Exfiltration

I thought I might not survive the interrogation, even though the guards hadn't laid a hand on me. It wasn't any physical technique that concerned me—that wasn't their style anyway. While I'm smaller and weaker than they are, pain is understandable, even if intolerable. It was the drugs that concerned me, especially the hypnotics. Under their influence, I would have no control of what I might say. Therefore, if they attempted such a thing, I would need to die.

Of course, this was a contingency that we had planned for. It would appear as if the stress was too much for me and my dainty heart or, more accurately, my aorta. It's just that all things being equal, I'd rather not have to execute that option. Hmm, perhaps an appropriate choice of words. And Matilda thought I had no sense of humor. At the moment, the questions were fairly civil and rote. Do I recall anyone acting suspicious, doing unusual things, behaving differently than they had before? That sort of thing. I decided I don't need to act nervous, so I asked a few clarification questions. Do you mean in the last few days or month or more? Just in my lab or in general (though I spent most of my time in the lab)? Anything besides the obvious, like people being in places they don't belong or acting nervous or surprised when I enter the room? I want them to believe I'm trying to help them.

They remain vague, as expected. Just as we said, anything unusual or suspicious. I offered a few weak examples of someone wandering in saying it was the "wrong lab" a week and a half ago (I had reported it and knew it was a security audit), a few whispers and murmurs among the cafeteria staff on occasion, and some unexpected delays getting a resupply order 17 months ago. I apologized that I couldn't be more helpful. They took notes but it was clear I wasn't very interesting.

The "interview" ended with the usual security mantras and then I was escorted back to my office. This time it was just one armed guard, as opposed to the three that brought me here an hour and a half ago.

Back in the lab, I assembled the entire team and gave the proscribed security pep talk about eyes and ears open, mouths closed, and to report anything strange to Security, and if appropriate, to me. I wanted them to think the loyal good doctor is with the program one hundred percent, since they most certainly were monitoring the lab and might even have a few spies or informants planted. I didn't care, as long as they did their job in my lab. And occasionally could be used for misdirection.

Giving an enthusiastic pro-security refresher talk helps me appear to be completely a company woman. But to the few who knew better, it was a status update on where I had been this morning and that it was a general rather than targeted screening, and orders to continue as planned. I then reviewed our results, always temptingly promising, but with so many practical barriers. So much so that we were currently pursuing three alternative approaches. But genetics are tricky. And so far, we were getting about 1

trillionth of the potential method's yield and a 15% success rate. Not terribly interesting but not quite a complete dead-end. Not yet. Which was exactly as how I wanted it to appear.

After the group meeting, a knock at my office door preceded the entrance of another guard. It's a cultural thing—they never wait for a response. Knocking first was a show of politeness. Sergeant Kim entered. He was responsible for security in my lab. He was somewhat stocky, solid but not the hulking linebacker physique of my earlier escorts. Dark hair, dark eyes, serious, but not unfriendly. He was at the bottom of the ladder of the security guards. That's not completely true, he was a specialist, being on this base and in a lab. But this wasn't a weapons lab and we weren't trying to make a super-soldier serum or mutant octo-parrots. We were studying information representation and DNA. Half the bio-labs on any college campus had more dangerous chemicals than we did. So this was not a prestige assignment for him. But he had been here almost three years, and I trusted him.

He sat down with a nod when I gestured at the chair. Our conversation was brief and perfunctory, everything that would be expected. I told him the things to keep an eye out for and a few people to watch, just as a spot check. He nodded and said he'd let me know if he found anything. I admitted I did not know what we were trying to find, but we'd have to do our best. With a final nod, he took his leave, again without asking for it. I sat at my desk for a bit and thought.

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Matilda had taught me a game she liked. It was a word-game that involved trying to get your team to pick several words from a larger list when given a single word clue, all while ensuring they didn't guess the wrong words from the list. The more people on your team trying to guess, the worse it got. The more I played with someone, the better I became at giving targeted clues for that specific person. And after some time, a clue my teammate would immediately understand would only confuse outsiders, or better yet, the other team who was looking for our words to eliminate from the same list that had their words too.

Matilda acknowledged the success of my strategy while at the same time accusing me of being a sort of "fun-vampire" that sucks all the joy out of a game by over-analyzing everything. She did that in her characteristically playful way, following the rules using a single word. It would take too long to provide the entire context, but for the record the word was sea-cucumber. I made an exception and allowed the hyphenated word, since it was just too good. And accurate too, I must admit.

***

One of the researchers stopped by my office with a data analysis question. Unlike Kim, he waited for me to say "come in." Harshot was an asset to our team: a year past his PhD and very sharp. He tended to stare at people when they talked as if they were an experiment he was observing. When he was thinking, trying to figure something out, he'd rub his forehead. It looked like he was trying to knead his eyebrows into a unibrow. He had the unenviable job of looking through the data for suggestions that we were on the right track (there were always many) and then digging into the practicalities to see if there was any realistic reason to believe it could be scaled up so massively (there never was). I saw a

lot of eyebrow massage over the last year. I wondered if there was an analog of Tantalus in the Vedas and tried not to think about the job and role I had given him and how it might derail his career.

We spent almost an hour reviewing the data, his analyses, and the results. Once again, they were inconclusive and he said he'd like to get HCC time to run some BD analyses to see if the filters and eBloodhounds could find some patterns. I told him I'd get the System Administrator to make the necessary arrangements once he sent me the specific resource requirements, such as how Big the Data would be, how long the analyses would need to run, and what were the accuracy, precision, S1, and C2 values. Harshot left, relieved that he didn't have to deal with our surly SysAdmin; it also meant I controlled the computational resource requests and performance parameters.

I spent the rest of the morning on correspondences, status reports, grant proposals, and thinking of ways I could further impede Harshot's progress. The last item consumed the bulk of the time, while I appeared to be doing the others. I'm fortunate to be a very fast reader, a fact I let few people know. Barring problems or questions, I met with most of the lab members only twice a week, each meeting taking no more than a half hour of my time. It says something about Harshot's talent that I spent a few hours each day to guide his progress; or more accurately, to hinder it.

After lunch the lab manager announced to me via Apex that SysAdmin Wallace would like a word or two with me. With an audible sigh of indulgence, I said sure, though I couldn't help but smirk. I wasn't sure if she would see that. The door opened and SysAdmin Wallace entered. Worn blue jeans, a baggy black t-shirt for some rock band that might have existed 40 years ago, sandals, brown hair messily tied in a pony tail, a baseball cap for a fictitious team, and glasses. Plus an attitude that filled the space in a way Wallace's small frame couldn't.

The announcement of the arrival and the sandals meant this was a formal meeting, so I followed suit with "SysAdmin Wallace" and a nod. I was met with a response of "Doctor Thompson" and then the SysAdmin launched into a rant, as she paced back and forth, on how the researchers and techs caused so many problems and how much time she had to spend on my lab compared to some of the others she supported. It was the usual post-lunch Tuesday tirade. When she stopped (she never finishes, only stops), I slid Harshot's Hyper Cluster Compute Resource Request form across my desk to her and said sweetly, "one more thing..." She didn't growl or curse, merely rolled her eyes and grumbled.

After a few moments of looking over the forms, I knew she couldn't find any obvious reason to reject the request. I had filled out the request correctly—no simple mistakes that would allow her to summarily reject it. I had dealt with the multitude of ways she could deny resource requests. These days I was close to a 30% success rate in getting the paperwork I submitted to her approved—much better than any of the other labs she supported. "Fine. I'll set up two I/O conduits for him by tonight and let him know when it's ready by Apex." I thought about what she said for a moment, then nodded and said, "He'll be grateful. Well, relieved anyway. He's scared of you."

She turned and walked to the door, stopped for a moment, turning her head back towards me and just before walking out the door said, "Good."

While most people fear SysAdmin Wallace for good reason, they respect her work ethic. If she says she'll do something by a certain time, it will be done and working by the specified time. But she has little tolerance for the mistakes users make, or as she might say, the "carbon-based life forms infesting her machines." She has a reputation for getting things done, but not necessarily in the most efficient way, and programmers describe her code as ugly and simplistic. It's not workplace sexism. It's true her programs often take too long to run and are inefficient. Second place only to "amiable" in things people would *never* call her is "a brilliant programmer and computer scientist." We agreed both were necessary.

***

DNA is at the heart of all living things. OK, "heart" is bad phrasing, since things without hearts have DNA. At the center of cells then. Yes, not every living thing has DNA—viruses make do with RNA, but it's almost the same thing. And yes, I write grants all the time, but I rarely have to explain "the basics" of Genetic Biology. I suppose I should work on that if I ever want to teach. Let me start again.

DNA is long strands of molecules that look sort of like a cross between a ladder and a spiral staircase. Each "rung" is one of 4 kinds of molecules, abbreviated A, C, G, and T. (I'm not going to explain any of the abbreviations. They're all just fancy chemical names. If you're interested and look them up, then good for you. If you already know this, then just bear with me for another moment.) Ignoring how each rung is actually a pair, each rung is a sort of line of code in a program that runs in each cell. They are used to make proteins, which is essentially everything in you. Again, ignore the huge number of exceptions. They can also start and stop the production of a protein. There is a specific sequence that means "start building a protein now" and one that means "stop." There are others that can enable or disable other parts of the DNA including other enablers and disablers. It all gets complicated quite quickly. There are vast parts of the "code" that are unused, they are never activated, don't build any proteins or enable or disable other parts of the DNA. For lack of a better term (and I almost *never* have a better term), it's essentially a scratch pad. Most mutations affect these "useless" parts of the DNA and don't result in immediate cancer or superpower (and the ones that do only cause the former, not the latter, sorry). Occasionally a mutation turns on one of the unused parts and it might result in blue eyes or the ability to resist malaria—about as close to superpowers as we get. Time and Darwin then determine if the change made things any better or worse. It's the same from humans down to single cell bacteria. And when cells divide, the two daughter cells each have an identical copy of the original DNA, including the huge scratch pad space.

Once, when I was explaining these unused parts of the DNA to Matilda, I said it was like the files on a disk after they'd been deleted. Yeah, I've always liked archaic analogies from long before my time. Anyway, the data is still there, just unconnected to anything. I didn't really think much about that again until she mentioned steganography. It's fair to say that conversation changed my life. And if I'm pulled in for another interrogation and need to invoke my Deathword, it'd also be fair to say it led to my death.

***

After work, my evening was the usual routine. Dinner was leftovers. Then I logged onto the Classic Literature Scape using anonymization and "onion routing" (so many layers!) to obscure my identity and location in a way that even Ms. Wallace would find challenging. I, or rather my Classic Scape identity *Vedder*, a 20-year-old boy at a big state school, posted yet another installment of his step-by-step, chapter-by-chapter analysis of Moby Dick. He was bogged down in the "practical cetology" chapters, in the 70s. Vedder would typically make 4 postings per chapter, with a new post almost every day. After 2.5 months, he was just a bit more than halfway through this section. I quickly wrote 2 pages, and then finished up with yet another sexual joke about sperm whales. After all, in here, I *was* a college boy.

It was much easier not having to care about the words, as well as little details like misplaced commas, extra spaces, and parenthetical asides (both number and type), anymore. But I couldn't let myself get careless, so, I inserted a few (extra) capitalized words, and commas,, just for Good Measure.

I scanned the news. Among all of the other current events, there were more leaks about government programs. I must admit a few surprised me. One article mentioned in passing examples of more mundane files in the leaks, but lunch receipts for conferences and 30 year old weather station data hardly merit the attention bio-weapons programs deserve. Other than perfunctory denials and accusations, there was little from the government side. I ignored all the noise that is just opinions and speculations. No wonder Base Security was interviewing everyone with "random" screenings. They had no idea and were scared. Not the Base Security "they" but a much higher up *they*.

If I were the type that worried about such things, I would have. But instead, I read some journals and called it a night.

The next day, the guards were checking everyone more thoroughly, searching bags and pockets and not blindly relying on their scanning devices and their image recognition software. They were searching people entering just as carefully as they were leaving. A mood of fear hung over the checkpoint. Not as much with the workers who were used to invasive checks by now, but the guards. They had extra staff so the delays weren't too bad. Besides, no one would risk complaining and appearing suspicious.

***

Back to genetics. So what if we could use that DNA scratch pad? GMOs could have copyrights or trademarks embedded in them, literally. The organism could directly contain such data. Seeds could have serial numbers, so contaminated food could be traced back to the source farm. (If it was a grain crop, it would be a cereal number. Take that, Matilda, I just made a pun!)

The problem is that a few hundred, a thousand, or even a hundred thousand characters does not provide much storage space, and there are a *lot* of unused "ladder rungs" available in the DNA scratch pad. The problems are mostly technical. But that's like saying it's not hard in theory to accelerate a spaceship to

0.5 c, it's just an *engineering problem* of having enough fuel and the effort to acquire and store it, and the money to pay for it. In other words, it's shorthand for "no way in hell."

***

In the lab, I could tell from their expressions when they arrived, Rao and Cortez had been detained and grilled by Security this morning. The "guilty by association" look on Sergeant Kim's face confirmed it, even though he's not part of that Security group. I checked in on the two of them while they were getting coffee before starting their work. They had been interviewed for almost an hour before Security released them. They guessed it was related to the leaks that were in the news but knew nothing beyond that. Through Apex they learned four of their friends in other labs had similar experiences. I'd say they had nothing to worry about since they knew nothing about what we were really up to, but then I realized I hadn't seen Samuels yet that day and he's never late.

Maybe they'd be coming for me next. And maybe I would have to use my Deathword. Ironically, because I have one, I try not to fixate on it. Certainly, I don't want to trigger it accidentally, but that's unlikely by design. More importantly, I don't want to have what might be the last hours or days of my life defined by misery and worry. It's there for a purpose, because I have a purpose. So in an odd way, it's kind of freeing.

It's also possible I'm conditioned to feel that way. So be it. Either way it's better than misery and worry.

SysAdmin Wallace stopped by my office to provide a status report and rant. Today's meeting was less formal—she didn't have the lab manager announce her arrival or greet me as "Doctor Thompson." The Wednesday Wrath usually focused on ways everyone does things wrong. To the casual observer, she was wearing the same clothes as yesterday. But I noticed the band's logo on her t-shirt was slightly different. I couldn't tell about anything else.

Because of new projects in other labs, we might get a reduction in the Cluster Compute resources, but she thought it should be manageable, as long as we didn't keep going down so many rabbit holes. She paused and then said that unless my team had some breakthroughs, it probably wouldn't matter. As an afterthought she added, "But I'm no biologist, let alone a doctor *and* PhD."

I told her I'd make sure we'd be focused on our goal and not distracted by academically interesting rabbit holes that, in the end, take us nowhere. I admitted, though, that if we couldn't get any significant scale-up, it was likely the project would not continue to get funding. The researchers and techs would be fine. There are a dozen positions open among the other labs just in this building alone. They're all "Big Data" based and would need support.

She gave a snort indicating that wasn't her question.

I said that I'm sure I could find a university job in an ivory tower if I couldn't get more funding for some other, related research.

Another snort, that one harder to interpret. Then she left.

***

The word-game Matilda taught me is useful beyond avoiding socially awkward conversations at parties. But, just like the game, I need to explain a word for this to make sense. And that word is: *steganography*. But to do *that*, I first need to explain *cryptography* and how those two words are different.

This is how I explain games, too. Can you feel the fun retreating faster than the tide before a tsunami? I never said Matilda was wrong about her use of the word sea-cucumber.

Cryptography is all about hidden meaning. There's some sort of code, maybe a key, and with that, you can encrypt a message into something that looks like gibberish, or decrypt the gibberish back into the original message. You can see the gibberish, but you can't understand it. But sometimes, just knowing that a message has been sent is enough to get you in trouble (like students passing notes in high school), or killed (like spies passing notes in a war).

Steganography is about hiding the *existence* of the message itself. Invisible ink, microdots, embedding pictures in other pictures or videos are all examples. The idea is that the teacher, or secret police, never even sees the note. Of course the note can be encrypted too for extra protection.

So, back to the game. If two people play it enough, they can develop their own "twin language" that no one else can (easily) understand. It might use a common language everyone knows, but words and references might have specific meaning only to them that no one else would get. You can have conversations in the open, but outsiders can't tell there's extra meaning hiding within the mundane conversation. Typically this works just between pairs of people. You need a different translation for someone else—each pair of people has their own language.

The few who use such languages typically know only one of them. But I need to have "special conversations" with several people, each in a different custom "language" in which I must be fluent. That is one reason why I do a lot less of the talking in the meetings with the SysAdmin.

To anyone else, our conversation was what I previously described. But our *hidden* conversation was different.

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Wallace: More useless screening by Security. They don't know what they're looking for, which is good, and they're just disrupting their own and everyone else's operations, which is better. At this point, we're in the long tail of normalizing data, cleanup, and shut down. Kind of out of our hands now. They're going to try to find data sources, but there were too many dead-end rabbit holes for them to pursue, even without any countermeasures. Things look stable.

Thompson: That's good. Everyone should be out in a few months. Even with Big Data analysis, they're unlikely to spot anything, and we've set up many rabbit holes.

Wallace: Be careful. You're the one in the most danger. I don't want you to die.

Thompson: I will. We have options and contingencies for all of us. We'll all be fine. I'll be fine.

Wallace: [unknown, then leaves]

***

In traditional stories, a Deathword is something to be feared. Not by the one who uses it (and dies as a consequence, of course), but by the ones upon whom it is used.

One of the older stories tell of an eastern monk who was summoned to see the king or emperor or perhaps just a local duke or noble, there are many versions. He was asked for something or to do something that would violate his beliefs, for he was an honorable man. He was given a day or a week or a month to comply with the decree, depending on how far away he lived. He returns at the given time, alone, to give his answer—he will not comply and will face the consequences.

What likely happened, if there was any real historical precedent, was that he was trained in the martial arts and while willing to die for his beliefs, he made sure the others paid a price for his sacrifice, ten to twenty times as great. In some versions the king or duke was killed, in others he merely witnesses the event, but became a changed man as a result.

The reality likely was that few suspected a soft-spoken humble monk could kill the best of the royal guards. It was easier to say "he fought as if possessed by a demon," and attribute his skills as being unearned and unnatural than to admit they were bested by a mere peasant.

Word got back to the monastery and, though pious, they were a practical lot. They allowed the rumor to persist, adding to it that some demons offer a bargain. They can be summoned with but a word, which need not even be spoken, and they will take the lives of all the enemies near he who used the summoning word in the most gruesome ways. The price? Merely the life of the summoner.

The monks were generally left alone after that. They lived peacefully and kept to themselves.

In more modern times, the Deathword takes on the simpler, mundane connotation of suicide. It seemed necessary for me to have as a contingency, because our success depends not only on achieving our initial goals but to avoid being discovered. If our work was only used once, it would be nothing more than a firecracker. The price, in terms of time, money, effort, and sacrifice, would be too high if our adversaries discovered and understood our techniques and could create countermeasures and deterrents. In fact, such a failure would be very counterproductive and make further efforts much harder and hurt our cause. On the other hand, if this can be used repeatedly, as an equalizer, then it will be well worth the costs. Since I am the hub and am the only person who knows the details of all aspects of this

operation and all those involved, I am the weak link. I needed a way to prevent them from extracting that information from me.

***

I sound like a fanatic, and I suppose in some ways I must be. My cause is freedom, but that is the same thing a terrorist would say. I'm also a pacifist, and I'd like to think that might count for something. I don't want to hurt anyone, even for my cause. Well, except myself, but I'm trying to avoid that as well. Nor do I want to blow things up or take some sort of drastic step to serve as a "wake-up call." I favor transparency, information freedom, an open society, Brookmanism, etc.. There are many names for it.

Long ago there was a phrase "speaking truth to power." The thinking was that if you were brave enough, you could tell the truth to the powerful, and upon hearing it they would change their minds about whatever it was they were doing, and the powerless would benefit from it. Brookman had a different take on it.

Brookman said that most of the time the powerful had a general sense of what was going on. And telling them what they're doing doesn't really surprise them. "What? You mean me stealing all these resources from these people and leaving barrels of leaking toxic chemicals and radioactive waste in its place makes me fabulously wealthy at the expense of those people? So you're saying that I value my wealth above the health and happiness of others? Gee, when you put it that way, I have to admit you're right. That's very brave of you to tell me that I have a lot of money. Maybe I should reward you for that, in addition to giving away all my money and changing my evil ways. Why don't you take a step just a little to the left, right where that X is on the floor? Perfect! And now here's your reward..." If they don't outright kill you, they'll have you disgraced, or possibly just ignore you because they *are* that powerful and don't need to listen to someone telling them what they know.

Brookman proposed an alternative approach: speaking truth to the powerless. At least that's the catch-phrase version of it. Really, the idea is to let them know that, en masse, they have power that can rival that of the privileged few.

Maybe it's naive, but by giving "everyone else" the truth in the form of the secrets that the powerful hide and use to keep their power, it can help balance things. Maybe it'll cause bloody wars. I hope not. But the logic of his arguments spoke to me. And because of the confluence of the availability to me of data and technology, I'm in a position to do something, even if it's a small contribution. Even if it costs me my life.

***

Almost two years ago, on a trip to Amsterdam, I made a stop for some undocumented outpatient therapy. The first micro-therapy applied an inert coating to the wall of my aorta; it was quick and surprisingly painless. Then a set of several redundant "glands" were implanted in my body and innervated, each little more than a small cluster of cells. Finally, there was rather extensive psycho-priming, so I could understand how to use them. This lets me connect them to my programmed trigger.

The glands release a chemical into my bloodstream that reacts with the aortic coating causing it to sever. A few seconds after that, I'm dead. A very premeditated death—it requires daily meditations to keep everything working properly.

If or when at some point in the future I feel safe or simply don't want this time bomb in my chest, there is a quick procedure that uses an oral solution to neutralize and remove the coating within a day. After the gland cells are triggered, assuming I'm still alive, those cells die and eventually my body removes them. Our SysAdmin was much keener on the whole idea when she thought it would be for her. She reluctantly agreed that it would be far more plausible for her than me to play dumb, since I am the one in charge of the lab. We both couldn't rely on sexist stereotypes for protection.

***

I am leading the effort of encoding data into bacterial DNA in my lab. But fortunately the idea was one many others have had and significant work had been done in the area. People have used raw DNA outside of cells to store essentially unlimited amounts of data for decades. But that requires a carrier that's accessible at a macro-level, so it becomes the same problem of smuggling out test tubes, Memory Dots, or OptiStiks, all of which are detectable by a simple pat-down. Cells are very small and are very adept at managing DNA. They even make copies of themselves—they're very good about backing up their data. And they're easy to carry, since we do that for trillions of them already.

The problem is that DNA tells the cells what to do, which includes making toxins, carcinogens, or doing little more than out-competing organisms we like, both for us personally and the environment at large. Not only should we avoid the mythical Zombie Apocalypse, but we must also avoid another Banana Apocalypse. (My grandmother told me the real ones tasted much better than the artificial flavor.)

Because it's not a new area, if it is ever discovered, I'll be just another one of the many, usual suspects working in this field. I knew it would take time to extend the state of the art to allow us to store vast amounts of data virtually undetectably in living cells safely in something weighing a tiny fraction of an eyelash. I would need to do the work, but I'd need delays in the work our sponsors think we're doing, as we developed and tested the techniques and acquired the data. Hence the years of near-misses and outright failures that "plagued" our lab.

I doubt any university would hire me given my meager positive results. I *know* none would if they knew how I faked the negative results to show one dead-end after another. Science is supposed to be repeatable, but no one wants to pay someone to verify someone else's results, especially if they believe those were dead-ends; so it's unlikely anyone will ever check my work. And only a trusted few in the lab had a sense of our real progress.

Then there was the question of what to encode into the DNA. We'd need data sources. But we didn't want it to be understandable by others—*what* we were putting there, not the fact that we were putting *something* there. Ms. Wallace solved a number of those problems. Encryption and steganography were our tools. We'd encrypt the data sources, so without the encryption keys, the data were opaque

gibberish. The mere presence of the encrypted data was hidden by the rest of the DNA molecules as well as everything else in the cells.

Once someone extracts the raw data fragments hidden in the DNA and assembles them into one big encrypted package, the next question is how to decrypt it. Of course they need the encryption key in order to decrypt it. But you can't just blast the key out everywhere, since you want it to be secret--secret in the sense of "I don't want anyone to know this is a decryption key" but we don't need to encrypt the encryption key (otherwise it'd be a never-ending cycle). So once again our old friend steganography helps us out.

If we come up with a way of hiding a document within another document, the cover document could be publicly available and, ideally, very boring so no one really cares to look very closely at it. So how do we hide a 2048 bit key?

2048 separate things sounds like a lot but cut it in half and it's 1024. Cut the work in half 10 more times and it's only 2 things. The trick is how you cut the work in half. Is there a capital letter in a sentence other than at the start? That's one bit. Chop. How about a parenthetical comment (or more than one (embedded or sequential)) or none? That's 2 bits of information. Chop, chop. Two paragraphs, 4 sentences in each paragraph. That's 8 bits. Chop, chop, chop. What letter is capitalized? 26 choices is, on the conservative side, 4 bits of information, Chop chop chop chop. And so on. But then where could we hide the cover file that contains the key? That's where Vedder and his rambling, multi-part, multi-chapter, multi-page, multi-paragraph, multi-sentence book review comes in. CHOP!

I haven't been spending the last few years reading Moby Dick—I read it back in high school. In addition to being a fast reader, I also remember things. I let *very* few people know that. And it's not just books I remember. For example, remembering 2048 small things is nothing compared to memorizing the White Whale epic in its entirety.

We also had to analyze a *lot* of DNA and related cellular data. That required a lot of computation time, memory, storage, and network traffic—something that could mask the transfer of similar huge volumes of data. As a surly, hard-working but marginally competent SysAdmin, it would be expected that our network routing would be "sub-optimal" or in other words inefficient and expensive. As a brilliant, wily network engineer and hacker, none would suspect that she managed to get data from the classified machines onto our machines using a "side-channel attack" (I don't really understand how she did it and don't *need* to know either), immediately encrypting the data before it hit our network. We filtered some of the content, so it wouldn't be obvious where the tap was.

The encrypted data was put into several strains of bacteria, about three dozen. Once extracted from the cells, it could be read with the DNA sequencers most high schools have. Of course it's worthless without any of the three dozen encryption keys. Each key is about four lines of solid text, much easier to memorize than Moby Dick, and no harder than π or e, mathematical numbers that are endless, non-repeating string of decimal digits (I had some unusual hobbies as a child). And bits of them were embedded in "Vedder's" ongoing reviews of Melville's magnum opus, once again using our new friend

steganography. The embedded keys were finished months ago, but I kept the reviews coming to avoid suspicion. Besides, as Vedder, I was hoping to get to Chapter 95.

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The actual smuggling out of the petabytes of data was a rather boring event. The carrier simply left the facility like normal. Even if the guards had done a thorough search, they would have found nothing, because there was nothing to find, no documents, no vials, nothing unusual. The crypto-bacteria were floating around happily in the blood of the carrier. But the carrier had no idea they were there. Add another black mark for my hypothetical university career: the use of a human subject for an experiment with no Institutional Review Board approval, not that they would have approved such a thing. The only thing an IRB would have done would be to have me arrested.

The carrier *did* willingly volunteer to help us and knew the ultimate goal of the mission: exfiltrate large amounts of secret data to be leaked to the public. He wasn't told the mechanism that would be used, when it would be done, or his exact role. We did this—I did this—to protect him.

Because there was no IRB, many in our lab and a few other people volunteered for some blood tests and inoculations to test that there would be no adverse reactions to the bacteria we were using. We were cautious. The bacteria we used were designed to be particularly susceptible to several common antibiotics. They were also engineered to die off within two months on their own, and their DNA should not be able to be transmitted to other organisms. Still, we realized that's how old zombie movies started.

We ran several rounds of tests to try to ensure that we weren't about to destroy the world with some mutant life-form. The tests took time, but there were no surprises. We needed extra time in our schedule for the testing, and potential isolation of anyone exhibiting any adverse reactions, so we had a series of unexpected hardware failures. The "root cause" was determined to be faulty wiring that managed to damage the logic boards of two pieces of expensive lab equipment. However, the logic boards were literally the last place the technicians expected a failure to occur—I had read their troubleshooting manual. That particular "unlucky"' incident bought us an extra two weeks in our schedule. Throughout the project, our lab was "plagued" by such convenient problems that always wound up being someone else's fault.

Once we were confident the bacteria were as harmless as their non-modified cousins, we had another testing round. Again, it was with bacteria that did *not* have any embedded data—at least for all but one of us.

I figured Sergeant Kim was the least likely of us to be suspected, so he got the real dose. All were instructed to seek medical attention if there was anything unusual, such as cold or flu-like symptoms. Also, given the number of tests, we told everyone it was likely two or three people might happen to catch something during all of these tests. A quick visit to a doctor could confirm that it was nothing. We gave everyone the name of an infectious disease specialist—one I trusted.

Kim's dose also had a vaccine component that typically causes mild flu-like symptoms for a day. So he dutifully paid a quick visit to the doctor on a Friday evening. She ran some simple tests including blood-work, and told Kim the good news that it was just a bug that was going around, and a day or two of rest should fix it, and to call her if not. By Saturday evening he was feeling normal and never missed a day of work.

The doctor *did* test the blood sample; I wanted her to verify it was harmless. Even with that test, more than enough blood remained for our purpose, which was to send ten samples to different geographically distributed labs, so they could process it. They only analyzed the bacterial DNA. Kim's DNA was destroyed with all the samples, once the sequences had been extracted and their quality verified. This was *without* decrypting any of the data embedded in the DNA.

Our lab continued its frantic work pace for months after that. But, each time the experiments always failed to store and extract more than a few megabytes of data; hardly more than double what earlier academic work had done.

We disseminated information on finding the keys to a few groups. Involving more people increases the risks of discovery, but we wanted the leaks to come from multiple sources with few common connections. We did include a few false connections, like many had offices in Munich and Brisbane, rabbit holes that would lead them to many weeks and months of fruitless searches, just like my research.

A few weeks later, the leaks started. Slowly at first—just a few dozen files. The leakers were curating the data. No spies would be listed (let's just call them that rather than "assets") unless several other documents had been released indicating that a particular location was compromised. In other words, there'd be sufficient time for escape or extraction. The leaks also contained a variety of other information, including ambassador schedules from 5-10 years ago, earthquake and ocean temperature records, disaster recovery plans for some pretty uninteresting situations, like a sudden shortage of guacamole or talcum powder.

With every release, the pressure at our base increased and all the labs were less effective at getting research done. SysAdmin Wallace had long since removed her data sniffers and eBloodhounds from the networks and destroyed all traces of them. Since then, huge amounts of legitimate, boring data had been flowing through our network, inefficiently and innocuously, "just like always."

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Almost eight months after the first public data release by the *kiwikiwi* group, I arrived at my office after the usual morning security screening. Ten minutes later I heard a knock at my door, and a male voice said, "Doctor Thompson." Likely a security detail, but I didn't recognize the voice and the protocol confused me. Perhaps the politeness indicated he could be friendly or merciful, but the lack of identification or context meant he was in charge. I got up and opened the door, rather than play games and waste time. Three armed guards stood there, waiting for me with their usual lack of expression.

Their insignias indicated they were attached to the Division Directorate's Office, rather than general Base Security. My guess was they worked for the Director himself, whatever that implied.

I thought about Samuels. No one had seen him since the day he disappeared. I had asked Sergeant Kim if he knew anything about him the next day when I learned he wasn't at home sick. Kim told me he knew nothing either. A few days later, he told me Samuel's status was now "provisional." Usually that's reserved for new staff their first week. He said it was equivalent to being on leave, which meant that no one here had any idea. His phrasing also meant that I should not pursue it any further, ever.

I wondered what happened to Samuels and what I could have done differently. I had a feeling that I'd never know the answers, and that perhaps I might similarly disappear without a trace.

The Directorate's Office was three buildings over from mine. My escorts and I walked there. The day was cool and clear, something we never see anymore. I enjoyed feeling the sun on my face, as I rarely go outside during the day. There was little point asking questions that would be answered shortly. Still, I needed to play the part of the innocent scientist, one who did not fully understand the hierarchy here. I commented, slightly puzzled, that we were not going to the Central Security Office. The guard nearest me said, "No Doctor, the Division Director wanted to talk to you. We are going to his office." Polite. No "shut up and keep walking if you know what's good for you" followed with a shove to my back. Perhaps a hopeful sign?

I'm not a prisoner, not yet at least. I assume the interview will start in a friendly way. I suppose I should be impressed he wants to talk to me. So I began to act like it. I made some small-talk indicating I was a little apprehensive, but honored, that he wanted to see me, and how I didn't have any time to prepare a report for him. The guard let me talk providing no feedback. That wasn't his job.

We arrived at a side entrance to the building. I stopped talking, appearing to be overwhelmed by the situation. We entered a small office and my guard nodded to a secretary at a desk. She made some hand gestures and her lips moved silently. I didn't see any cords, cables, rings, or other obvious devices, so assumed she had implants that let her interface directly to Apex. Probably verifying my identity and alerting the Director to my arrival. Five seconds later she nodded and looked towards the door. My escorts led me through it.

The office had a strong antique, academic feel to it. It looked as if it could be the office of a college dean. The room smelled of mahogany and books. Not mold or mildew, just print and power. It was very different from the lab smells that permeated my office, work and worry. Two walls had a series of bookshelves, filled with books on dozens of areas; the director was very well read. I took in the titles and authors, in case it could be useful later. An actual slate blackboard sat along one wall. Oddly enough, the board was spotless, not a scribble on it. It was probably used in classified meetings and then cleaned between sessions. It's easier to securely wipe a board than a networked electronic device. I spotted a few other clues that supported my "secure room" theory, including the thick walls when we walked in, the slots by the windows where metallic plates can slide out and block any visible light or radio frequencies from entering or leaving, and the desk itself. While at first glance it looked like the

desk of an Ivy League humanities dean, I noticed that the stacks of books on it obscured anyone seeing what was actually on his desk. The way he was looking down at the desk suggested he was looking at an actual screen instead of some heads up display.

The Director looked up from his desk, typed a few keys on a keyboard I couldn't see and said, "Please come in, Doctor Thompson. Have a seat." The Director was an older man, in his upper 60s. He was dressed in formal attire; a blue blazer neatly hanging on a hook in the corner completed the look. His hair was short and graying, neatly cut; his eyes were gray as well. Also, they looked basic-human, so no sensor enhancements or Apex interlinks. Plus he didn't wear glasses, so no option for using that as a HUD or virtual screen. He was trim, in good shape, and his face had lines in them that looked like they could be from warm smiles or icy stares. His tapered nose suggested a predatory bird like a hawk or an eagle. He wore a thin black glove on his left hand: a data glove. So he had no implants. Perhaps that would be a liability for someone in his position.

I sat on a comfortable chair in front of his desk. I assumed it was rigged to monitor my vital signs. I would need to remember to act stressed, elevated heart rate, breathing, perspiration and temperature, if the situation warranted it. The guards remained in the room and closed the door. No extra bolts to secure the door, no weapons drawn. There would be sufficient time to act surprised and scared if needed.

In the time I've been working here, I've only spoken to the Director twice before, briefly, at large, public events. There had been time for little more than a few perfunctory exchanges of pleasantries after I was introduced. I'm sure he had a transcript of our two introductions on his monitor, but he skipped over the meaningless pleasantries entirely. "We have a few things to discuss. I'm sure you've heard enough of this ongoing leak scandal and lived with the daily Security shit-show," he paused and said, "No offence intended, boys" to the guards at the back of the room. Out of the corner of my eye, I saw the lead guard acknowledge with a very small nod. The Director continued where he left off, "…to know that even if we're not in the center of it, we're affected. Everything is being questioned, as part of the ongoing review. I need to ask you a few questions about the Systems Administrator for your lab."

"Wallace?" I asked, as if there were anyone else.

"Yes. As part of a routine review, we noticed your lab, and the four others she manages have Information Management expenses far above average, even for ones doing similar activities. I had one of our staff audit the work she's done. No one has complaints about her getting things done. Her attitude, which I'm sure you're familiar with, is not unusual in the field, though not exemplary. But looking at her work..."

He paused as he pulled up a report with a motion from his left hand and then read an excerpt from it out loud. "*SysAdmin W tends to code in extremely inefficient and sloppy ways. Many values are recalculated, some never initialized, and some never used. Library calls upon repeated library calls are made in loops, unnecessarily with no caching of pre-computed results. The code often only uses the*

most basic capabilities of a library package. Little code reuse. It looks like she has limited or no formal training in programming. Backups are done, but finding a file would take hours. And so on and so on. I'll spare you the details." He looked up from the report. "Her file states that you recommended her and knew her from your undergraduate university. What are your thoughts on this, Doctor Thompson?"

I had several options, but oddly enough, the one that made the most sense in the moment was the honest answer. I said, "I can't really comment on your staff's assessment of her work and I haven't reviewed her coding nor would I have the background to do so. We did go to school together. While we don't interact much beyond me giving her assignments and she doing them, back in school, I found her to be very clever. I can't say anything about the details of her formal training. I assume she did well in her classes."

"And you have no informal interactions?"

"As far as I know, I've never seen her at a base holiday party. The last time we were at the same party was my junior year in undergrad. I never was much into punk or heavy metal music to be honest."

"But you stand behind your recommendation?"

I paused for a few seconds to give the appearance of thinking about it. But I had decided what I'd be saying when I first arrived here. I wondered, for a moment, if the demon my Deathword would summon could claim the lives of the Director and the three guards in this room. But that only works in legends. And these days, kung-fu masters don't do so well against military-grade weapons. Also, I'm not a kung-fu master. Hence my "clever" or desperate ploy of telling the truth. I put those thoughts aside as I appeared to reach my decision.

"Yes sir, absolutely."

The room was silent for 10 seconds as the black-gloved raptor sitting behind his desk stared at me with his eagle eyes, as well as the eyes the room's technology provided him, sizing up his prey.

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He nodded. His eyes glanced down momentarily to an information display in his desk.

"Alright. I don't suppose it really mattered. But I do value personal assessments. Wallace isn't a terrible person, she's just in over her head and instead of getting help she wasted on the order of ten million dollars of computing resources."

My face showed shock.

"It's kind of funny-money, but it's indicative of problems. She won't be working here much longer."

"You're firing her?" I asked with a hint of concern in my voice.

"No. Her position is being eliminated. She'll get the appropriate termination benefits. It's not like she wasn't putting in the work."

"But if her position is eliminated, who will support our… oh…" I said as the implications dawned on me.

"You are loyal, and that's very good, especially in these times. This base is one of quite a few that is a possible origin point for the leaks. We're watching everyone carefully. You're loyal, but your judgment is not great. Just like with Wallace, you've been pinning your hopes on the DNA-encoding project. And you *know* that's just not working out."

I started to say something then, stopped. I looked down for a few seconds, sighed, and then said, "Yes, sir," as if I were finally having to admit it to myself.

"My project won't continue," I said flatly.

"No."

"And after all the time and money I …" I paused for a moment, as if not wanting to say the next word out loud, "...wasted." Another self-confession the Director elicited. I continued to follow the logic.

"I won't be here anymore either. Part of the reason the SysAdmin position won't be renewed."

"Yes," the Director said, with a bit of sympathy in his voice. "You won't be fired either. Just no more money for the project, so you'll have to move on."

"My lab...the people…?"

"We'll find places for them if they want to stay. We only need one sacrificial lamb."

I smiled grimly at that bit of black humor.

He continued. "Actually, you've been of more help to us than you can imagine. Like I said, the base is a possible leak source. Because of you, we've got a lot of study data on why it *can't* be DNA-based. You probably saved everyone here a lot of wasted time and effort. Your work demonstrates that it is highly unlikely we could be the source. Even using more conventional espionage, it would require a pretty big conspiracy to smuggle that much data from anywhere: thousands of people over the course of decades. The various data centers are pretty tight, but they're a way more practical target than we are."

I nodded again, appreciating the unintentional contribution of my work.

"No hard feelings, Doctor. Like I said, we value loyalty. You just happened to pick two bad horses, and money drives a lot in this place. You know the saying, *you don't have to go home, but you can't stay here*."

"I understand. Thank you, sir."

I shook the hand he offered and our meeting was over.

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That handshake was four years ago. While I'm sure the director could be ruthless—how could he achieve that position otherwise—he was true to his word. Wallace was let go the next day, but managed to get a decent corporate offer less than a week later. I'm sure he put in "a good word." I heard she moved through a few start-up companies after that. My lab started to disband two weeks after Wallace left.

Sergeant Kim, now Lieutenant Kim, stayed on at the base for some time. After that, he was reassigned and moved a few times, but now is in charge of a logistics group in the southwest. We don't keep directly in touch, it would be too risky for both of us, but we hear of news through friends of friends and the like.

Others moved on. Rao and Cortez went to neighboring labs that focused on ways to reduce soil erosion. Most of the others fell off my radar. I never made any progress in finding anything about Samuels. He had no relatives and simply was "missing, presumed dead" according to the police. But I was keeping a low profile as well.

My greatest failure is also my greatest success. Despite my best efforts, Harshot managed to steer clear of all of the landmines I put in his path and now has his own bio-technology lab at MIT-Mainland. I saw him at a symposium once and he told me he learned much working in my lab, honing his already sharp data analysis skills. He said that the problems he has tackled have been simple by comparison. He thought I was merely being polite when I said he had solved far more difficult problems than I had. While he has learned to be highly suspicious of any single experiment, fortunately he did not learn to distrust his staff or the fundamentals of science. I am glad I did not do him that disservice.

And his analyses of plant growth and biodiversity given the climate records we released has lead to climate models that provide a glimmer of hope amid a blinding explosion of fears—some are validated existing ones, while others are new terrors that had not been imagined. The irony is that even with his brilliant mind for cold, meticulous analysis, as well as a vast imagination, it never occurred to him that he was partially responsible for the availability of the very data that has been so essential to his work, as well as to so many others.

I decided I wanted something slower. I took a position as a lecturer at a mid-level state school—not the same one as Vedder. After a year, I decided I'd prefer a tenure track job at a smaller teaching school. Perhaps another "good word" was put in. Or maybe I suffer from Impostor Syndrome and my CV impressed them. In any case, I like the place and position. I have tenure now and a house. And I enjoy teaching the students.

It's been six months since I took the Deathword antidote. Even though it's fully effective within 24 hours, I waited a week to test it and purge the "trigger glands." My aorta is fine. There was a strange feeling as the glands' cocktail of chemicals hit my bloodstream. Adrenaline, but also some form of sedative. I felt strangely at peace with my decision, whether the Deathword had been neutralized or not. Not a sensation I would seek out recreationally.

For the record, the Deathword itself was *sea-cucumber*. Yes, I could write, think, or even speak it, and it wouldn't kill me if I didn't want it to. The meditation requirement was a safeguard against accidental activation. But I wanted to free that word and all its associations—it had been too long. My life or death no longer mattered, at least to the cause. The information in my head was long obsolete.

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There's a knock at my door. I try to walk normally to it, not rushing. I open it and even though we had texted to figure out a time, I'm still a little surprised. I don't trust Apex and mostly avoid it, falling back on technology my grandmother might have used. My visitor stands in front of the doorway. Her eyes are light blue, her light hair is straight, falling below her shoulders, and she wears a pastel colored sundress and a jaunty wide-brimmed hat with a bow. I stare blankly for a moment.

"It's so good to see you," she beams, "won't you come in?"

I open my mouth, confused and silent.

She enters my house, walks past me, then says quietly with a wink, "That was *your* line, dear."

I offer her a drink, without coaching, and we sit in the living room.

She tells me of her jobs and life in a few short sentences, and I provide an equally terse summary. Before she can tell me my next "line" I say, "You look great."

She smiles and says, "It's nice to dress as me, instead of her. To be me, instead of her. Acting like I was hiding feelings of inadequacy. Pretending to like different music. Being such a grumpy bitch."

"You always were such a Grinch…so serious," I joke.

She smiles and says, "As opposed to you, who was always such a…" Her eyes search for the right insult.

"A sea-cucumber," I reply. Her eyes show she immediately understands what I mean. "Yeah, it's been six months now since I 'cleaned my pipes'—or rather pipe."

"I'm so happy to hear that," she beams. "Maybe it's finally been long enough to..."

"Start again?" I ask.

"I don't care. The mission is over. We did what we had to. We risked our lives for that."

"You know I'd risk more than that for you."

"I just want to call you Lois again, instead of Doctor."

I take her hand. "And I just want to call you Matilda."

□