

Water Music

Alyssa Pelish

THE SUMMER I WAS NINETEEN, I never saw an actual molecule of substance P with my own eyes, or even with the help of nuclear magnetic resonance spectroscopy, but I knew it comprised eleven amino acid residues and had an α -helical core stabilized by two hydrogen bonds, that it had a highly flexible extended NH_2 terminal, a central turn on its Gly9, and a carboxyl terminal sequence that bore a family resemblance to that of its fellow tachykinins. I knew that after—text-book example—a hand touches a hot stove or a finger is slammed in a door, or, say, the blade of a Swiss Army knife (which was the only knife I personally ever owned as a teenager) presses into the soft flesh of the inner thigh, ion channels in nerve cell membranes would open, depolarizing the membrane and sending an electric shock of excitation shooting through the sensory neuron, all the way to its terminal in the spinal cord. I could diagram this on a sheet of graph paper with a four-color pen. I knew that the depolarization of the sensory neuron terminal in the dorsal horn (blue pen) would result in an influx of Ca^{2+} into that terminal, the second influx of which would fuse tiny waiting vesicles of substance P to the terminal membrane (green pen), forming a temporary ion channel that eventually dilated (black pen), thus releasing the SP into the synaptic cleft (red pen). And I knew that everything that happened after that—the excitatory postsynaptic potentials that electrified motor neurons traveling back down to the body part in question and causing it to pull away, and the interneurons snaking up through the spinal-thalamic pathways, bulging into awareness of pain *qua* pain in the somatosensory cortex and bursting into an affective response in the limbic cortical regions—was set in motion by the release of substance P. And I knew that the theory was that all of this could be cut off, or at least blunted, if you cut off the substance P.

I'd just run five miles around the dim little indoor track, which was an eighth of a mile and so required a total of forty laps, which I would

count out under my breath every time I passed the starting line, which began next to the steps to the weight room, each of the laps taking approximately 52.5 seconds, which was my training pace. I liked to think it focused me to repeat the lap number under my breath, like a kind of mantra, for the length of each lap. That it kept my mind absolutely still and nearly impervious to all those stray thoughts that could otherwise creep in and no doubt slow my pace. Early December in the Twin Cities meant the temperature outside was hovering at most around zero, and once I was done with my laps and the complex series of push-ups and crunches and glutes extensions and stretches I always did afterward, I'd peel off my sweaty maroon running tights and compressing maroon-and-yellow sports bra and take a scalding shower back at my dorm, after which I'd emerge feeling cleansed in a way that went beyond just my pores, and take my place at my desk with my homework and a cold can of Mendota Heights spring water and three hours to study before bed.

That night, I remember, I was reviewing the chapter on interneuronal communication in my neurophys textbook, which meant going over only the parts I'd highlighted, paying the most attention to those parts I'd highlighted in orange, as opposed to ordinary yellow. My hair was still wet and my cheeks still felt red from the shower, and I was seated such that I could imagine a thread pulled straight from my spine to my coccyx, my body weight distributed evenly on both hips, my shoulders parallel with my hips, my knees bent at a right angle, and my feet flat on the floor. *Type of stimulus, type of receptor channel, what change in permeability occurs, whether action potentials are used, what transmitter is released.*

I remember that the jangle of the phone broke in while I was concentrating on an orange passage about ionotropic (i.e., direct) versus metabotropic (i.e., indirect) opening of ionic channels in receptor cell membranes. I found it mildly condescending, the way the prim British voice of the textbook would anthropomorphize cellular anatomy, as in "direct channels are *looking* outward, *waiting* for signals to arrive from the outside world, whereas indirect channels are *looking* inward, *waiting* for messages that are generated within the cell itself." As if ionic channels had eyes or sat waiting next to the phone on Saturday nights or something. But anyway, the phone did ring, which was certainly not something I'd been sitting around waiting for like an anthropomorphized ionotropic cell membrane channel.

When I picked up, there was a pause at the other end, and then a voice that declaimed my name in full: the dactyl of my given name,

the single syllable of the middle, and the trochee of the last. (Or at least this was how it suddenly, beautifully occurred to me, having taken a semester of English Prosody from 1368 to 1798.) The voice spoke with what sounded like great fondness, and it seemed, for a moment, like my name was a kind of secret code that only I and this voice knew. I was silent, although I could feel my sympathetic nervous system pulse into gear.

"Do you know who this is?" the voice asked me, but not like it was a pop quiz, or in a creepy way, but like he was momentarily sad at the prospect that I genuinely might not know.

I did, though. I tried not to let the grin on my face or the throb in my chest seep too much into my own voice, which is something I'd gotten pretty good at doing—I mean concealing the effects of the sympathetic nervous system.

"KDWA," I finally said. "Straight Talk on Your AM Dial."

There was a pause, after which the voice replied, "KDUZ," pronouncing the three last letters as a single, drawling syllable. "Your Information Station."

This was how I remembered my brother answering the phone in our house, when I was twelve and he was sixteen. The chirrup of the antennae cordless on the kitchen counter, his poker-faced delivery of a local radio call sign and slogan, the long pause on the other end.

I adored my older brother. As a kid, I had tagged alongside and taken orders from and copied him, to the best of my ability. It had been that way for as long as I could recall. A thing was good by virtue of his having done it, or covetable by virtue of belonging to him, and other people were important by virtue of his liking them. His standard, the most visible and most immediate in my small world, was like that of a ship sailing perpetually a knot ahead of me. I aspired, therefore, to know what he knew, do what he did. We could hate each other, have bitter, knockdown, drag-out screaming matches that would compel my mother to call my father at his office and demand he come home to intervene. But we were also, being the only two children in a household run by adults, coconspirators. Banished to the upstairs when our father held campaign strategy meetings in the dining room, we ran reconnaissance missions, gathering what scraps of intel we could and poring over whatever it was that the adults were saying or doing in our absence. We conjured an inner life for the family dog, ventriloquizing him in a coarse accent that gave us leave to utter things we could not say in our own voices. In the basement, we dressed up in our father's cast-off army fatigues, his old ties and corduroy jackets,

picking through the accumulated stack of red-white-and-blue signs with his name blazoned across them (FOR BOARD OF COMMISSIONERS, FOR DISTRICT 23 STATE HOUSE, FOR DISTRICT 23 SENATE), and we'd hold them aloft and chant the slogans we'd hear him proclaim any year that the signs came—which was every other year—and then shake each other's hands officiously to make our mimicry more authentic.

But my brother was four years older, and I was perpetually in his wake. As we grew, as he turned thirteen or fourteen, and I was still nine, or barely ten, he had no use for a little sister, for a hanger-on who couldn't compass whatever complicated considerations were now circulating in the narrows of his mind. So I lurked in the outlands of his floating citadel, exiled but always admiring.

Early in high school, he drifted away from the wholesome, ball-playing figure of an all-American boy that had pleased our father (who had demonstrated his general approval by talking sports stats—professional and junior-senior-high league—with my brother, and clapping him on the back whenever he was suited up for a game). The nylon football jerseys and perfectly broken-in baseball caps fell away, as did the Old Spice judiciously applied after postpractice showers. All of it was replaced by a wardrobe either tie-dyed or salvaged from the racks at St. Vincent de Paul's. His once closely clipped hair, cut monthly by a hockey-booster barber at Buck's Clips downtown, now dusted his shoulders. A mossy, cuminy odor of sweat and whatever he was smoking clung to his hair and skin and clothes.

This new persona clearly rankled our father, who kept an antique carpenter's level on the little ledge over his home-office desk like it was some kind of religious icon, and developed the habit of humming the refrain to "Straighten Up and Fly Right" in my brother's presence. But there was a cabin somewhere out in the woods where my brother and a few confederates—at least as suggested by their similarly shaggy hair and Deadhead tie-dyes—would disappear, presumably to smoke up and noodle on the guitar. And so, when my father appeared in the evenings to drink his Scotch and eat mixed nuts poured tidily into a ramekin in front of the nightly news with Channel 12's Don Winn, after which he would preside over the dinner table, my brother's place setting would go untouched, the equilateral triangle of its napkin still neatly folded. When he was home, he disappeared behind a haze of sound and a skunky smell I couldn't ID at the time, the door to his room inevitably locked.

"The Lubrication Station," after the local oil-change place just off

Highway 47, was what my brother took to calling our father, whose greatest priority was that everything run smoothly, or, more accurately, that nothing ever be found to not run smoothly. We had grown up watching his glad-handing in church basements and at Lions Club suppers and while filling up his tank at the Pump n' Pak, grown up hearing his Dale Carnegie method of repeating people's first names an unnatural number of times while speaking to them, and knowing—in the way that we knew all twelve sound effects in *Dig Dug*—his indefatigable repertoire of phatic responses, which included *ain't that the darnedest, you bet* (typically repeated twice, emphasis on the second *bet*), *good for you*, and, most reliably, seasonally appropriate remarks about the weather. Every two years, his fulsome smile radiated from the TV screen, interrupting the regular string of commercials for Pepsi and Fruit 'n Fibre cereal and AT&T long-distance plans. "Sweeps Week," my brother called it, although it lasted much longer than that. We watched our father make conspicuous appearances at high-school football games, cheering boisterously in the stands, and at fire hall pancake breakfasts, cheerfully pouring OJ. At his own dinner table, the sharp corners of each triangularly folded napkin carefully pointing away from the place mat, he would give thanks for the bounty, proceed to slice and serve each of us our portion, and remind us that this was no place for Negative Neds or Nancys, which was a term that he preferred to use preemptively. Once, while paging through the S-SN volume of our *World Book Encyclopedia*, I read about the physiological differences between a genuine spontaneous smile and the more perfunctory social smile. After that, I would practice contracting my orbicularis oculi muscles in front of a handheld mirror in my bedroom, willing myself to produce the "smize," or "smile with the eyes," that is the mark of a genuine grin.

I don't remember exactly when it started, but there grew in me the dim feeling that whatever was inside me—whatever you'd call the vague hum or ghost in the machine of the face and body and voice that as far as you know everyone considers to be you—was entirely inappropriate for the table my father presided over and the world as stamped with his bland seal of approval. His was a flat plain of contented normalcy that I seemed always on the verge of staining with whatever black substance there was inside me. But that was all the world there was. I went to school dances and pep rallies and ball games and played volleyball as a Lady Trojan and sang in the choir at Immaculate Conception, even dueting "Faith of Our Fathers" and

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“Let All Mortal Flesh Keep Silent” with soprano Amber Anderson, who would go on to lead the senior-high show choir to four medals of various alloys at the state competition.

My brother, though, played music I couldn’t recognize, wah-wahing so fervently on his guitar that I assume he couldn’t hear anything outside his room. When my father pointedly hummed “Straighten Up and Fly Right” on the increasingly rare occasions that he and my brother were in the same room at the same time, my brother, his eyelids heavy, bobbed his head and grunted out the first few bars of “Purple Haze,” like a dueling Fender Stratocaster. He showed up to a family photo op dressed not at all in the plaid shirt and new Levi’s and boat shoes our father had had our mother lay out for him, but wearing instead a multicolored, fringed serape and combat boots, looking so relaxed it was as if he were moving in slow motion. He did not attend the guest sermon our father gave at the baccalaureate service at Our Lady the year my brother’s class graduated, even as my mother and I sat up front, ostensibly rapt, and afterward served Country Time lemonade and sliced squares of the giant *Congratulations Graduates* sheet cake at the reception. He did not even attend his own graduation ceremony—it was later found that he had not even gone through the charade of standing in line to pick up his blue-and-white cap and gown from the band-room storage closet.

I was in awe. Somehow, my brother had found a way around, or maybe under, the smooth surface of this world. I wanted to let him know that I saw this, and that I too loathed everything about these flat plains and the school spirit and county pride I pretended to spout, and our father’s smooth smile, which had become my own smile. I would smile, attempting to convey the appreciation that I felt, when he’d let one of his deadpan remarks drop—sotto voce digs at our father or Hyde County, South Dakota, at large—but I knew my smile looked just the same as it always did, and there was no reason for him to believe that anything else lay beneath it.

The October I was thirteen, though, I found him all alone one night in the house. The lights were blazing. Approached from the driveway, where I was dropped off by a fellow Lady Trojan after volleyball practice, the house looked like it was on fire. It was Sweeps Week again, and my parents were away at some kind of fundraising dinner, but I assured my ride that someone must have just forgotten to turn off the lights. When I walked in, there was a human shape on the living-room sectional that it took me a second to realize was my brother. He was holding his head in his hands, like the ceiling might collapse

at any minute. He rocked slowly back and forth. I stood there in front of the door, the hump of my L.L.Bean Book Pack still rounding my back, my blue-and-white-canvas athletic bag still in my hand. It wasn't just that every overhead light in the room was blazing, it was every tiny table-side lamp and corner lamp and even our mother's tiny faux-Tiffany night-light that she'd received one Christmas from her sister in Sioux Falls, switched on in the little nook above the kitchen sink, was also visible from the doorway.

When I called to my brother, he just kept slowly rocking and holding his head. I stood there a little longer before he said something. He muttered, not like he was talking to me, but more like he was registering an aftershock. I let go of my athletic bag and shifted my backpack to the floor. In as unobtrusive a way as possible, I asked why all the lights were on. By this time, I was in my stocking feet and had seated myself on the edge of the La-Z-Boy so that the chair was in no danger of actually reclining. *Oh God*, I heard him say, and his voice sounded like a little boy's, uncharacteristically high and thin. He had now removed his hands from his head and was clutching himself, his fingers trying to wind themselves around his thin arms. His feet were bare and he was wearing only a ratty undershirt and elaborately frayed and torn corduroys, and I wondered if he was cold. I was going to ask if he wanted me to get him some socks and a sweater. But he began to say *Oh God* again, an uncountable number of times in a row, so that the two words began to sound like one long, endless word. It sounded like a plea, but the fact that it wasn't clear whom he was pleading to (surely not actually God) made him sound even more wretched. He stared straight ahead, so that he seemed to be facing the sliding glass door that opened onto the patio but which right then was just reflecting all the furniture and burning lamps in the living room against the backdrop of the black night, as if there were some dark, alternate version of the rooms of our house right outside. I must have asked him then what was wrong. He surprised me by turning to look at me. His dark eyes were open wide and almost rolling in their sockets, which made me think of the squirrels our dog would sometimes pin in a corner of the garage. He called me by the whole of my first name, all three syllables, which hardly anyone ever did—certainly not my brother, who at that point barely called me anything at all. But he called me by my full name, in this terrified, pleading voice that seemed almost entirely disconnected from the deadpan, poker-faced delivery of the few things I still heard him say in those days.

He asked me if I'd ever felt the darkness inside of me.

I sat forward a little more on the unreclined La-Z-Boy.

"Just like this dark . . . formless thing." He was reaching for words, his hands moving even as he kept clutching himself. "Like it's rising in your throat, and in your chest, and maybe you're going to choke on it."

I nodded, slightly.

"I mean—" He shook his head, glanced at the sliding door again. "It's always there, in some way, but then—" His eyes almost rolled back in his head. "Then you're suddenly . . . choking on it. It's choking you." He seemed to be appealing to me. "I mean, it's always there, like sitting inside you, isn't it?"

I nodded again.

"And you try to push it back and you go through your day like that, just trying to keep it down, and then—" His voice, to me, sounded unbearably mournful. "It rises up in you and you're . . . drowning . . ."

He went on like this for what must have been a long time, sometimes looking out the glass door and other times at me, as if trying to make sure I understood what he was saying. And he seemed to keep trying to describe it—this dark, choking, internal thing—not because he could, not in any entirely accurate way, but because it felt too horrible to keep inside. I kept nodding. I thought of how, when I would sit cross-legged in my room and press the blade of my Swiss Army knife into the soft, white flesh of my very inner thighs, the part that wouldn't be revealed even when I squatted and jumped on the volleyball court, the line of blood would darkly swell out. Everything my brother was managing to convey seemed vaguely familiar, like he was referring to a dream I myself had had dozens of times without remembering it until then. It did, after a bit, seem to make him feel better to keep trying to describe the horrible thing, maybe like how you feel better after you've thrown up.

After a long while, he got up and took a glass from the kitchen cupboards above the sink and drifted out of the room. I almost thought that was it, that he was gone. But when he came back, the glass tumbler, the kind we drank milk and orange juice out of, was maybe a quarter full of some amber-colored liquid. Our father's liquor cabinet was in the dining room, but I'd never looked inside it. I'd taken the Trojan "Just Say No to Drugs" pledge and had developed an almost superstitious fear of Substances, although I couldn't exactly say what I was afraid of. My brother steadied himself on the couch, still hunched in a self-protective way. He held the glass up to his nostrils and inhaled.

His breath came out shaky, like the aftermath of a crying jag. I watched him sip, then swallow, watched the knob of his Adam's apple rise and fall in a deliberate way. I sat there on the edge of the unrec-lined La-Z-Boy and watched him sip, swallow, breathe, a little less shaky each time, the rigid hunch of his shoulders softening.

Then he held out the glass to me. I shook my head automatically, of course, as if the cup contained a distillate of contraband and poison that would send me straight to academic and athletic probation. But he smiled, a lost, mournful smile that seemed to fit the shape of his face but which I don't think I'd ever noticed before, and he kept his hand out. "Just a little sip," he said. "It'll make you feel better." It seemed to me then that he knew I understood what he'd been trying to describe. And how could I have understood him if I hadn't felt it myself, the awful dark thing he could only gesture at?

So I took the glass, and I brought it to my lips the way he had, and I took a very small sip, as if it were a chalice of Communion wine. I swallowed slowly, felt it burn my throat, and then imagined that what I'd just swallowed—in the way that I'd seen cartoon depictions of cough medicine coat the glowing throat of a translucent man on TV commercials and begin manifesting its soothing properties immediately—was soothing whatever awful thing was inside me, too. "One sip more," my brother said, very seriously, as if he knew what the recommended dosage was. So I did, one sip more, just for him, because he'd asked me to. I felt the fumes flood my sinuses and the heavy liquid burn my throat again, then I handed the glass back to him.

After he finished it off, his chest rising and falling after each swallow, as if he were rocking himself to sleep, he rose again and washed the glass in the sink and dried it with the Grand Canyon dish towel our mother had purchased a couple summers ago during one of the family vacations my brother no longer joined us on, and then placed the glass back in the cupboard where it'd come from. At some point, he wandered back upstairs, and I sat for a while longer, feeling the pleasant fog in my head. Then I walked from room to room, switching off enough lights so that just a normal, inconspicuous number would be on when my parents returned.

My brother never brought up that night, so I never did either. Sometimes, when I'd pass him in the short stretch of hallway that ran along our two bedrooms, I would want to say something, and then wondered if he even remembered. He was rarely home by that point, and when he was, rarely in sight. I could hear the high wah-wah on his side of the wall we shared, and sometimes I would find him staring

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into space as he spooned granola into his mouth at the kitchen counter, but he hardly registered my presence. And that June, he was eighteen and his senior year at Hyde County Junior-Senior High School came to an end, and while my parents and I were all at the ceremony in the school gym, my brother found a ride out of town and was gone when we got back.

When he called that winter, I hadn't seen him in five years. There'd been a few postcards over the years—from places like Crescent City, California, and Gold Beach, Oregon—and some stiffly delivered updates from my father, who I assumed had been ceded certain logistical details that I hadn't. But that was all.

"Where have you been?" I asked the voice on the other end of the phone.

There was silence for a while, like maybe he was trying to figure out how best to describe his trajectory from age eighteen to nearly twenty-four—which details had faded in importance over time and could be condensed into a single sentence or just eliminated completely, and which details had come to seem more like the watermark of the whole thing and thus had to be given their due, even if no one could ever fully know what he meant.

What he finally said, though, was, "On a submarine."

The lab did not study pain per se, I made sure to explain to anyone who asked—even though the regular people working in the lab didn't really seem to make a big deal, on an everyday basis, about this distinction. As soon as I got the internship, I made sure to read the pertinent lectures in Charles S. Sherrington's 1906 *The Integrated Action of the Nervous System*, in which he first makes the distinction between the "imperative protective reflex" triggered by the application of a noxious stimulus to peripheral nerve cells and the "displeasurable affective quality" that is a "psychical adjunct" to the former. His coinage for the former, in order to distinguish it from the latter, was *nociception*. What we studied, I would make sure to explain to anyone who asked, was *nociception*. This seemed to me like a higher plane of consideration. It was the reaction of the body before the brain, with its tears and distress and complicating associations, ever got wind of it. Pure physiology. You might say what the lab studied, then, was how to disconnect the one from the other.

The research subjects were Sprague Dawley rats, which, having been bred in the sterile confines of a laboratory, have lives as uncomplicated

as their albino coloration. In the faintly musky, pellet-scented room where their cages were shelved, they would squeak mutedly when I picked them up by their rosy pink tails and placed them in the weighing pan, which was one of my regular responsibilities. The rats, in groups of eight, were moved in assembly-line fashion through the multiple phases of the study, which began with an important if workaday surgery, in which a tiny polyurethane catheter, about half the diameter of a juice-box drinking straw, was implanted in the lumbar region of their spines. After seven days of rest and relaxation, interrupted only by a shot of lidocaine through their catheters to confirm that the surgery had been successful, they were subjected to “the hot-plate test,” which means they were placed on a Fisherbrand Isotemp hot plate with digital temperature control and a guardrail surrounding the plate like a tiny medieval city wall. The point of the hot-plate test was to see how long it took each of the rats to demonstrate nociceptive behaviors—namely, to withdraw their naked pink paws from the plate—as it was heated from 44 degrees Celsius to 47 to 52. At 52 degrees, which is 125.6 Fahrenheit, which is 21.6 degrees Fahrenheit warmer than the max hot-tub temperature that the US Consumer Product Safety Commission has determined is safe for human beings, the average time before a rat began hot stepping (as some of the lab techs liked to call it) was twenty-six seconds. These times were recorded scrupulously by the head lab tech, a small, toothy woman who herself had a certain rodent-like quality about her and was the only member of the lab to actually wear a white lab coat on a regular basis. The next phase, Phase III, was injection, the moment when one of four solutions was injected into each rat’s tiny drinking-straw catheter, which poked out like some kind of cyborg scuba gear from its lumbar region. Aside from the control solution of saline, there were three kinds of “punch,” as the round-faced dental-studies lab tech called it: an adenosine analog that was thought to inhibit the release of substance P; an NMDA receptor blocker that inhibited postsynaptic glutamate binding, which seemed as if it might enhance substance P’s effects; and lastly, a dose of each, which some of the lab techs referred to as a “double scoop.” Approximately thirty minutes postinjection, each rat was given the hot-plate test again. This was Phase IV. Phase V began thirty minutes after the commencement of Phase IV, an interval that was timed with the head lab tech’s stopwatch, which she, as the de facto timekeeper, wore on her wrist at all times. As each rat lay prone, following an intraperitoneal shot of chloral hydrate, a twenty six-gauge steel cannula was implanted in its

fourth ventricle, like a pipeline, to tap its cerebral spinal fluid. CSF could then be sucked up—up to 200 microL of it, or until blood appeared in the cannula, was the rule of thumb. The CSF was released into a sterile plastic vial the size and shape of a bullet, after which the molecules of substance P in it would be counted via radioimmunoassay. The rats themselves were then “sacrificed,” which is to say a glass stirring rod was pressed across the backs of their necks while their now limp pink tails were pulled, until you could feel the empty space between their narrow little spines and their skulls, and were then sealed in a Ziploc baggie and disposed of. The next day, another group of eight rats would be fished out of their cedar chip-lined cages for their first hot-plate test. Thus went the rhythms of the lab. I never observed any of this from start to finish, but rather in disconnected phases here and there, wherever another set of hands was needed for the most menial part of the work, so that I held in my head a kind of fractured tableau of any given rat’s progress.

I stepped into this research cycle in medias res, in late May, after the end of my sophomore year at the U of M and my second semester of organic chemistry, which was a requirement for the neuroscience major. I was not, in fact, good at science, but I’d found that it was possible to become passable at it if I approached it the way I approached anything that didn’t come naturally to me, which was via brute force and repetition. I had also taken up training for marathons. English lit was what I’d wanted to major in—I had hand copied “Ode to a Nightingale” on the inside cover of my diary my senior year of high school. My freshman year of college, however, I happened to pick up a copy of a book that my roommate, a future landscape design major who was at the time enrolled in Intro Psych, had left lying around. The book was the account of an academic with bipolar disorder, and, after chronicling the author’s lurid bouts of mania and black troughs of suicidal despair, detailed the favorable effects of lithium on her throbbing brain. I stayed up into the wee hours of the night reading, although I couldn’t have said much more about it at the time, other than it was a gripping story. Psych was not a plausible major. As I understood the subject, which was largely via my father’s understanding, which he had occasion to voice when it was once suggested that a psychotherapist might provide some kind of guidance to his son (who was perhaps marching just a tad too much to the beat of his own drummer), the entire discipline was a quackery of *feelings* and mesmerism. (I remember having to look up “mesmerism” in the *World Book*.) But I had learned there was such a thing as a neuroscience

major, and this included a course called Behavioral Neuroscience, which promised to lay bare the neural mechanisms underlying human behavior. The part I mentioned to my father was that the major required at least twelve credits of 3000-level molecular and cellular biology and six credits of at least 2000-level chemistry. I declared my major in the fall of my sophomore year, a full semester before the deadline.

The lab itself comprised two conjoined rooms on the fourteenth floor of the gray brutalist structure called “Moos,” otherwise known as Moos Health Science Tower, and was headed by a postdoc whom I rarely saw whose wardrobe tended toward woolen pencil skirts and high collars, in contradistinction to the three lab techs, two of whom were male grad students who favored T-shirts with logos on them and the third of whom, the head lab tech, simply favored a white lab coat. The lab, which was already in Week 11 of the study (informally known as “the pain quotidien” study), didn’t have a specific set of responsibilities for an intern—which of course disconcerted me, since I preferred to be given my marching orders and then to proceed full bore. Instead, the techs just began to pass off odd jobs to me, such as weighing the rats and washing the labware—tasks that I performed with as much industry and exactitude as possible, recording each rat’s weight down to a hundredth of a milligram and hand drying the double- and single-spouted beakers and stir sticks and solution bottles so that none would be spotted with water stains, although no one seemed to notice.

At 5:00 p.m., I would most often go back to my subleased room in a house full of people I didn’t know, feeling empty and unmoored. It was June, and I was waiting for a sign from my brother, scanning the streets and checking my email and the mailbox by the side of the door that I passed every time I entered or exited the house, and holding my breath when the phone rang, not unlike a receptor cell membrane’s ionotropic channel awaiting the arrival of neurotransmitter particles in the synaptic cleft. There was never any sign, though, never any signal, and I would sit on my futon in my basement room and read the extra copies of articles on substance P research that I was occasionally sent to the bunker-like stacks of the biomed library to find. I was trying to memorize the entire process of substance P biosynthesis, its postsynaptic effects, and the various methods of inhibiting its actions that had so far been studied.

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The submarine my brother had been on was an Ohio-class ballistic missile sub called, confusingly, the *Alaska*, which had been patrolling some classified area of the Pacific for the past seventy-seven days. The mission of the boat, he said, was strategic deterrence, which seemed to mean harboring twenty-four ballistic missiles while cruising at a classified depth of several hundred feet below the surface of the ocean.

My father, maybe two years before, had noted to me, in the tones he summoned to commend 4-H prize winners and honor roll students, that my brother had “joined up” and was “really thriving,” but this was intel I received with some skepticism. I still imagined my brother, his sun-bleached hair dusting his shoulders, roaming free out West—a phrase itself that somehow suggested a release from our constrained, landlocked part of the country. I pictured him strumming his guitar beneath the kind of blossoming fruit trees that would never survive a South Dakota winter. But when I raced to the door to let him in that December, a week and four days after he’d called, his hair was shorn to regulation length, and he stood with his feet shoulder width apart and his hands clasped behind his back. When I hugged him, my face pressed to the scratchy wool peacoat he wore, there was no trace of the mossy, cuminy smell that would still hit me sometimes, if only in part, when I’d walk past certain rooms in Comstock Hall. I ushered him into my room, where *Neurophysiology: A Conceptual Approach* was laid open on my desk as a sort of prop, and he set down his olive-drab duffel, which looked a lot like a sandbag. I took in his pressed khaki trousers and tucked-in, buttoned-up khaki shirt, and did not know what to say.

“So what’s the POD?” He was the first to speak, in that poker-faced way that had become, after a certain age, his main mode of communication. *POD*, it turned out, was navy cant: “plan of the day.” As it happened, I did have a POD, because I always had a POD. I was incapable of getting through the day without the scaffolding of a highly regimented POD, which maybe my brother remembered. He seemed to.

“It occurred to me that you would do well in the military.” He was still in that wide-legged stance, hands clasped behind his back like he was hiding something.

“Have *you*?” I was waiting for the electric kettle to begin steaming so that I could offer him a choice of Ceylon orange pekoe or ginseng Focus tea.

He rubbed the flat of his hand over his shorn head. “I do Oscar Kilo,”

he said, in a noncommittal sort of way. *Oscar Kilo* being the NATO Phonetic Alphabet rendering of OK, though I didn't get the sense, after he explained it, that this was a standard usage.

He told me that he'd let me have the ginseng Focus, since he knew it was finals week.

"Oh but it's not!" I was fairly bursting. "Finals are all over for me! I got permission to take them all in the first week—so I'm *done!*"

He tilted his head, and I was suddenly embarrassed at my untempered expression of pleasure. "So it seems," he said, helping himself to a packet of Ceylon orange pekoe, "that we are both on authorized leave."

I nodded, trying not to appear as happy as I felt.

"So what's this about you being some kind of rocket scientist?" He had removed his clunky brown leather shoes, and his socks, I saw, were the same khaki color as his pants and shirt.

"I build spaceships," I said, affecting the poker face that he'd just pulled. "It's the final frontier."

"Uh huh." He squinted at me over his orange pekoe, which he was drinking out of my human-brain mug, which featured a different cross-sectional view on either side. "And how's that going?"

"Oscar Kilo," I said, pronouncing *kilo* with an *ee* sound like I'd heard him do.

He nodded, impenetrably. "That's good."

We sat for a little while, neither of us saying anything, both of us cradling our respective mugs of tea in our hands. The dorm room I lived in seemed suddenly dollhouse sized, too big to contain my brother now that he was actually here. He was studying the room, its seven-anatomical-views-of-the-human-brain poster, including a close-up of the glial cells and meninges; the bookshelf of textbooks organized by discipline (e.g., chemistry, biology, cognitive science); the cold spotlight of the gooseneck lamp on my two neat stacks of anatomy flash cards, one for the general anatomy of the brain and another for that of a single nerve cell; the translucent blue-and-purple rendering of a nerve synapse, taped above my desk.

He nodded at me again. "Good program," he said. Which was one of our father's sort of all-purpose responses when presented with a description of something he knew little about but for which he needed to demonstrate his approval. It was also a term my brother had picked up on as a teenager and applied, absurdly, to phenomena and occurrences as disparate as his first swig of orange juice from a just-opened bottle of Minute Maid in the fridge, our mother's harried instructions

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to us prior to the arrival of some prospective donor cum dinner guest, the much-gossiped-about occasion of a student driver's unexpected crash into the storefront of the Ben Franklin on Main, and the red necktie and brass American eagle cuff links our father presented him with on his eighteenth birthday. "Good program." It was a response in place of a response, the ironic quality of which, in my brother's mouth, shifted from one situation to another, but which always, obliquely, damned its original user. It was a joke that I recognized and was in on, and I contorted my face to contain my glee.

"A real good program." I lent my voice the cartoonishly flat man-of-the-South-Dakota-people's pronunciation that our father's vowels would take on when he was at his most glad-handing.

"OK." My brother set down the human-brain mug. "Tell me the POD."

The truth was, the remaining POD was entirely devoted to him. I'd risen at six and run forty-eight laps around the indoor track and completed my complex routine of push-ups and crunches and glutes extensions and stretches, eaten my allotted portion of bran flakes, skim milk, and sliced banana at a nearly empty table in Comstock Dining, scoured the floors and surfaces of my room with a bottle of lemon-scent Lysol and a can of multisurface classic-scent Pledge, and read three chapters of *Consciousness Explained*, yellow highlighter in hand. But leaving this iceberg of the day's activity unmentioned, I spread out my hands before me, as if to indicate the oyster of the world that was ours, in spite of the single-digit temperature outside.

"The meteorite collection at Pillsbury. The telescope at Bell." I began to recite from memory the list of sights I'd written down in semiranked order. "The Weisman. The American Swedish Institute."

"The American Swedish Institute?" He furrowed his brow.

I said I'd never been but the Nordic Christmas rooms were supposed to be nice.

"Uh huh." He nodded diplomatically. "Do they still have the tunnels here?"

These were the basement-level corridors running in a disjointed network across a patchwork of campus, a convoluted diversion from the cold. Of course the tunnels were still there, I told him. The Gopher Way. Six miles or more.

He wanted to know if I used them.

Only stretches of them, here and there, I explained. Instead of

tunneling steadily underground from building to building to building, a corridor would run for a block or so and then force you to emerge aboveground for the length of a building before descending again. They weren't all that practical.

Where was the nearest point of entry, he wanted to know.

We began in the underground parking garage a few blocks away, the concrete ceiling pressing down with the weight of its rows of four-wheel-drive vehicles, and walked, uncertain spelunkers, map in hand, about two and a half sides of the square garage before following the track lighting that led us below Delaware Street, after which we hit a stairway that forced us to ascend for the length of the student union before we spied the next stairwell back underground, where a square circuit of the corridor took us below the campus bookstore and then right back into the student union, at which point it was once again necessary to ascend and locate the next stairway to the next stretch of tunnel, which was on the building's east side, allowing us to snake once more below and across Delaware, tunneling halfway beneath the Mayo Building, rising up once again, descending again, and skirting the west side of the P-W Building and Moos, across Washington Ave. and beneath the Wash. Ave. parking ramp. This was still less than half of the tunnels on the campus west of the river. So we continued in this way, heading vaguely north, fretting the cinder-block corridors that were at times lined with convolutes of piping and ducts and other times with only lurid track lighting against bare walls, which walls were occasionally painted with larger-than-life-size depictions of Goldy the grinning Gopher leaning louchely against a giant M. Whenever we were forced to emerge, like mole people, onto an aboveground hallway, we scouted instinctively for the next staircase down, descending as rapidly as we could, like children holding our breath past a cemetery. We had no destination in particular, save to remain belowground, and thus we worked our way along, from one segment to another, tracing our fingers along the map as needed.

My brother walked at an even pace, his hands in the pockets of his neatly buttoned peacoat, which seemed entirely without lint or pills, steadily scanning the corridors for the next turn or the next stairway. Sometimes, the only sound we heard was the echo of our footsteps off the smooth cinder-block walls. Occasionally, a round surveillance mirror reflected our faces, now distorted, back at us. It struck

me as odd that someone who had just spent seventy-seven days beneath the surface of the ocean would be so keen to keep to the underground of the campus. But it also just seemed like a game that my brother might have made up when we were both still in grade school—like who could go the longest without using a particular word, or who could stay underwater the longest at the reservoir.

The amazing thing about nuclear submarines, he said, as we emerged from a stairwell onto a second-floor passageway, searching for the next portal down, was how they could, theoretically, cruise for years beneath the ocean. They generate their own fuel and thus their own propulsion, make their own oxygen, and distill their own water. Only the needs of the crew prevent them from staying down for years on end. He had nothing to do with the missiles *per se*, he said. His job was simply to keep the boat running. Maintaining the water-tight doors, repairing the valves and compressors, storing the oxygen. Strictly maintenance. He did what was needed to keep the boat cruising at whatever classified depth under the sea it was. And the entire design, he said, was in the service of stealth. To avoid detection at all costs. We sighted the next stairway down. You couldn't hear the nuclear-generated steam propelling the turbines. Nobody could hear it. That was the idea. He pushed open the heavy door to the stairs and we descended. The control room was bathed in the red glow of a darkroom, so that no light might shine its way up through a periscope and reveal the presence of the sub. There were even anechoic tiles on the surface of the hull. In the fluorescent lighting of the tunnels, I could see the violet shadows beneath his eyes. His face was very pale. When we emerged, late in the afternoon, the winter sky was nearly leached of its light.

That summer in Minneapolis was thickly humid, the heat like some kind of retribution for the terrible cold winter, and I often, after racing to Moos on my spindly Schwinn, entered the lab streaming with sweat. At the very back of the two rooms was a walk-in freezer, crammed with plastic cases of vials and racks of test tubes containing samples and solutions. I would step in and close the door and just stand there in my soaked T-shirt until I began to feel iced over. Then I would step out, into the air-conditioned lab, and wait for someone to tell me what I was supposed to do.

Frequently, the head lab tech was about to anesthetize another group of rats, presurgical implantation of their juice-box-straw-sized

catheters. She went about this in a more ritualistic way than the other lab techs. First, before any of the rats were brought in, she pressed play on her own personal CD of Handel's *Water Music*, which she felt created a soothing ambience. And then, as I wheeled the rats in, each in its respective single-occupancy cage, she proceeded to drape a dark towel over each one, to calm them and shield them from the stressful moment when their peers were lifted, dangling, from their cages, and injected via hypodermic needle with a 350 mg/kg dose of chloral hydrate in solution. The HLT approached the task with great solemnity, like a high priest at the altar. Her faintly rodent face would become grave as she donned her latex gloves, laid out a disposable towel on the bench, and prepared her instruments: the spray bottle of ethanol and stack of white towelettes, the rack of test tubes, and the 26-gauge needle and one-microL syringe, which she would flick officiously to remove any air bubbles after she'd drawn up the correct dosage of CH solution. At her side, I learned how to restrain each rat by the scruff of its white back, its chest fluttering and its tiny, pale pink, disconcertingly humanoid paws grasping at the air, as I applied an ethanol-sprayed towelette to the lower portion of its exposed abdomen and then used the same hand to firmly drive the needle home. It took at least a week of injections before I could do this without flinching or altogether letting go of the rat, which would then skitter away in terror. But I applied myself diligently, and I learned. The rat would squirm, frantically, almost insupportably, and then, within a few seconds, go limp, save for the slow shiver of its heart in its chest. Meanwhile, the dulcet tones of *Water Music*, which struck me as having an awful lot of allegro in it for something that was supposed to be soothing, would continue to fill the room, like counterprogramming to the musky odor of the rats' cages and their muted squeals.

When the HLT wasn't performing injections, the CD player was usually commandeered by the more affable of the two grad students, the round-faced dentistry student, who, at the age of twenty-three, already had a cheerful-looking blonde wife at home, whose wallet-sized photo he would happily display whenever the occasion arose. I don't actually think that he tended to play a lot of eighties synth-pop, but the only CD of his that I paid attention to was the Pet Shop Boys. Just about every track consisted of a dark, hushed melody undercut by an impossibly chipper dance beat. The melancholy voice of the lyrics could never quite extract itself from the drum machine. I wanted him to play the disc over and over, although I knew it would be inappropriate of me to keep asking. Eventually, I brought in a

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blank cassette tape and made myself a copy, which I could then in fact play over and over, on my headphones, as I ran along the cloudy Mississippi.

My favorite song, the one I would rewind and replay as I ran, was "Red Letter Day." *Aaaaaall Iiiiiii waaaaaant . . . is what yoooooou waaaaaaant*, went the refrain. *I'm always waiting, for a reeeeeeed letter daaaaaaay*. There was still no sign of my brother, no matter that I checked for his NAVY bumper sticker on every blue-gray car in the vicinity of Moos or my subleased room, and the song became like a private anthem to me. *All I want is what you want*. Like it was just a matter of waiting.

"Now, the navy," my brother was saying, "is renowned for their rack making. We're famous for our hospital corners." He was speaking in the stilted tones of a drill sergeant who'd been set down in a home-ec class. Before commencing, he had hauled the bunk bed away from the wall, scoffing at what I'd always thought was my perfectly respectable method of making a bed. He shook out the top sheet with one officious billow. "First thing you wanna do is take the sheet"—he was all focus—"and you wanna place it on the rack so it is flat, all the way from side to side."

I was stiff faced with laughter it seemed undignified to give voice to, given the admirably controlled pitch of his performance. I watched him line up the edge of my cornflower-blue bed sheet with the foot of the extra-long mattress, demonstrating that the overhang on each side was equal before tucking in the end of the sheet. "Now," he declaimed, "you go to one side of the rack to begin your forty five-degree corner." At this point, he had somehow lifted up the side of the sheet as if it were the wing of an origami crane. He pulled its triangular lower half tight and tucked it beneath the mattress, leaving the triangle of its upper half to flap. "Now." He stood for a moment holding this upper flap out tight, like its existence was a problem to be solved. "Now you will tuck up that excess underneath the rack." His hands, with their carefully clipped nails, took on a mitten-like shape, all the fingers pressed carefully together as he tucked in the flap and began to smooth out the sheet. "You wanna *tuck in* the excess." He stood back with a flourish. "Now what you've got there is your forty five-degree-angle corner."

"Could bounce a quarter off it." I tried to mimic the military machismo in his voice.

He held up an admonitory finger. "But we're not done yet." He worked his hands delicately along the edge of the mattress, toward the head, tucking in the rest of the sheet and smoothing it as he went. He paused to look at me over his shoulder. "You always wanna make sure that you smooth down the sheet." He swept the surface of the bed with the palm of his hand. "*Smoooooth* down the sheet." When he had repeated the process on the other side of the bed, the top bunk looked like it had been sanded down with a blaster.

With another sweep of his arm, though, he tugged the entire top sheet from the bed. He balled it up and tossed it at me. "Now *you* do it."

I gaped at him, and then it was like I was six and he was showing me how to make a paper airplane. His stubby fingertips on the folds of notebook paper, each sharp fold preceding another, even narrower fold, until the flat arrow of the nose was formed. He directed me, largely with his hands clasped behind his back, and I smoothed down the sheet on the rack, folded the overhang in a triangular shape, tucked in the excess, and smoothed down the surface, tucked in the excess, and smoothed down the surface.

I thought of the bunk bed he'd had in his room until maybe junior high—the *Star Wars* sheets and navy comforter, the fortlike feel of the whole structure, with the inside lair of the bottom bunk and the lookout of the top. Sometimes he let me sleep on the bottom bunk, and then, for the groggy space of time just before sleep and just after waking, I felt like I'd been let into his citadel, even as he drifted further and further away from me. I thought of this as I lay there in the dark that night, him on the bunk above mine. Shorn head, uniform, military stance, and as poker-faced as I remembered from the years just before he'd left. But he was here. He hadn't said, exactly, why he'd joined the navy, why he'd gone for a submariner. These didn't seem like the kinds of things I could ask.

Still, after only a few minutes had passed, I said his name out loud in the dark. "Are you awake?"

I could hear him breathing, very quietly, before he answered in the affirmative.

"Do you remember"—I wasn't sure how to formulate the question. "I still remember—"

He was perfectly still.

"That night I came home and found you with all the lights on?" I waited. "What you said—I still remember what you said—about the awful, horrible blackness."

There was still no sound from the upper bunk.

I stared at the bottom of the bunk and thought about what he'd tried to say—about the choking, dark, formless thing, about almost drowning in it. How he couldn't quite find the words for it. The horrible thing sitting inside you. I wanted to reach my hand to the bunk above me. "Do you remember?"

The room was completely silent. Most of the other students in the dorm had already left for break. The frozen campus outside was empty. There was the distant rumor of traffic on the East River Parkway. I lay there listening, for minutes, for maybe an hour, before I understood he wasn't going to answer.

When I woke in the morning, it was with the sense of someone moving in the room. And when I opened my eyes, I saw it was my brother. The light was a predawn gray, the color of insomnia. He stood in front of my seven-views-of-the-brain poster, in his khakis and thick-soled shoes, just buttoning his peacoat, as if, in another second, he wouldn't have been there at all. Where was he going, I asked. His face was very smooth, and composed, as if he'd just planed off any furrows or creases with a razor in front of the mirror. He had to head back, was all he said. "Back," referring very broadly to wherever it was that he'd come from—a naval base, or maybe the submarine itself. He'd hardly just gotten here, I said, an observation that he did not dispute. He was going off into the woods, and I was not allowed. He was locking the door to his room. My mind was still fuzzy with sleep. When was he ever coming back? He paused by the door, his sandbag of a duffel slung over one shoulder. His watch cap was pulled low, nearly over his eyes. He would have another leave in June, he finally said. It was December now.

I watched the door close, watched the knob being silently twisted. Then I lay on my side, my throat aching, and tried to visualize the relevant neuroanatomy as seen in lateral cross section: the curled horn of the caudate nucleus, curved around the crescent of the thalamus, which itself curls around the shell of the putamen, deep in the forebrain. The thalamus perched upon the brain stem, like an ancient bust on a plinth. And, as viewed from above, on a map of the brain's mantle, across the medial prefrontal cortex, the bilateral ripple that is Brodmann area 9, thought to be involved in the suppression of sadness.

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All throughout the month of June, I looked for my brother. The blue-gray car with the NAVY sticker, the shorn head and military stance and regulation khakis, and, sometimes, the sun-bleached hair dusting his shoulders, the back of one of those faded tie-dyes, its ray of colors spiraling into itself. On the very last day of the month, like a ship sending up a flare, I decided to write him a letter.

The letter took up three sheets of notebook paper, and was written in blue ink. I told him again that I still remembered what he'd said about the choking blackness, how it was rising up inside of him, this awful, dark feeling. I tried to explain how it had stayed with me over the years, to explain much more precisely than I'd been able to from the dark of the bottom bunk. I told him that I'd never forgotten the horrible feeling he was describing. And then, I wrote, this was because I felt it, too. And I explained how the blackness had welled up in me, like an illness, like a heaviness, like a rottenness I could never root out. I apologized for still not having the right words either. I told him about practicing my fake smile, and serving sheet cake at receptions and harmonizing in the Immaculate Conception choir and cheering on my fellow Lady Trojans and doing the wave at Trojan football and basketball games, and then how I'd joined the Gopher women's cross-country and track teams, putting on the maroon and gold and radiating team spirit like a nuclear test site, all the while feeling like there was something rotting inside of me—like I was rotting—and that I'd rather just lie down and die. *I'm telling you this*, I finally wrote, *because I think you might be the only one who understands*. A declaration that today strikes me as melodramatic and naive, and probably honest. Then, not knowing what else to write, I wrote, *Please write back*.

I found the address of the naval base he'd mentioned, northwest of Seattle, and I addressed the envelope with machinelike precision, pausing after each letter and number, careful not to let any character blur into any other. I inscribed my own address, the return address, just as precisely. I slid it into the mailbox next to the front door of the house, and waited. It was a Sunday afternoon, and I looked at the envelope again before I went to bed. It seemed, in its compact way, as if it contained a small but volatile time bomb. In the morning, when I left for the lab, the envelope was still there, the last number of the address just visible. I wondered if I should take it back and tear it up. But I left it there. And when I returned in the evening, the envelope was gone.

By early July, I was assisting the HLT with all of the chloral hydrate

injections. The draping of the cages, the flicking of the syringes, the plunge of the needle. "You have a firm hand," she said to me one day, and then told me there was a spare lab coat in the storage closet next to the walk-in freezer. Sometimes I would find myself humming different movements of *Water Music*—the overture, or one of the well-tempered allegros, or maybe the vaguely wistful lumentent.

I wondered, often, where the letter was. If it had found its way to the naval base half a continent away, had it also found its way into my brother's hands? I tried to picture its possible fates. Was it pressed within the pages of a book, or at the bottom of his olive-drab duffel, or folded into his breast pocket? Or had it never reached him at all and was instead lying unseen in a pigeon hole or on a dusty metal shelf while he cruised hundreds of meters beneath the ocean? I checked the mailbox by the door every evening as I entered the house, peered inside to make sure there wasn't an envelope stuck at the bottom. I dialed the communal voice mail several times a day, listening till the end of every message, every out-of-breath hello or garbled instruction or meandering stream of consciousness that would get cut off after three minutes—just in case. At work, there was a computer with an Ethernet connection in the break room, and I would log into my email account at lunch and just before leaving for the day. I called home to make sure nothing had been delivered into the hands of the Lubrication Station. Every means of transmitting and receiving a message became a site of possibility, and then, just after I checked it, a site of acute disappointment. A hollowing out of my chest, an ache behind my eyes. I couldn't have said what it was, exactly, that I wanted from my brother, except for him to write back.

In August, the gruffer of the grad students—a callous young PharmD with a thin blonde mustache and tiny eyes—told me that if I wanted to come in earlier one morning, I could assist him with Phases III through V. This was the core of the study, when a group of rats was injected with one of the four solutions and then tested again on the walled plain of the hot plate. That morning, only I was aware of which rats had been shot up with which solutions, given that it had been my job to prepare each syringe before handing it to the PharmD student. But right away, you could tell which ones had been given something more than the control solution. One by one, each rat, its tiny catheter still protruding from its lumbar region like a snorkel, was dropped by its ropy pink tail onto the hot plate. And certain of these rats stood dumbly on the plate, their red eyes absorbing the new sort of cage they'd been placed in. Instead of beginning to lift

their tiny, humanoid paws off the plate after about twenty-six seconds at 52 degrees Celsius, instead of squeaking with an alarm-like repetition, these rats lingered. They were slow on the uptake, beginning to get a little itchy footed only after forty seconds had passed. And then there were the real outliers of the group: after forty seconds, after fifty, these rats were unperturbed. Technically, we should have been removing every rat from the plate after thirty-five seconds at 52 degrees. But the PharmD student, as if to satisfy his own personal curiosity, in a way that made me think of boys pulling the wings off of flies just to see what they'll do, pushed it further. Fifty seconds, sixty. There was the faintest odor of something burning. The rat would crouch blankly on the hot plate, not even its tail twitching. When the PharmD pulled the rat out, the bottoms of its paws were a raw red, the underside of its pink tail a deeper pink. These were the rats—it would later be confirmed—that had been injected with the double scoop, the solution that suppressed both the release of substance P and the binding of another transmitter that worked in postsynaptic concert with substance P.

Later, as we aspirated cerebral spinal fluid from their fourth ventricles, that region between the base of the skull and the highest knob of the spine, I stared at the cloudy liquid. You couldn't, of course, tell one vial of CSF apart from any of the others. Only a radioimmunoassay could do that. All I knew was that in some of the vials there existed a deluge of substance P's undecapeptide molecules, and in others there was none. I looked at the two rats who hadn't responded at all to the hot plate, who had only looked blankly at their surroundings, the beads of their red eyes shifting. Where had the pain gone? Had it ever existed? Or was it still there in the terminals of their afferent neurons, in their unexpressed loads of substance P, waiting?

All eight of the rats lay limp on the bench, prostrate beneath the giant cannulas now embedded in their necks, their eyes closed like docile sleepers. Once 200 microL of their CSF had been siphoned off, the rats were of no more use. The PharmD took a ballpoint pen from his pocket and gave me a brief tutorial on how to roll it across the back of a rat's neck while pulling at its tail as if it were some sort of party cracker. He had me feel with my index finger the now empty space between the hardness of its skull and ridge of its spine. He gave me a grim smile. "No pain now."

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I never received any reply to the letter I'd sent my brother. By the end of the summer, I had pretty well convinced myself that this was just as well. What I had written was something I no longer felt. It could be readily enough disavowed. And the hurt that I'd carried with me all summer could be sharpened into anger. My brother, I wrote in the pages of my journal, had become a military automaton who didn't have the common decency to even just acknowledge the receipt of a three-page letter from the one person on earth who had only ever admired him.

It's amazing how slowly but surely this occurs, like the transformation of a liquid into a crystalline solid.

The fall semester would begin soon, and I would be taking Cellular and Molecular Neuroscience, Pharmacology of the Synapse, and Neural Engineering. The Gopher women's cross-country team had begun training for the season, and I picked up my racing uniform from the field house. The lab had the data they needed and would submit their findings on substance P to *Anesthesia and Analgesia*. It was Sweeps Season again, and I would briefly travel back to Hyde County to pose with my father at the usual pancake breakfasts and Lions Club award banquets. He liked to refer now to his son who couldn't be there because he was serving this great nation in a submarine all the way under the shining sea.

Years later, back in South Dakota to appear at a fundraiser for my father's first run for the US Senate, I drifted toward the bookshelves in the home of the couple hosting the event. Weary of smiling and nodding, I began to gaze with tilted head at the spines. The husband, it seemed, was a military history buff, and my eyes skimmed over a length of titles like *Principles of Maritime Strategy*, *Modern Air Combat*, *Chemicals in Combat*, *Strategic and Ballistic Missile Defense*, *Field Artillery: V. I-X*, followed by titles such as *Desperate Stand*, *March to Victory*, *Honor and Fidelity*, *Arms and Men*, after which came *The Spartans*, *The Samurai*, *The Huns*, *The Mongols*, *The Cossacks*, *The Zulus*, which were directly above a span of spines branded with a single name, at least half in all caps: GRANT, Lee, Custer, MACARTHUR, CHURCHILL, Pershing, PATTON. Somewhere in the middle of the shelf that contained *B-29 Superfortress Units of World War 2*, *Combat History of the Panzer-Abteilung 103*, and *Fire for Effect: A Unit History of the 522 Field Artillery Battalion*, I came upon a narrow book called *The Sinking of the USS Thresher: The Most Tragic Dive in Submarine History*.

It would not be accurate to say I never thought about submarines, or about the fact that my brother was on one about 75 percent of the days in any given year. But it would be accurate to say that I tried not to, and thus that I actually knew very little about submarines. At that point, I had not seen or heard from my brother in nearly ten years. As far as my understanding of these things went, he had become what's called a lifer in the navy, a veteran submariner. That was all I knew.

The *Thresher*, I learned, when I sat down in a mid-century leather armchair with the dry martini the host had poured out for me along with some allusion to Churchill, had been a nuclear-powered sub named after the solitary thresher shark. The boat had the ability to operate at depths greater than any submarine before it. But in this ability, the author reflected, lay the *Thresher's* undoing. In the spring of 1963, while diving about 250 miles off the New England coast, the submarine sank too far to be recovered. A day later, it was declared "lost with all hands"—a phrase that, somehow, in its workmanlike contraction, seems to compound the horror of the thing. Eventually, it would be determined that a pipe had burst, that the engine room had flooded, and that the boat could no longer propel itself forward. Heavy with the growing weight of water, it began to sink. At about 2,400 feet, it's estimated, the submarine imploded from the pressure of the sea.

Nearly two decades later, when the remnants of the *Thresher* were at last located, these were scattered at a depth of 8,400 feet below the surface. The only piece recovered was a fifty-seven-inch length of twisted pipe. No human remains were ever found.