight line. It was shot right outside the habitat.

Most of the rocks on the plain around us are evenly spaced. It's due to an effect called saltation, where the wind pushes the sand around rocks in a way that makes them

move very slowly. My mom, being a geologist and a climatologist, is way into this stuff.

The saltation moves the rocks so they look randomly distributed most of the time. It was unusual to see so many big ones lined up like this. I already knew if I asked her about this, she would deny there was anything spooky going on. It would be like the time when I was a kid and I thought I saw the face of Pikachu burned into my toast. I wanted to save that toast. I thought it was special and magic. Everybody I showed it to just told me to eat it. You didn't waste food on Mars, especially not bread.

I sent the old picture of rocks in a line to Zetta. She replied:

ALIENS DEF (LOL)

She told me to recreate the picture, just in case the rocks in a line were pointing at something interesting. When I had a robot line up the rocks outside, they seemed to make a straight line from our habitat to the pillars. I used mapping software to verify this. If you continued the line of rocks, they went all the way to the plain and met the space between the pillars right at the midpoint. If this was a message, it was telling me to walk through the pillars. Probably a good thing to try eventually. But I felt like I was too busy to do it right just then. I'd get to it when I could.

* * *

The next morning, I woke up with a question. I'd just had a nightmare about an event I didn't remember. I called the *Fortitude*.

"Can we talk about the solar flare?" I asked my mom.

She had told me about it before. I got the feeling it was the defining event of the mission.

The normal radiation of living on Mars is a problem for most humans. There's no magnetic field, so no protection. But one sol, when I was a baby, the Sun hiccupped and burped powerful radiation right at us. It was a new type of flare and it contained a new type of radiation that hadn't been observed before or since. It's called theta radiation, and it's pretty killer to anyone who isn't me. I don't think it affected me at all, but it's difficult to prove a negative.

The base had been fortified since the "event," so I wasn't supposed to worry about getting zapped again. Anyway, it was a one in a trillion thing. Kind of like having a flying saucer duck out of your sight or having your morning beverage boil away right in front of you. Someone has to live in the most improbable timeline of them all. It might as well be me.

"Doesn't the solar flare seem like an act of God?" I hardly remembered my nightmare at all, but it seemed to have some theological implications.

"I don't think it was," was all she said. I could tell the question made her mad. And she was having a hard enough time as it was. I wished I hadn't said anything in the first place.

We hung up pretty soon after that. I got another call from the *Fortitude* later that day.

"The interstellar object appears to be moving away from you under its own power," Raj told me.

"Yes, people keep telling me that. I get it, the aliens do not want to talk to me." I had spent the whole morning on the phone trying to get different people on Earth to help fix various broken things. I was talking to Raj between transmission-delayed messages from Earth.

"I hope Earth doesn't try to shoot it down."

"Do they have a gun that can do that?" I asked.

"Not yet."

"The president says they are going to try to reconfigure the Cop Rocket to arrest O3 instead of me. I don't see how that's going to work, given that thing's the size of Gotham City."

"Gotham City is quite a bit bigger than two kilometers across."

"Whatever. I've never been."

"Obviously."

'Oumuamua was acting like a mirror, and not just because it was shiny. You could tell a lot about a person by how they responded to it. If you were an aggressive person, you thought the mere presence of a piece of alien technology was an act of aggression. If you were a curious person, like Raj, like Mom, like me, you saw the technology as an extension of another civilization's technology. And what a piece of advanced technology it was: sturdy, lightweight, and capable of traveling vast distances. Judging from its shape and trajectory, it had probably used a solar wind to power part of its journey. The fact that it could change speeds and directions so quickly also indicated that it had another power source besides the solar wind.

The big question on my mind was how something so big and so thin could avoid being ruptured by all the rocks floating around the Solar System. Maybe a self-repairing material? Force field? Or maybe it was full of holes, and we just couldn't see them because all our pictures were blurry as heck? None of the large telescopes were designed to get detailed pictures of something so small and fast moving. The Mars telescopes were capable, but sadly they were operated by me and a glitchtastic AI.

Some people still thought it was a really weird comet. Like a giant, saucer shaped comet. The differential sublimation of ice on a comet can cause unusual trajectories, but the p-value of that hypothesis was beyond unreasonable.

The telescopes designed to detect chemical and biological signatures had not picked up any life signs. Some people advanced the theory that the object was itself a lifeform. I doubted it. The likeliest thing was that whoever sent this was like us: a life form evolved to live on a rocky planet. Such a life form would be totally unsuited to space, which is why they'd build a bot to explore for them. I mean, that's been our strategy.

If the interstellar object was a bot, it might be suffering some kind of malfunction. Perhaps that was why it kept speeding up and slowing down. Occam's razor says that in the absence of information, the simplest explanation is probably the best. The simplest explanation for any strange robot behavior is that it's broken somehow.

So, when the Solar Sail, 'Oumuamua, O3, whatever you choose to call it, did not fly by when I expected it to, when it zoomed away, and then later reversed course and returned to Mars, when it fell out of orbit and then entered the almost nonexistent Martian atmosphere and then crashed into the plain near the base of the plateau Acidalia Mensa. . . . I assumed it was a glitch. There is no shortage of glitches on Mars.

It happened while I was asleep. After my nightmare about the solar flare, I had printed a sleeping pill to get through my next rest period. All my devices were in do-not-disturb mode. I didn't see the footage until the next morning.

Two cameras captured the collision, though being automated, they didn't capture it very well. It is hard to see what's going on. You can view the object falling like a giant parachute upon the landscape, casting a huge shadow before it landed. The friction of entry tore at the object and charred it. When it hit the ground, it kicked up a bunch of dust.

I felt something like a chunk of ice in my heart. Like a dusty glacier of disappointment right where my cardiac muscle should be. O3 was so cool and mysterious, and now it was crashed and broken. I would never get to see it fly.

I checked my inbox, and predictably, it was on fire. Earth had seen the footage, too. Twelve different officials each had 1,000-item action lists that required my immediate attention.

So many messages were coming through the station to activate bots on the ground that my terminal kept crashing. An investigative caravan was a top priority, yet none seemed to be on the way due to all the software malfunctions. I figured the best

thing I could do at that moment was find some bots that were cut off from the network for whatever reason and program each one by hand to visit the crash site. I rebooted my terminal again and suited up.

My plan for the excursion was to scan the landscape for inactive bots and use the Rover's interface to reprogram the bots manually. Of course, the best place to find such ready and able bots was in the Northern Quadrangle, right by the pillars. I planned on catching them one by one, like Pokémon. This was the course of action the president had wanted me to enact weeks ago, only now I had a reason to do it.

But when I got to the pillars, all the bots were gone.

I could see track marks in the dust. I sent a copter equipped with a camera to follow them. It didn't take long to catch up. They were headed toward the crash site. This wasn't surprising to me at the time. I thought that Earth had finally regained control of the mutiny and had directed it toward a useful purpose.

I went back to the station and checked my inbox. I found an outpouring of congratulations. Even from Zetta, who was monitoring the situation using satellite photos.

Oh, I thought as I read through my newest messages. They think I'm doing it. They think I'm directing the bots toward the crash site.

And since I wasn't, only two possibilities remained: that the bots were acting of their own accord or that something else was directing them.

These weren't mutually exclusive possibilities. Perhaps some agreement was reached. Perhaps a request was made, or some payment was offered. Or perhaps the bots were asked to go in order to save me and perhaps they said yes. I wish you would tell me.

* * *

The only person I felt I could trust with this secret was Zetta.

YOU DIDN'T SEND THE BOTS?

* * *

No

Wow, wild

Well, it might be best to keep

that fun fact to yourself

Here's my reasoning:

The bots are doing a good job,

so it makes you look like a top engineer.

Like the kind of person

they might want to keep around

instead of flinging into space

at the first opportunity

Also . . .

Well, this part is

hard to explain

but people down here are

really worried about

an alien invasion

like, some people are

freaking out (seriously

there has never been a

better time for a

worldwide ceasefire)

anyway, there are people that

might want to act

hostile toward the wreckage

WHEN WE SHOULD BE RESPECTFUL
 LIKE, THERE MIGHT BE A
 DEAD ALIEN IN THERE
 BUT I KNOW YOU WILL DO
 WHAT YOU CAN TO BE
 SUPER DIPLOMATIC

* * *

Zetta was right. The hostility of Earthlings toward aliens was hard for me to understand. I called Raj to ask him about it.

"If you look at human history, it becomes easier to contextualize the fear."

"I feel like I'm a little too busy to look at all of human history right now. Could you please summarize it for me?"

"Well, it's happened many times before that when one human culture has met another for the first time, the result has been the subjugation or eradication of one of those cultures."

"So people think aliens are homicidal?"

"It's not a viewpoint I agree with. You don't travel light-years just to commit murder. If you want to kill things, you can stay in your own star system, on your own rocky planet. And if you are advanced enough to leave your own star system, you don't need to enslave humans. You make bots do your labor; it's easier and cheaper. In fact, it's probably impossible to go very far from your own planet without robotic assistance.

"You travel light-years to learn about what's out there. There is no other reason to leave the comfort of your own home, of your own star. That's why we visited the Moon and then Mars. That's why we should go to Europa and Enceladus. To learn about other life. And to learn what other life can teach you about yourself."

"I agree that the aliens probably don't want to hurt me on purpose, but what if they hurt me by accident? Like they could have crashed right into me."

"Yeah, accidental harm is a big worry. And it can go both ways. We might harm them without realizing it."

"Do you think there were aliens on board O3?"

"It's unlikely given how thin the sail was. There doesn't seem to be room for a passenger compartment. So no, I don't think you need to worry about either corpses or survivors.

"But they may have equipped their ship with something of significance to them. Could be something like a chip that contains a replica of a work of great artistic or religious significance. Or the object might have been carrying a very small sample of genetic material as cargo; something that we need to be very careful with."

"Because it could be pathogenic?"

"Absolutely it could. But there are other reasons to be careful, too. It might mean a lot to them. It might be precious and irreplaceable to them. But it's also precious to us. If we were to study it, it might teach us a lot about other life that's out there."

"If such cargo exists," I said.

"Right. It might not. But it's worth considering. So I have a request of you."

"Yes?"

"Here on the *Fortitude*, we've been pretty relaxed about letting you do whatever you want, even if it makes the authorities on Earth mad. But now, please, don't do anything to that wreckage without authorization. I know you mean well, but you could destroy something important without intending to.

"It's good you sent the mutinous bots there, but when they get there, have them hold their position with all cameras on so the site can be surveilled until the sanctioned salvage crew can get there."

That would have been a good time to tell him that the mutinous bots were not, in

fact, under my control. I wish I had. Instead, I just said “Okay” and hoped everything would work out.

* * *

The wreckage was at first only viewable using high-resolution satellite images. It didn't look like anything special, just a shiny torn parachute, charred in places. Scientists pored over the images, searching for something that might resemble a computer or a lifeform. Earth-based engineers were able to get a flight-capable video drone there a couple sols later, but even in close-up, the wreckage provided few clues. The site was a dusty, dirty mess.

Where were the object's controls? Was there any cargo? This was a job for an agile salvage bot. To that end, the Earth Space Agencies commandeered several bots to follow the mutinous caravan. I was on standby to pilot them if they asked me to. The advantage of using me was that I could control a device in real time. The disadvantage of using me was that I was me, the person who failed to get a good shot of the object while it was still intact. Thanks to me, we might never know what the ship looked like in detail when it was in working order. The regret pained me at least twenty-five times a sol. It pains me now, still.

I was able to track things myself by using a helicopter equipped with a camera. The camera was not great, but it was light, which was important because the helicopter could not lift that much. There were better videodrones on Mars, but those had all been commandeered by the Earth Space Agencies.

The wreckage was four hundred kilometers away. At the rate the mutinous caravan was going, it was probably going to take them twenty sols to get to it, but that depended on the terrain and the weather.

The salvage bots being controlled remotely from Earth were slow, and they carried a lot of specialized equipment. The transmission delay slowed them further, and after two sols of making less than one kilometer of progress, they did finally call me in for help getting the bots moving.

By then, it was clear which caravan would win.

How I hoped the mutinous bots would just get there and stop. That's what the scientists who had programmed and trained them would do. It was what I would do. I would get there and have a good long look. A weeks-long look. I would look and look before I even thought about touching anything. That would make the most sense, right? I really thought that's what they were going to do.

They were moving more quickly than I expected them to. The closer they got to the crash site, the faster they seemed to move. They took breaks to repair and charge, but those breaks seemed impossibly short. I wondered if they had somehow stumbled across a software upgrade. Like, had they upgraded themselves somehow? Or received one from you guys?

The medium-sized wheeled bots were the fastest, followed by the medium-sized legged bots. The rear was brought up by maintenance and charging bots, who rescued any dead or stuck bots. Bertha marched slowly behind everyone, moving only at night and charging during the day. Under the shade of its solar panels, Bertha would remain fixed at one spot, stamping its hooves to the tune of Margaritaville. Bertha was moving so slowly at first that I thought the salvage bots might pass it. But while Bertha was moving at a glacial pace, the salvage bots were even slower.

It took the fastest bots fifteen sols to get there. Truly, this is faster than is technically feasible, but I've since learned for myself that all time is relative. The first arrivals did stop and wait. They didn't respond to any of my commands, so I couldn't access their cameras, but the situation seemed tenable. Slowly, over the next few sols, more and more mutinous bots arrived. They lined up around the perimeter of

the wreckage. Some charged or repaired themselves. Some repaired others or received repairs themselves. Or at least that's what it looked like was happening. I was not only locked out of the controls, I was also locked out of the logs. I didn't know why they were waiting or what they were waiting for.

Once Bertha arrived, a full eight sols after all the other mutinous bots had lined up, all hell broke loose. The bots began attacking the wreckage right away. You can see them intentionally tearing the shiny fabric that made up the sail. The destruction gave me a sick feeling. What was I missing? There was something going on at the crash site I couldn't see or understand.

I was trying to angle my video copter to get a better view, but then other bots began to kick up dust. I wondered if they were doing this intentionally to block surveillance of their activities. Once it became apparent I wasn't going to get a clear shot of the bots ripping the sail to shreds, I called my mom.

"I'm sorry." I was crying. I had fucked everything up. Again!

"No, it's okay, hon. We know it's not you, right?"

"No, I can't control them," I said between sobs.

"Yeah, that's what we figured. You've never been able to control them, have you?"

"I don't know. I mean, at first, I wasn't even trying to."

"Yeah, but even if you tried, you might not have been able to do anything. This is bigger than you are."

"Apparently."

"You know the Fermi Paradox?" she asked. I scoffed. Of course I did. I had messed up a lot of stuff, especially recently, but I wasn't some ignorant baby.

"Did you even read Hillier's corollary to Fermi Paradox?"

"Hillier? Not that asshole again. I hate him."

"Yes, me too, but at the end of his book he updates the Fermi Paradox. Fermi wanted to know why humans seemed to be the only intelligent life in the Universe. Hillier's answer to this is that once a society advances to a certain point, the point where it can communicate and travel across vast distances, it becomes a bot-dependent society. And so Hillier predicted that First Contact would be bot-mediated. Just something to think about."

"Okay."

"Now get some rest."

"Okay."

* * *

I took a sleeping pill and didn't feel so great once I woke up. The crash site was still a dusty blur, but some bots had emerged from the site carrying long ribbons of the solar sail material. They were headed back this way and due to meet the salvage bots in a few sols.

I mostly stayed in bed and drank soup. I didn't have the energy to message anybody, but occasionally I piloted my copter around the crash site to see if I could see anything.

As the sol progressed, the dust began to settle, and more and more of the bots began to depart the site. They seemed to be headed toward the carved pillars, and indeed the fastest bots arrived back at the quadrangle within a matter of sols. This was unimaginably fast. I had thought at first that their hardware might have been upgraded, but now I wonder if time flowed differently for them.

All the bots clutched pieces of solar sail, except Bertha, who was the last to leave. Bertha held something in the claw that protruded from the top of its torso, which we sometimes called its mouth.

The thing that Bertha was carrying was small and box-like, clearly not a sail shred. I tried to get a closer look, but then my copter suddenly died. This was not a coincidence. When Bertha passed the salvage bots, who were still headed to the

crash site in the optimistic hope there was something left to salvage, they all dropped dead as well. The box-thing that Bertha was carrying was deadly to bots, which was worrying enough, because I relied on bots to survive. But as Bertha approached the base, it became clear that the box was also deadly to people.

After the flare, numerous sensors had been set up to detect theta radiation, the kind that was emitted by the solar flare long ago. Those sensors were now going wild because Bertha's cargo was emitting a ton of the stuff. Bertha kept walking toward the camp, and there seemed to be nothing I, or anybody, could do about it.

I wasn't scared about the theta radiation, though you have to admit it was ominous. Theoretically, my gene mods were supposed to protect me from cancer. I was scared of losing my bots.

I coordinated with Earth scientists to plan for how I might deal with massive systems failures. The truth was I probably couldn't survive even a moderate systems failure, not by myself. I was barely hanging on now.

I wanted to meet the moment heroically. I wanted to fight to the last. My body had other plans. I had headaches and vertigo, and I was unable to work from that point on. I thought the stress might kill me even before Bertha would.

As Bertha approached, I wondered if I was getting dosed with something poisonous or pathogenic. Things were far, far beyond my control. The cops sent to arrest me were less than halfway here and already having serious discussions about turning back.

I spent twenty sols in bed, longer than I ever have. I tracked Bertha's movements, but was not able to get much else done. At first it seemed Bertha was coming right for me, but then it turned away. It walked a long path around back to the Quadrangle, but it stayed clear of the station and most of the bots I relied on.

And then I got better, like I always did. I think it was the stress that made me sick. Just my body, once more rebelling against the conditions it was subject to. My body, the most mysterious piece of technology in the Universe.

While I was down, nearly all of my crops died. The farmbots needed close supervision and were always getting things mixed up. I felt too sick to even do the simplest status checks. During that time one drone confused fungicide with water; another had a faulty light sensor and keep making the greenhouse too dim. Two faulty bots working among a menagerie of two-dozen operational bots managed to kill almost everything. The tomatoes, corn, wheat, even the Lupines. All gone. Most of what was left was algae.

By the time Mom and Raj and Mission Control noticed something was wrong in the greenhouse, it was too late to do anything.

When I felt well enough to stand, I had to get to work salvaging as much as I could. I had some MREs. The Space Cops were bringing even more MREs, but they were also counting on eating my crops. I replanted what I could and then I started researching which of the algae was edible and which of those could possibly be cultured outside, as I needed to maximize my farming area. There was no way the cops would let me stay if there wasn't enough for all of us to eat.

I thought about the mutiny all the time. I wanted to escape. I wanted to walk through those pillars.

Satellite photos showed the bots attaching pieces of wreckage to the pillars, but none of the other video drones could get close. I needed to see it for myself. It was another ten sols before I could take enough time away from the farm for a recreational excursion. Because of the dangerously high levels of radiation, I was officially forbidden from approaching the site. I took an iodine pill before I suited up. The Space Cops would just have to add this to my list of charges.

I parked my rover a safe distance away from the Quadrangle so it wouldn't get fried by Bertha's box. The mutineers continued to be unaffected by the theta radiation.

When I found them, they had laid out the salvaged pieces of wreckage on the

raked ground in a pattern that resembled a mandala, albeit one with slices missing. It reminded me of a partially eaten pizza.

The smaller bots scurried back and forth between the pillars and the mandala, fetching pieces of the wreckage to give to the medium-sized bots, who attached the pieces to the outside of the pillar or stuffed them inside.

I couldn't linger, but I returned every sol in between shifts at the farm. When the pillars had been stuffed full of crash material, the bots began garlanding the tops of the pillars with the sail fabric, connecting the pillars so that they formed an arch. It looked like a gateway. Before they even finished, I knew what it was and that it was made for me.

When they had run out of wreckage, they took themselves and each other apart and then began to climb on the arch. Their panels were hanging open; their circuits and wires were hanging loose. They attached themselves to the arch and connected themselves together so that they surrounded it entirely. You could not see the sail shreds stuffed inside, or the engraved bricks the bots clung to. You could only see the fused mess of bots on the exterior.

These were machines capable of destroying the entire station. Yet they hadn't. They meant me no harm. On the day I decided to walk through, I took the Rover as close to the site as I could get it. It died two hundred meters away. So I got out and walked.

Bertha was standing underneath the canopy of fused bots that connected the pillars, the box still in its mouth. It was at the midpoint of the pillars, the point the line of rocks had been directing me to.

I walked toward it and then stopped. I stood right underneath the arch and looked toward the horizon, where I might catch the ascent of Phobos if it weren't for the bright light of day. I walked toward Bertha and put one hand on its body as I tried to get a closer look at the box it carried.

Bertha wasn't like the other, smaller bots who seemed to sense and respond to my presence. Bertha was indifferent. It had been considered too big for me to safely train, so we were unfamiliar to each other. It carried the box at my eye-level. I leaned in for a closer look. The box looked unremarkable. It wore a fine coat of regolith and was chipped at one corner. It was dusty and broken just like everything else here.

I looked up. The arch above me hummed and swayed, though there was no wind pushing it.

I was ready to walk through. So I did.

And nothing happened.

I looked behind me. I had not moved in space or time at all. I wanted to scream. I thought there was something magical about the arch. I thought it would rescue me somehow, and not in the abstract sense of "Art can save a life," but in the very real sense of it being a portal to a better world.

The bots fused to the gate and each other made clicking noises. They twitched and writhed to an irregular rhythm.

I turned around. The station was behind me. I considered how reality could be both surprising and disappointing and then decided it was time to lie down again. I had a marathon algae culturing session planned for that night. It would be good to rest up beforehand.

So I walked back through the arch, underneath once more, and that's when everything changed.

The landscape around me was the same rocky plain, but Bertha was red with dust. So were the bots that covered the Gateway, and they no longer writhed. I put my finger to the nearest distinguishable bot on the gate exterior. This bot had once been named Cheddar, and was an all-purpose small assistant. I wanted to test the thickness of the dust, but Cheddar's exterior crumbled under my glove's light touch. The

bot was brittle and thin and completely dead.

In the distance I spotted the Rover I had arrived in. It, too, was covered in dust. It did not crumble under my touch, but neither did it respond to any of my commands.

Like tea that boils away spontaneously, like a single celled organism that evolves into a flowering plant as you hold it, the matter and energy that made up my body had been funneled through time in a particular, accelerated way. It had to be the future. I checked my suit—six hours left of oxygen. This was plenty for the three-hour walk to the station. But if the station no longer had life support, then the consumption bar on my AR overlay was also counting down the remaining hours of my life.

My body was feeling pretty good. Stiff on the left side, as usual. But minimal pain or dizziness. I counted my fingers. Still twelve of them: five on my regular hand and seven on my claw hand, which wore a custom glove. I hadn't been cured, but neither had I left anything behind.

On the walk over, I saw a Rover approaching. I decided I would be friendly to whomever greeted me, even if it was the Space Police.

The suited figures hopped out and leaned in. The effect is sort of like a bow, but it allows you to better see the face behind the glass of the helmet. Their faces were familiar, but old.

“Mom! Is that you? Zetta? Is it? Is it?”

“Yes! Yes!”

I knew I wasn't in Heaven because my back had already started to ache, a mere one kilometer into my walk. Even leaning in so they could see my face had hurt my back.

They hugged me and touched their helmets to mine. This is how you kiss in a suit. Zetta saw I was having trouble standing and rushed to the Rover to bring me my walker.

“How long have I been gone?”

“Sixteen years.”

And that was confusing, because I was only sixteen years old in the first place, and it took a minute to understand that I had disappeared from the surface of Mars for a time equivalent to my lifetime. This meant the Earth had made thirty-two revolutions around the Sun since I had been born here. Thirty-two was also the age of my father when he passed; I looked back to the gate and thought for a minute that he might walk through behind me and then remembered, no, they found his body and buried it. And if his body was gone then so was his consciousness. There are no ghosts, only machines.

“Did you think I was dead?”

And Zetta answered no while Mom answered yes. A video drone had filmed me walking through the gate and then disappearing. This despite nearly all machinery near the gate malfunctioning thanks to the high levels of theta radiation.

“We wanted to examine the gate. We still want to, but our bots can't get near it and the radiation makes it dangerous for our bodies.”

“Dangerous for some bodies. Not my body, I'm modded . . .” said Zetta, and then my mom interrupted her: “All the young astronauts are modded, but it's not worth the risk. I mean, you disappeared, we can't subject someone else to that. . . .”

And then Zetta interrupted: “Clearly she's fine. . . .”

And then I finally had to tell them to stop talking over one another because they were scrambling the radio receiver in my suit. I had stepped in the middle of some long argument that would probably be litigated to one extent or another for the rest of my life. And I could tell by the way they bickered in those few minutes that in the time I had gone, Zetta had become a sort of surrogate daughter to my mom.

My mom had returned at the next launch window, touching down nearly three years after I had disappeared. She arrived 180 sols after the Space Cops, who turned out to be capable engineers. They made necessary repairs to the station and launched

a thorough effort to search for me. Two of the Space Cops remain on the station even now. They took me aside to apologize. They said they didn't realize the extent of my disabilities until they arrived here and looked over my files. They said they never meant me any harm and they are glad they didn't ultimately end up enforcing the old president's orders. They told me there have been two new presidents since I disappeared. I am supposed to talk with the new one, but I can't seem to find the time.

I asked one of the Space Cops if they had run out of food when they arrived. I mean, there were only two of them now, did they lose the other four to cannibalism? She laughed as if I were joking and showed me pictures of the station exterior. What I had taken for a dark green coat of paint on the outside of the expanded station was actually a living wall of cultured algae. The algae could grow outside, it was edible, and it provided extra radiation shielding. In my absence, several botany geniuses had taken the algae strains Lily had engineered, and I had cultured, and tinkered with them until they could do this. Incredible.

Lily had always talked about doing something like this, taking part of the station and making it alive somehow. She was gone, but her work continued. That was her afterlife.

After my disappearance and the clear evidence of extraterrestrial intelligence, Earth began sending scientists here by the busload. Earth's Moon has a fully staffed base now, too. No further contact has been made, though not for lack of trying. You guys aren't very chatty, are you? Everyone wants to know when we can expect another solar sail in our skies.

At the station, I was greeted by almost a hundred astronauts. I had never seen so many people in my life. I only knew Mom and Zetta, but each person knew me. They were so happy to see me. It was like I had managed to throw a surprise party for myself. Many people cried, but, like happy tears.

There was even a baby. Her mom, an astronaut named Priya, had made the journey to Mars while pregnant on a ship that spun to replicate high gravity. When Priya had arrived, she began a daily routine of jumping on a trampoline in order to subject her body to higher g forces. It's wild that such a routine would work. Now the baby has to jump on a trampoline every day. And the baby seems fine? She doesn't have any of the delays I had at that age, plus she's very cheerful.

Zetta also jumps on the trampoline every day. She says that once the baby turns one, Zetta herself will start trying to get pregnant. I told her she is too young. She reminded me she is in fact thirty-four years old, though she doesn't look a day over twenty-five. Her skin care regimen is highly effective. She prints her own moisturizers using lab equipment. We are roommates now; that was always the plan. I sleep on the bottom bunk.

In the meantime, a team here discovered an archaea-like organism buried deep in the cone of an ancient mud volcano, about three hundred kilometers south of here. The genetic material of this organism, called *Van martininus*, is very DNA-like. It even has a double helix! The phosphate spine has some differences (including a pretty strange phosphate-phosphate double bond), as do the makeup of the base pairs. The differences are a huge relief, actually—there is no way this life form journeyed here from Earth. The amazing thing is that, despite these differences, the genes code for many of the same proteins that are made by Earth organisms.

The logs on my suit confirm that no time passed for me in the period of my absence from Mars. Still, everyone wanted to know if I had made contact. Did anything special happen to me? No, not that I can remember. While I was gone, they sent you hundreds of messages asking where I was. We all eagerly await your reply.

There is a quantum specialist here now. His name is Rowan. He's the one that told me that time is just another way of measuring entropy. Time is not real, it's abstract.

Apparently temperature isn't real either!

Rowan suspects that you might use the manipulation of matter to communicate. So the boiling of tea was one sign, the spontaneous flowering of the plant another. He thinks you used quantum entanglement to communicate in this manner across a great distance. I can't follow the math, but if he's right, then you've been watching for quite a long time.

Rowan thinks I entered and exited a wormhole, and that explains how I ended up so far in the future. He drew a picture on the whiteboard of the wormhole. It looked like a donut. I asked him why it looked like a donut and he said that time is donut-shaped. Is it wrong that I have a crush on him? He's twenty-five, the youngest person here besides me.

Rowan explained to me that time travel to the future is not impossible, it just requires a lot of energy. So a lot of energy must have been contained in the gate somehow. Nobody can figure that part out. When I returned to the site, the gate had begun to crumble, despite being sturdy for the whole time I was gone. The bot pieces and bricks were falling off. There was no sign of the torn sail pieces that had lined the inside of the gate.

Ever since I returned I have been mostly the same, with one subtle difference: there are moments I can feel time washing over me like a river. And sometimes the river is shallow, and sometimes it is deep. And when it is really shallow, thin as Martian air, I feel I can almost slip in. Almost. Is it real, what I'm feeling? I feel as if I could find a time bubble and stay there for another sixteen years.

Or maybe not that long. Since I could not find such a bubble, I've had to compose this letter in my scant free time, sometimes faking illness to get out of chores. It feels so urgent to write you, but it has taken me weeks. I am sending it to the same coordinates my father used when he wrote you shortly before his death.

I am writing to thank you for the gate. Time travel was a great idea, and I really appreciate your help. I'm sorry this letter is so long. I just really wanted you guys to understand how your gift affected me. I probably could have found a shorter way to say all this, but so much time alone has turned me into someone who rambles.

I think the gate was meant for my father. He asked for help and you sent it. You were trying to give him more time, I think. But, ironically enough, he needed more time to receive the gift of more time.

On the other hand, if he had been able to wait long enough to walk through the gate, then I couldn't have. The gate was designed for one passenger only, wasn't it? That's why it no longer works. It barely stands. The crumbling bricks and bot parts are a hazard, in addition to the high levels of theta radiation. No one but Zetta will permit me to go near it, and so I have to sneak out to see it.

In that sense, my father's bad decision saved me. He missed the gate, which allowed me to meet it. And so I forgive him, without condoning his actions. I don't know if I could have survived much longer on this planet alone. And even if I had, the astronauts sent to deport me would likely have killed me by forcing me on an ascent vehicle.

That doesn't justify my father's decision, or rather, the decision his disease made for him. Please don't write back and tell me that everything happens for a reason. Truly, silence would be preferable. And anyway, it's a phrase my mother uses at least once a day. So I've heard it, believe me, and I choose not to accept it.

If there is a version of my dad in some other universe that is about to repeat his mistake, please, if you can, tell him not to. If possible, tell him he is needed. Tell him he is needed in ways he does not yet understand. You can show him this letter, if you'd like. That's the other reason this letter is so long. Just in case there is a chance you guys might be able to forward it to a version of him. What if he could see how I turned

out? Would his desire to meet me help him seek the help he needs? He wrote you a suicide note, now I am writing you an anti-suicide note. Show it to him if you can.

Sorry to make requests, it feels impolite. You don't have to write back at all. We don't really need words, and I get the sense you guys aren't great with language. Here is what we do need: another gate. Or ten more. Or a hundred more. Does it feel greedy to ask? What's the difference between greed and a survival drive?

Our bodies are so fragile, and space is enormous. To truly explore the Galaxy, we need help managing the time scales. In return, we can offer the pleasure of our company. It may not sound like much, but it truly is wonderful to be among people.

I will look to the sky as I await your reply.

Best,

Paz