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Ars Poetica

For all the history of grief
An empty doorway and a maple leaf.

For love
The leaning grasses and two lights above the sea—
—Archibald MacLeish, "Ars Poetica"

In preparation for today's surgeries, I scrawl these words on my arms. I do it first thing in the morning, with a thick black lab marker, just before we enter the surgery room. This "we," I mean: Ren, Tao, and three undergrads: Mei-Lin, Emily, me. The work of a summer comes down to this final operation. I am of course afraid, but then I look down, see one stanza per arm. I am *armed*, I tell myself, and try to laugh.

Ren and Tao work in the lab full time. The undergrads are just here for a summer, learning how to be scientists and hopefully getting inspired. If we are sufficiently inspired, maybe we will stay in this lab, keep working during the school year and in future summers. If we are even more inspired, perhaps we will apply for graduate school and pursue careers in science. It is everybody's hope that we will then become the next generation of scientists.

Ren is our mentor, our inspiration-in-chief. He turns to the undergrads. Today we are performing brain surgeries, he says. We will operate on sixteen rats before the end of the day. He means this "we": himself and Tao. The undergrads may be the next generation, but for now we are merely lumps of primordial enthusiasm, striving to be good. The undergrads, therefore, will stand behind the real scientists and observe. Take note: how much does each rat weigh? What dosage of anesthetic did we give them? What time is it? You need to remind us, the real scientists, to check every fifteen minutes whether or not the rats are still unconscious. If they stir, we have to give them more anesthetic. This is a very important

responsibility. Do you understand?

The undergrads will "observe." That is a nice way of saying "stand there and mostly do nothing." The lab is full of nice ways of saying things. For example, "stimulus" means "pinching the rat's foot to see if it kicks." "Administer" means "poke the rat with a needle." As in, *If the rat is responsive to stimulus during surgery, we will administer more anesthetic.*

During surgery I will learn many more examples. For "cut the rat's head open and drill a tiny hole in its skull, then deliver drugs through the hole with a syringe," there is "convection-enhanced delivery." For "choke the rat to death before harvesting its organs," there is "terminate with CO_2."

In the surgery room everything is sterile, so we (this "we": everybody) have to wear surgical gowns and face masks and gloves. The gowns are banana-yellow and translucent and look like smocks you would wear to art class. I strain to read the black scrawl on my arms through the banana-colored sheet. I decipher the words one by one, looking up after every other word to make sure fifteen minutes have not passed without my noticing so I can perform my one all-important function, human alarm clock.

For love, I read from my right arm, and shiver.

More examples just for the undergrads: for "you are always in the way," there is "your contributions are important." For "you really screwed this up," there is "it is okay." For undergrads, the bar is low.

Before we begin, Mei-Lin looks over at me.

What were you writing on your arm?

A poem, I say.

Why?

I do not say: Because I am afraid of you.

Afraid of everything else, too.

We begin. The scientists are preparing for surgery. The undergrads are observing and taking notes.

Observe: Tao throws open a sterile plastic cage and gingerly pulls out a rat by its tail. Note this about Tao, how his hands know when to be blunt and when to be gentle. Blunt and fast for opening

cage doors or plopping polypropylene tubes into the centrifuge. Gentle and slow for holding animals or purifying DNA. Commit these to memory, the hands of a good scientist.

The rat's tail is wormy and tan-colored, but otherwise the animal is pure white. Its thick coat of fur immediately reminds you of a woman you once saw in a magazine, a beautiful young model pulling a white coat coyly around her shoulders.

Take note: this rat is beautiful like a young woman.

This is Rat Number One, Tao calls out. The undergrads scribble obediently.

Number One is much bigger than I expected. She fits in Tao's gloved palm like a child's shoe. Observe: Tao places a beaker on a scale, tares the scale. Then he pinches her thick white fur between his thumb and forefinger and drops her in. Watch as Number One pokes first her nose and then her entire head out of the beaker, drapes her tiny forepaws over the rim. See her wiggle and squeak.

Rat Number One, two hundred and fifty grams, Tao hollers. The undergrads once again scribble.

Observe: Tao moves with steady and confident hands, jokes with Ren, is unaffected by the little subject in the beaker appraising him with her beady red intelligent eyes. Watch him return Number One to the cage and reach in for another rat.

Three months ago, start of summer: Tao and I begin working together in the lab and are fast friends within a week. Tao is short like me and this makes it easy for us to look each other in the eye. Early on in our friendship, Tao says that he is lucky to have found me. Later in the summer, after I have gone crazy, I will realize that I am the lucky one.

We are first brought into each other's orbits because we both orbit Ren: Tao is Ren's collaborator and I am Ren's mentee. Summer is barely underway and the other undergrads—Mei-Lin, Emily—will not start working for a few weeks. So all day it's just us.

All day Ren conducts chemistry experiments and I trot after him, from the bench to the chemical hood to the freezer and back. Mostly I observe, but sometimes I do something small, like weigh something or pour something or plug something in, and Ren tells me that my contribution is important.

Whenever Tao has time, he comes over and observes too.

Tao is busier than me because he runs his own experiments independently of Ren or anybody. He can do this because he has everything I have—unbridled enthusiasm and a desire to be good—plus a slew of things I do not have—many years of research experience and two additional degrees in science, a bachelor's degree and a master's degree. It is a matter of time before I am trotting after Tao in the lab on days when Ren is busy. All day he conducts biology experiments and I follow him from the bench to the cell-culture room to the centrifuge and back.

What comes after this step? Tao asks as he pipettes a suspension of rat glioma cells. To make sure I am paying attention, he is asking me a question. But even when he is sure I am attentive, Tao still asks questions. He is never not asking questions.

What's the goal of this experiment? What would happen if we used a higher speed for the centrifuge? Are you applying to graduate school? Is this measurement in micrograms or nanograms? What do your parents do for a living?

Later he asks, Why do you need other people's praise to feel confident in yourself?

Tao always asks me questions in English. He asks Ren questions in Chinese. Chinese is their native language and they communicate more efficiently when they speak it. I can hear the difference in rhythm compared to the way they speak English: the syllables come more steadily, faster and lighter and smoother.

There is something else too. A subtle change in the voice, a shift to a more tender register. They stop calling each other by name. Tao calls Ren *shi xiong*, which, Ren later explains to me, is what a student studying under a professor calls a fellow student who has been studying under that professor longer. It is like a strange permutation of *brother from another mother*.

Sometimes Tao calls Ren *Ge*, which means big brother. For a moment they are not just labmates, but family. *Ge*, let me get that for you. *Ge*, is this what you meant? Don't worry, *Ge*, I can take care of it.

I speak Chinese too, because it's my parents' native language and when I was a child it permeated the house. But it has been many years. Now my words are rusty and my vocabulary is small. Still, the first time I hear Tao say that, I almost start to cry.

Today, on the big day, I observe: Ren prepares a syringe and a tube full of clear fluid. This fluid is the anesthetic: a mixture of ketamine and xylazine, a cocktail of drugs that will slow a rat's heartbeat and cause it to lose consciousness before surgery.

Each rat needs a different dose of the cocktail corresponding to its body weight, Ren explains. He is measured, cautious, precise, like a lawyer testifying under oath. It is as if he is always afraid of being misunderstood, so he uses words to mold himself into a flawless, impenetrable human being. And like magic, it works: in the lab, everyone finds him polite and kind and he is universally well-liked.

It is very important to give the correct dose of anesthetic, he says now to the undergrads. Too much, and the animal's heartbeat will be too slow and it will die. Too little and the animal will awaken in the middle of surgery and squirm in great pain.

Ren identifies his target rat, calculates the dosage in his head, punches numbers into a calculator to check, nods with satisfaction. Then he brings the syringe to eye level and slowly pulls the plunger outward, drawing liquid into the barrel. Measured, cautious, precise.

Also, he says, turning, the injection must be very precise. You must put the needle just deep enough to penetrate all the layers of skin and fur, but not deep enough to poke into the abdominal cavity where all the important organs are. This is called an intraperitoneal injection.

In three quick motions he is finished: the white fur is pinched, the needle slides in and the plunger is pushed, the needle emerges. Within seconds, the rat's eyes darken from red to ashy brown and its squeaks diminish. It is perfectly still except for the tiny rise and fall of its back from its now-shallow breathing.

I am first assigned to work with Ren the summer after my first year of college. In the beginning I am terrified because I have never worked in a lab before. Also because Ren is tall and looms over me.

Mostly I am terrified because many of the things I say are not very smart, unlike Ren, who is very smart. Every day I worry that I am learning too slowly or that Ren will think I am not worth his time teaching.

During the first month, many of my questions are variations

of What is this? and How do I use it?

But Ren never criticizes, is endlessly patient, and has a forgiving laugh.

That is a pipette, he says. I will show you how to use it. Or, if he is busy: That is a pipette, and this is my fellow scientist and collaborator Tao. He will show you how to use it.

I'm afraid I will be a nuisance, I tell Ren during my first week in the lab.

I expect you to be a nuisance, he says, and laughs his forgiving laugh.

I like him very much after that.

Two months ago, mid-summer: Outside, everything is suddenly hotter. In the lab, the heat is all anyone talks about. I hear it'll be above ninety degrees again today, isn't that crazy? Yes, crazy—last night it was so hot I couldn't sleep!

Inside, everything is suddenly busier. One reason for the busyness is because there is a new undergrad: Mei-Lin has arrived. She goes to a different school across the country from me whose summer break starts later than mine. As soon as she finished her last final exam, she boarded a plane and was in the lab by nine the next morning.

Now, instead of just me, the two of us trot after Ren in the lab, from the bench to the chemical hood to the freezer and back. Two turtledoves to replace the partridge in a pear tree. When Ren is too busy, the turtledoves trot after Tao.

Mei-Lin is a year older than me and has more lab experience. At the bench, her hands are quick and carefree and do not shake with nerves like mine. When we work together to analyze experimental data, she calculates everything in her head and yells out the answer before I have even finished reading the numbers. I'm a biochemistry major, she tells me. Immediately I know what comes next: after she gets her degree in biochemistry she will go to graduate school and pursue a career in science, and someday soon after that she will take her place in the next generation of capital-S Scientists.

In between experiments I find myself thinking. Why would the next generation of scientists need someone like me when it can have someone like her?

On top of all this, Mei-Lin speaks fluent Chinese. This is because she grew up in Beijing and has been speaking it all her life. Now she jokes excitedly with Ren and Tao, using a big vocabulary I do not have, and they respond to her in strings of smooth and steady syllables.

But I, too, fall in love with Mei-Lin. I cannot help it: because all her sentences are exclamatory, she always sounds warm and excited and happy to see you. I think the centrifuge cycle is done! Perfect, that's two-point-five grams! I'll put these flasks in the incubator!

You should be more confident! Mei-Lin tells me the day we meet. I blink at her.

At night, I suddenly cannot sleep. Night after night this happens: it is three a.m., then four a.m., then finally I give up and turn the lights back on, wait for sunrise.

I think maybe it is the heat.

In mid-summer I get busier too. Tao is applying for Ph.D. programs soon and needs to take the GRE. In preparation, he requests help with his English. I love English and have nothing to do after work, so I immediately say yes.

My shiny new evening routine: leave lab at five p.m., study with Tao until midnight, ask Tao for a ride home, pretend to sleep, turn all the lights back on, wait for sunrise, find sunrise a great and devastating surprise, walk back to lab.

In between bouts of studying there are breaks, which Tao uses to fire off a thousand questions as quickly as possible. What do you think the job market for scientists will be like in five years? If you went to graduate school what would you study? What do you think is a good age to get married? He asks everything with a strange urgency.

When I point this out he says, It's because I'm old. He grins.

Tao is not old. He means only that most scientists his age, like Ren, are finished with their doctoral programs instead of just starting to apply. The age comment is a joke but when I look closely I can see that the grin does not reach his eyes.

Back to the big day:

Once the animals are unconscious, they must quickly be moved into position. So observe: An impromptu scientist assembly line. Tao, who stands near the cages, scoops up each rat and pours it into the waiting hands of Ren, who glides over to the operating table. The rats sleep, sweetly unaware of this progression. As they are transferred from one gloved hand to the next, their mouths hang slightly open; they are limp and soft like sleeping children.

On the operating table the scientists have arranged machines specially designed for this experiment: small mounted platforms with various attachments, a surgical Christmas tree. Ren points at a fleshy, bowl-shaped appendage at the front of the platform: This is a nose cone for delivering more anesthetic. He indicates a vertically-protruding clamp with a screw: this is where we mount the syringes loaded with drugs. Tao lays each rat on its stomach so that its belly fur rests against cool metal and its tail hangs over the edge of the table, dangling, like a fishhook baiting nothing. He strokes each rat, creating a ridge in its back: a single ripple of white fur.

Somewhere I read that mothers should not lay infants on their stomachs for sleeping. Tao is not a mother and these rats are not his children, but still I wonder if he ever looks at them and thinks of that.

Later, after some of the rats have been "terminated with CO_2," Ren will collect their bone marrow while I watch. How do you know if you should be a scientist? I will ask him as he flushes the goopy gray substance into centrifuge tubes, and he will say, If you love science and can't imagine doing anything else.

But how can I know if I love it that much?

Easy. If you went to graduate school and for fifteen years your research didn't work, would you still want to keep trying?

If I worked on anything for fifteen years and it didn't work, I would jump out the window.

Okay, then that's something to think about, Ren will say. He will laugh, pause to admire his gray goop. Then he will carry his tubes to the centrifuge, leaving me with my throat full of shards.

In the surgery room it is also Ren's turn. For a long moment he studies the top of each rat's head. Then, cutting slowly down the center, he slices through delicate layers of skin until blade grazes bone. From here the protocol is easy to follow: Trade the scalpel for a drill. Mark the target site with a black lab marker. Align the

drill with the mark. And finally: carve a tiny, perfect hole into each rat's skull.

If you peer into the hole, you can see the rat's brain, says Ren. I peer: nestled against a beige skull, a red-orange mass. It is the first brain I have ever seen. I feel a jolt of something like surprise, almost happy.

Before Ren programs the syringe to start injecting drugs, I steal another glance to see if I have missed anything.

For love: the leaning grasses and two lights above the sea. Does love also take the form of wrinkled, grapefruit-colored flesh?

One stifling night, mid-summer:

Tao is tired again from studying, so he asks me a question:

How does a precocious second child from China find himself in an American lab, performing brain surgeries?

Here is one way: Grow up in a small town where everyone knows you as the talented younger brother. Do well in school and set everyone's expectations high. Then, at the last minute, mess up what everyone tells you is the most important exam of your life, the college entrance exam.

Move to a new town far from your weeping mother and humiliated father. Start out alone, but be kind and alert and this way make allies. Come to see that studying is really just a better way of being alone. At last, pass the entrance exam. Once in college, work harder than you possibly can, four years of classes in three years. Find your way into some terrifying trouble, find your way out of it again. Find your way out of the country and move to America on a prayer and the promise of a job in a lab in suburban Ohio.

Three years into your lab work, feel the outer edges of this small lab, this small town, and realize you do not have a future here. Long for something bigger. Take a shot in the dark, move to Boston.

Find the two universities most scientists believe to be the two best universities in the world. Spend three more years wandering between them, twelve labs in all, learning, failing, learning. Remain resolved that research is your calling, even when you cannot see how. Become a Christian but forgo church for the lab. Or think of it this way: make the lab your church, the place you believe you can best serve God.

One day, lose yourself so deeply in a sleepless stretch of lab work that you collapse from vertigo and have to be hospitalized. When you get home, cry with the desolation of a lost man who has tried everything and does not know what else he can do.

Everywhere you go, exude a haggard determination that people will point to and say: There! There is the unmistakable mark of a man who is lost—who is walking the world looking for something important.

Above all, love science. *For all the history of grief,* you must always love science.

The day I go crazy, Tao will call me with a strange urgency.

Are you okay? he will ask, and I will wonder how he knows.

One month ago, late summer: Mei-Lin and I have been working side by side for a month and are finally reaching a new equilibrium. In the lab we instinctively make enough space for each other at the bench, call out to each other from opposite sides of the cell-culture hood. Outside the lab, we share sunny walks and chocolate bars. We are acid and base ions carefully titrated to a perfect pH balance.

Then, six weeks before school starts, the lab gets a splash of strong acid. Emily is here, the youngest undergrad and the last new arrival of the summer. I take one look at her and count two good reasons to be afraid. Her face: sharp, luminous cat eyes pressed into a pale, round moon. Her voice: laughter echoing on marble, beautiful and unforgivably resonant.

Suddenly, the turtledoves are gone, replaced by three French hens trotting after Ren, or Tao on busy days. There is much crowding at the centrifuge, vying for position at the bench, accidental jostling at the chemical hood, all followed by much apologizing.

"Collaborating," Ren says.

Emily absorbs the new vocabulary of the lab quickly. She is already well versed in most of it because during high school she worked in a research lab for three years. She uses her cat eyes to catch every motion Ren makes, and her beautiful echoing voice to ask many interesting and insightful questions I had not thought of. She too will be a great asset to the next generation of scientists, I

think to myself.

But Emily laughs when I say this out loud. She wants to be a doctor, knows this with one hundred percent of herself. She would never go to graduate school in a million years because a career in research is too difficult and uncertain.

Honestly, it sounds like torture, she says in that resonant voice.

It is another night of waiting on the couch with my eyes open. Under a blanket I huddle, horizontal, fetal, shivering, even though outside it is ninety degrees and climbing.

It's just that you are not goal-oriented, Tao tells me, one day when we are not in lab. He can say this because it is just the two of us. It is a warm Saturday and everything is still as we walk through the morning air in this sun-dappled city.

Mei-Lin and Emily, they know exactly what they want and take steps to reach their goals, but you can only see what you love at this moment.

Is that bad?

It depends, he says. They will probably be more successful than you, find happiness earlier.

Oh.

I think, says Tao carefully, that people like you are more rare—more precious.

I forget we are walking and crash into a tree.

Hey! Are you okay? says Tao.

Yes, I think so.

Don't think so hard about things, he says, laughing. See you in lab on Monday.

At sunrise on Monday I am still horizontal. I watch absently as one by one the colors fade in: first indigo, then deep blue, then finally streaks of creamy reds and oranges take over the sky.

More precious, says Tao. It is a generous thing to say. I get vertical, throw off the blanket, scuff my feet through the kitchen and stop at the window, crack it open. Just outside is the fire escape and beyond that is the street, from where the intermittent honking of cars floats in with the morning.

Beneath the streaky red-orange sky I consider Tao's complicated life, yet his simple conviction that he must do research. *For all the history of grief / an empty doorway and a maple leaf.*

Do I have this conviction?

But if your research didn't work for fifteen years, asks Ren, would you still want to keep trying? I put my head and arms through the open window and crawl out onto the fire escape, look down at the street three floors below.

For love / the leaning grasses and two lights above the sea. Is that enough?

It sounds like torture, says Emily.

You should be more confident! says Mei-Lin.

But suddenly all I can think is how three floors is not such a long way to fall. I climb the railing and perch on the thin rim of rusty metal, deciding.

The phone rings. It's Tao. *Are you okay?*

One week after I go crazy, Ren takes me for chicken and biscuits and advice. It will help to remember why you are here, he says. In the restaurant, with Ren looking straight into my eyes, this advice is easy to take. But as soon as I step into the lab all my confidence melts away and I cannot think.

Why am I here?

On my right arm, a reminder about *the leaning grasses and two lights above the sea —*

Here in the surgery room I must find them.

And now, on the big day:

That's all for today, says Ren. He breathes with relief, flexes his gloved hands, smiles at Tao. Tao grins back and this time the grin reaches all the way to his eyes.

It has been a whirlwind of a day: after each round of convection-enhanced delivery, the scientists removed the syringes, pulled the soft papery skin back over each rat's skull, stapled the skin shut with a special surgical stapler. Now each rat lies in a warm recovery cage, wearing an ugly crown of silvery metal flecks. Thick twisted bands protrude from their scalps like wrinkles in a tablecloth. "Recovery without incident," the undergrads scribble

obediently, for each rat who is successfully and grotesquely crowned king.

The undergrads have had a time of it too: besides "observing," we have meted out an eight-hour day into excruciating fifteen-minute chunks.

Tomorrow there will be sixteen more rats, Ren announces to the room.

Tomorrow? Another day of this? I am surprised, suddenly, to feel my heart. But it isn't fear. It's plodding a little faster, this big dumb heart, shaky but eager, like it's just been reset by Ren's simple declaration and is settling into a new rhythm. Whether or not this experiment works, whether or not the next generation of scientists needs me, whether or not love can persist through countless years of failure—there are certainties.

For example, this I know: Tomorrow there will be sixteen more rats. Tomorrow, therefore, there will be a flurry of syringes, staples, and scientists.

This, too, I know: In one day, it is possible to operate on sixteen rats. In one day, then, it is possible for a human heart to be broken and mended by them, by two scientists, and by many details, odd and wonderful.

And suddenly I know that these are enough. I check my arms for confirmation.

For love, I read, and shiver.

Most of the rats are slowly waking up from the anesthesia now. Rats have no eyelids to open, but you can watch for other signs of arousal: a red glow reigniting in their eyes, a brief twitch of the tail or nose. When they awaken, they will be at first pathetic, moving sights, lumbering and slow. Each rat will remind you of a child taking her first steps, soft white shoes discovering how to walk in the world.